Price Rigidity and Market Power in German Retailing

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1 Introduction

In view of an increasing market share of discounters in German retailing, particularly the hard discounters Aldi and Lidl, the intensification of inter-retail competition has raised public and legal concern. Within the process of consolidation and increasing concentration an intensification of retail price-competition is assumed to have major impacts on consumers as well as on preliminary stages of food marketing. The question arises whether retail market power exists and the level of price transmission across the preliminary market stages will be affected.

These central research question is answered by using two different methodological approaches. In the first section, strategic pricing behaviour is identified across different store types. In this context, we analyze the degree of price rigidity in contradiction to competitive theory and the law of market clearing. The following section presents an econometric framework for the empirical analysis of oligopsony and oligopoly retail-market power. Based on the parameter of conjectural variation, the competitive behaviour of retailers as the deviation from perfect competition is estimated. In addition, LERNER indices as well as percentage price distortion due to market power are calculated.

While the analysis of consumer price rigidity is based on weekly scanner data and the period 1999-2000, the estimation of retail market power is conducted on an extensive dataset on the process of retail distribution of different beef and pork products. Corresponding information on consumer demand and processors supply of beef and pork was also used.

The paper is organized as follows. The theoretical and empirical literature on consumer price rigidity is surveyed. Then, the scanner dataset is presented followed by the empirical analysis of price rigidity across different beef and pork products as well as retail store types. Section 4 presents the econometric framework regarding the measurement of retail market power. Major results of the simultaneous analysis of oligopsony and oligopoly power are outlined. Conclusions are drawn and major results are summarized in the last chapter.

2 Consumer Price Rigidity

Theoretical models of pricing under perfect competition suggest that prices follow the law of market clearing will immediately adapt to changes in the market environment (Waldman/Jensen, 2001, p. 76). Thus, changes in cost or demand conditions will quickly induce changes in market output and prices. Studies of price rigidity like Means (1935), Carlton (1986) and Kashyap (1995) point out that this behaviour does not prevail all the time.

In the literature of industrial organization such pricing behaviour in relation to market shifts is called price rigidity (or sticky prices) and is not restricted to single industries. Thus, many theories have developed, which try to explain the causes of such rigidities. A comprehensive survey of most relevant and discussed theories provide Blinder et al. (1998).

Not all theories discussed by Blinder et al. are relevant in case of the German retail industry, consequently only a selection of theories is presented here. Of potential interest are the theory of contracts between trading partners, costs of price adjustment and psychological pricing points.

The theory of contracts between the processors and retailers is manifold due to the fact that much of the contents of such contracts is not open to the public. Costs of price adjustment, in particular menu costs (Carlton, 1986; Levy et al., 1997, 1998, 2002) are viewed to have a remarkable influence on the frequency of price changes. Not only costs of material or labour have an impact on the price changes, but also the amount of time managers need to implement new prices. Menu costs appear for every single price change, but are independent from the size of the price change. The difficulty of the price adjustment concept is closely related to the measurement of the menu costs, because menu costs are difficult to measure and empirical data are lacking. The survey of Levy et al. (1998) is an exception. In this study the authors investigate the time expenditure needed in the process of price adjustment and allocate the results to labour costs. Otherwise one has to assume oblique assumptions. The central hypothesis is, that if menu costs exist prices remain constant over for a certain period. Therefore fewer but larger price changes will be observed (Blinder et al., 1998; Slade, 1998, p. 88).

According to Blinder et al. the theory of psychological pricing points is of secondary importance in the survey, since the retail industry is underrepresented. Other surveys (e.g. Herrmann/Möser, 2004) prove a considerable impact of psychological pricing points in the pricing behaviour of German retailers and thus on the degree of price rigidity.

In addition two further explanations of price stickiness are relevant. First, a strong emphasis of the industrial organization literature is on the relationship between market structure and pricing behaviour. Several market surveys (Rotemberg/Saloner, 1987; Carlton, 1986; Stigler, 1947) examine whether concentrated markets change prices less frequent than less concentrated industries. The motivation of such behaviour is that oligopolists face different incentives in responding to exogenous shocks.

In this context, pricing strategies are of major importance, because different firm strategies will result in different price settings. Owen and Trzepacz (2002) emphasis that firm strategy is among the most important factor of the probability of price changes. Typical pricing strategies in food retailing are the "every-day-low-price"-strategy (EDLP) and the "high-low"-strategy (Hi-Lo). Firms using EDLP charge a daily constant low price without temporary price discounts. Firms following the Hi-Lo-strategy, in contrast, charge a higher mean price level and temporary allow price discounts below the level of EDLP (Hoch/Drèze/Purk, 1994). Hence, firms with an EDLP-strategy ceteris paribus will exhibit less frequent price changes than firms applying a Hi-Lo-strategy (Levy et al., 1997, 1998).

Apparently, these differences are store type related. While discounters will typically follow an EDLP-strategy, all other store types, particularly self-service warehouses, are assumed to apply a Hi-Lo-strategy.

By the use of scanner data of a retail panel of the MADAKOM GmbH Cologne, the impact of the latter theories will be examined. We utilize data from January 2000 to December 2001 in weekly aggregation. The panel contains information on 207 outlets with scanning technology in 24 retail product groups also covering individual product information. The outlets include discounters[1], supermarkets (400 to 700 square meters sales area), small consumer markets (800 to 1499 square meters sales area), large consumer markets (1500 to 4999 square meters sales area) and self-service warehouses (>5000 square meters sales area). Additionally product-code (EAN), prices, quantities sold and information on several promotional activities are available.

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[1] Some of the hard discounters, e.g. Aldi or Lidl, are not included is this panel.

Table 1: Mean price of tinned meat (beef and pork) on a weekly basis for store types in DM [a]

Commodity	DISC μ	DISC s	SM μ	SM s	sm CM μ	sm CM s	CM μ	CM s	SSW μ	SSW s
Armour Beef 400g	- [b]	-	2.52	0.0954	2.54	0.1121	2.54	0.1159	2.57	0.1799
Dreistern Beef 300g	2.52	0.0171	-	-	-	-	-	-	-	-
Halber Beef 300g	-	-	-	-	-	-	3.85	0.0000	3.97	0.1862
Goldhand Tip Beef 400g	-	-	-	-	2.34	0.0967	2.35	0.1063	2.32	0.1856
Rewe Beef	-	-	2.94	0.1826	2.75	0.1736	2.79	0.1912	-	-
Simon Lard Meat 400g	2.20	0.1549	1.99	0.0000	-	-	1.73	0.2641	1.72	0.2273
Simon Beef 300g	2.81	0.1973	3.84	0.1342	2.83	0.1989	2.72	0.2009	2.70	0.2298
Simon Beef 400g	2.54	0.0883	2.63	0.2169	2.41	0.1704	2.77	0.1399	-	-
Yanno Beef 300g	3.32	0.0000	-	-	3.52	0.0938	3.07	0.4185	3.46	0.2101
Armour Lard Meat 4ßßg	-	-	1.90	0.0000	-	-	1.79	0.0000	-	-
Armour Pork 400g	-	-	1.99	0.0000	-	-	1.99	0.0000	-	-
Döbel Belly of Pork 720g	1.66	0.1723	-	-	1.68	0.1802	1.61	0.0555	1.64	0.1098
Goldhand Tip Pork 400g	-	-	-	-	-	-	-	-	2.08	0.1349
Halber Lard Meat 300g	2.65	0.0000	-	-	3.66	0.7387	2.66	0.4173	2.80	0.4146
Halber Pork 300g	-	-	-	-	-	-	4.27	0.8090	4.19	0.5952
Homann Lard Meat 300g	-	-	-	-	-	-	2.44	0.0727	2.41	0.0552
Landsknecht Spam 340g	2.12	0.1719	-	-	2.21	0.1097	2.23	0.1003	2.18	0.1049
Omnia Lard Meat 400g	1.62	0.0680	-	-	-	-	-	-	-	-
Schulte Pick-led Pork400g	-	-	-	-	-	-	4.53	0.2822	4.66	0.2338
Simon Pork 300g	2.97	0.3549	3.03	0.2742	-	-	2.57	0.0869	2.78	0.3536
Simon Pork 400g	2.32	0.1490	2.28	0.3646	2.13	0.1498	2.62	0.1632	2.48	0.1902
Werner Spam 200g	-	-	4.39	0.6348	3.80	0.6958	3.90	0.5808	-	-
Yano Pork 300g	3.78	0.1205	4.15	0.2791	4.11	0.3095	3.85	0.2980	3.97	0.2685

[a] The mean price μ consists of the charged normal price and the price while sales promotion activity, s is the standard deviation. DISC = discounters, SM = supermarkets, sm CM = small consumer markets, CM = large consumer markets, SSW = self-service warehouses. [b] Not distributed or lack of data.
Source: Own computations.

Table 1 presents mean prices as the normal price level and the prices with sales promotion in the different store types. In order to ensure comparability of prices packaging sizes have been adjusted to trading units of 400g.

Different price strategies appear when product prices are compared across store types. With the exception of Armour's Pork 400g which is sold in both listed store types at one uniform price Table 1 shows, that altering pricing strategies exist. All other tinned meat commodities differ in their prices at the store type level. While Armour's Beef 400g, e.g. is sold in both small and large consumer markets at a price level of 2.54 German Mark (DM), consumers have to pay less in supermarkets (2.52 DM) and more in self-service warehouses (2.57 DM).

The hypothesis of overall lower prices at discounters compared to other retail stores can only be affirmed for three cases in the group of pork products: Halber's Lard Meat 300g, Landsknecht's Spam 340g as well as Yano's Pork 300g. In the group of beef products discounters are most expensive for

Simon's Lard Meat 400g with 2.30 DM, while all other products are priced midfield. This result is plausible and can be ascribed to the absence of hard discounters, e.g. Aldi or Lidl, which typically do not release any information of their firm strategy and important business information.

Concepts of competitive theory in particular the rule of perfect competition imply that the law of one price. With regard to Table 1 the rule of one price is definitely violated.

As a measure for price stickiness the mean duration of unchanged prices can easily be expressed as,

$$PRIG = \frac{w}{w_{ch}}. \tag{1}$$

PRIG is calculated by dividing the number of weekly price settings per product by the number of weeks with price changes (Powers/Powers, 2001).

Table 2: Mean weekly duration of price rigidity for tinned meat - cross section by store types [a]

| Group | ALL | | sm CM | | | PA | | sm CM | | | SKIP | | sm CM | | |
	DISC	SM	CM	CM	SSW	DISC	SM	CM	CM	SSW	DISC	SM	CM	CM	SSW
Beef	63.2	61.1	40.6	48.6	26.8	83.2	70.9	68.6	72.2	62.6	68.7	76.9	53.1	53.7	37.1
Pork	31.6	35.1	26.4	36.1	20.4	84.9	66.2	76.0	71.9	70.9	33.2	36.6	28.2	42.0	24.9

[a] ALL = all price changes; PA = sales promotions or other price changes; SKIP = real price changes.
Source: Own computations.

On an aggregate level discounters are price stickiest for beef, followed by supermarkets. At an average discounters change the price of beef products every 63.2 weeks. In supermarkets the period between price changes is 61.1 weeks. The store type of self-service warehouse shows comparatively the highest price flexibility with a price rigidity of 26.8 weeks. To allow for a differentiated consideration of consumer price rigidity changes are separated into long run "real" price adjustments and temporary retail sales.

If only sales promotions in discounters are considered prices get conspicuously more rigid. This finding is consistent with theory and the hypothesis that discounters are typical representatives of an EDLP pricing strategy and consequently carry out fewer sales. 83.2 weeks decay between two sales promotions in an average discounter. Less promotions are observable in all other store types reflecting a greater price stability. Self-service warehouses show the highest rate of promotions with the least duration between two price adjustments of 62.6 weeks. Considering only real price adaptations supermarkets become the store type with stickiest prices. Here 76.9 weeks elapse between two price alignments. Discounters are in the second position with 68.7 weeks and the self-service warehouses again show the highest price flexibility with 37 weeks of unchanged prices.

In contrast the results for the group of pork products are quite different. Examining all price changes, the large consumer markets bear the highest price rigidity with 36.1 weeks. The evaluation for supermarkets and discounters reveals 35.1 and 31.6 weeks respectively. Again the self-service warehouses exhibit the highest prices flexibility with a duration of only 20.4 weeks. Compared to the group of beef Table 2 presents a lower proportion of retail promotions for pork, so that the price rigidity due to sales raises. In line with theory discounters again hold the highest rigidity with almost 85 weeks. In contrast supermarkets carry out most price adjustments. The duration of robust prices is 66.2 weeks. The pricing strategy for large consumer markets seems to respond least to market shifts and thus shows a rigidity of 42 weeks compared to self-service warehouses which carry out price alignments at an average of 24.9 weeks. Discounters range midfield with a calculated average of 33 weeks of stable prices.

For statistical significance of price rigidity median tests are finally calculated. The test statistics show that across beef products there is a significant difference in rigidity between discounters and self-service warehouses as well as between small consumer markets and self-service warehouses at the 10 percent level. For pork only the difference between discounters and self-service warehouses is significant at a 5 percent level.

The results indicate that major differences exist in response to market shifts across store types. To some extend these point to the existence of market power. In particular the violation of the law of one price is considered as an explicit indicator for the refusal of the hypothesis of perfect competition in the German retailing. Only if firms exhibit a certain degree of market power they are able raise price above marginal costs and deviate from their competitors price level. Thus, the results of consumer price rigidity give a noticeable evidence on the existence of retail market power.

Market structure appears to be a major factor on the explanation of retail pricing behaviour. Numerous empirical studies imply a close relationship between market structure and price adjustment costs. These surveys indicate that in concentrated industries menu costs exert a larger impact on price flexibility and consequently the degree of price rigidity. Firms in oligopolistic industries will adjust prices less frequent than competitive market participants will do (Rotemberg/Saloner, 1987; Carlton, 1986; Stigler, 1947). Since this theory is of broad acceptance it will be necessary to determine to which extend German retailers exercise market power. The explicit analysis of retail market power therefore follows in the next chapter.

3 Market Power in German Retailing

While there are numerous applications of the established industrial organization framework of measuring market power in various manufacturing sectors, the retail sector has received very limited attention in the context of imperfect competition. Dobson and Waterson (1999) emphasise that retailing in the U.S. as well as in Europe is highly concentrated, while economic analysis traditionally view the retail level as lacking in market power. This is hardly justifiable since retail concentration and merger activities raise concern about the consequences of retail market power on welfare.

Studies like Ailiwadi et al. (1995) and Messinger and Narasimhan (1995) come up with the question whether there is a shift of market power from manufacturing to the retail level. Dobson and Waterson (1999) among others confirm that most areas of retailing display market power and consumer prices are highly correlated with retail concentration, especially when measured on the regional and local market level (Cotterill 1986). Among the few quantitative surveys in retailing the studies of Hyde and Perloff (1998), Park and Weliwita (1999) as well as Sexton and Zhang (2001) are exemplary. Apart from the few contributions of the Anglo-Saxon industrial economics literature, there has been given minor attention to the measurement of market power in Europe. The only studies are Gohin and Guyomard (2000) and Körner (2004).

Given the background of the cited literature on the measurement of market power, the objective of this chapter is to estimate the degree of imperfect competition in German retailing. In this context the emphasis is on a regional segment of the marketing channel.

Considering a non-competitive retail industry of N firms, the following theoretical model presents the framework for measuring the degree market power at the retail market level. In producing homogenous consumer meat products, retail firms buy corresponding wholesale products from processors and employ additional factors in the distribution process. The industry is assumed to be a price taker in the factor markets, but to exercise market power in purchasing meat from regional processors as well as in selling the final products. The production technology is presumed to be of fixed proportions, so that input and output quantities can be represented by the same variable Q_i. Due to the lack of regional firm-level data, the model is presented at the aggregate industry level. The cost function of the retail industry is defined as $C = c(Q,w,z)$. Following the theoretical model proposed by Gohin and Guyomard (2000), the total cost of retail distribution then is:

$$CT_i(Q,w,z,CF) = w_i \cdot Q_i + C(Q_i,z) + CF_i, \tag{1}$$

where Q_i is the total industry production of meat product I, w_i are wholesale meat prices and z are additional factors in the retail distribution process. The supply function of the upstream regional meat processing industry is given by:

$$Q_i = S_i(w_i, X). \tag{2}$$

X are additional shifters of supply. The meat demand function faced by the retail industry is given by:

$$Q_i = D_i(p_i, y), \tag{3}$$

where p_i is the consumer price of the ith final meat product and y are exogenous demand shifters.

Assuming a profit maximizing retail industry, the problem is to choose optimal quantities of Q_i which maximize the aggregate industry profits (4) with respect to supply (2) and demand (3) conditions. The retail industries profit function for the distribution of i meat products is then:

$$\Pi_i = \sum_{i=1}^{m} p_i \cdot Q_i - \sum_{i=1}^{m} w_i \cdot Q_i - C_i(Q_i, z) - CF. \tag{4}$$

C_i is the total cost function of the industry and CF is a fixed cost term. It is assumed that the meat products are related to demand but not to supply. Taking the first order condition of the maximization problem and applying additional algebra leads to[2]:

$$p_i - w_i - \frac{\partial C}{\partial Q_i} = -\left(\frac{\theta_i}{Q_i}\right) \cdot \left[\sum_{i=1}^{m} \varepsilon_i \cdot p_i \cdot Q_i - \eta_i \cdot w_i \cdot Q_i\right], \tag{5}$$

where $\varepsilon_i = (\partial Q_i/\partial w_i)*(w_i/Q_i)$ is the elasticity of supply at the processors level and $\eta_i = (\partial Q_i/\partial p_i)*(p_i/Q_i)$ is the price elasticity of final consumer demand.

From equation (5) it is evident that the coefficient of conjectural elasticity θ_i is the crucial conduct parameter. As we know from theory, θ_i provides a useful benchmark to test for market power versus price-taking behaviour, i.e. perfect competition. The plausible range of θ_i lies between zero and 1. In the case of θ_i being zero the right hand side of (5) reduces to the fact that consumers´ price equals marginal costs. At the other extreme of θ_i being equal to one, equation (5) represents the retail industries optimally condition of a simultaneous monopoly-monopsony situation and total marginal costs are equal to perceived net marginal revenues. In other words, if θ_i is zero we assume retail price taking behaviour in both the upstream and downstream regional meat markets. If θ_i deviates significantly from zero, this indicates retail market power exertion in the meat marketing channel with a retail monopolist and monopsonist in the case of $\theta_i = 1$ [3].

To test for retail market power empirical functional forms of the simultaneous equation model have to be specified. The issues of aggregation of simultaneous equation models have been largely discussed, e.g. Schroeter and Azzam (1991), Wann and Sexton (1992). The aggregate industry cost function is specified in the Gorman Polar form with constant and identical marginal costs but fixed costs which can vary among retailers [4]:

$$CT\ (Q, w, z, CF) = \sum_{i=1}^{m} w_i \cdot Q_i + G_i(z) + \sum_{i=1}^{m} H_i \cdot Q_i + CF, \tag{6}$$

where H_i are additional factors in the retail distribution of meat products.

From equation (6) it is evident that marginal costs of the final product i are constant. Another aggregation issue concerns the parameter of conjectural elasticity in equation (5). According to Appelbaum (1982) it is assumed that in equilibrium θ is identical across retail firms. As shown by Schroeter and Azzam (1991) the latter assumption can be achieved without loss of generality, if constant and identical marginal costs are assured in the aggregation procedure. Aggregating equation (5) then leads to:

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[2] Cross-conjectural elasticities between the market segments i of beef and pork are assumed to be equal to zero and therefore are eliminated from the theoretical derivation.

[3] A comprehensive discussion of possible interpretations of the parameter of conjectural variation in the industrial economics literature are among others Sexton and Lavoie (2001), Gasmi and Vuong (1991) and Gasmi, Laffont and Vuong (1992).

[4] For an extensive discussion of the questions of market power measurement, cost economics and especially the cost-function specification see Morrison-Paul (1999).

$$p_i = w_i + H_i(z) - \sum_{i=1} \sum_{i=1} \eta_i \cdot \theta_i \cdot p_i \cdot \left(\frac{Q}{Q_i} \right) + \sum_{i=1} \varepsilon_i \cdot \theta_{ii} \cdot w_i \cdot \left(\frac{Q}{Q_i} \right). \tag{7}$$

$\theta_i = \theta_{ii} = \Sigma(\partial Q/\partial q_i)*(q_i/Q_i)$ are average conjectural elasticities with respect to the retail output (θ_i) and the meat processors´ factor input (θ_{ii}). Equation (7) now is the basis for several tests of the hypothesis of retail market power in the regional meat marketing channel. Tests of oligopsony or oligopoly market power in beef or pork marketing are carried out separately so that the coefficients of conjectural elasticities are not restricted to be identical. To identify the several parameters in the empirical model, thus implies the simultaneous estimation of equation (7) with the supply function (2) and the final demand functions (3).

The simultaneous equation system utilizes aggregated monthly data for the period 1995-2000. Covering all necessary information on the vertical stages of meat processing, retail distribution and consumer demand, the dataset includes quantitative information on prices and cost factors of meat marketing and other exogenous shift factors of supply and demand. The retail industry is assumed to apply the competitively priced input factors labor, energy and capital.

Due to the excellent small sample properties of full-information maximum-likelihood estimators (FIML) (Hausman 1985), this consistent estimation procedure is favoured over iterative three-stage least-squares (i3SLS). To account for the numerous coefficients in a simultaneous estimation and the problem of multicollinearity, the following analysis presents separate model estimations for the retail marketing of beef and pork.

3.2 Results

The results from the film-estimation of the simultaneous retail market power model are presented in Table 1. A first striking result is that the majority of coefficients are significantly different from zero. The elasticities of meat supply and consumer demand all have the expected signs .The model also highlights both oligopsony and oligopoly market power estimates for the regional distribution of beef and pork by German retailers. The equations fit the data reasonably well. The corrected R^2 ranges from 0.56 up to 0.95 with the exception of the beef supply elasticity being 0.25. Autocorrelation is unproblematic in the pork model. In the case of the beef model the Durbin-Watson statistics of 1.39 and 1.45 are in the inconclusive region. Runs-tests (Gujarati 1988) were performed but could not reject the hypothesis of missing autocorrelation among the disturbances. For the retail equilibrium condition for beef the runs-test confirms the existence of positive autocorrelation at the 95 % level.

Table 1: FIML-Estimates of Oligopsony-Oligopoly Retail Market Power in Meat Marketing

Test of Retail Market Power in…			Estimate	corr. R^2	DW
pork distribution	Processors` supply	ε	0.419[*]	0.56	2.42
	Consumers` demand	η	-0.588[***]	0.63	1.79
	Oligopsony Power	θ^S	0.0125[*]	0.95	1.57
	Oligopoly Power	θ^D	0.0035[***]		
beef distribution	Processors` supply	ε	1.706[*]	0.25	1.65
	Consumers´ demand	η	-2.741[***]	0.67	1.45
	Oligopsony Power	θ^S	0.173	0.88	1.39
	Oligopoly Power	θ^D	0.080[***]	0.67	

[*], [**] and [***] statistically significantly different from o at the 90%, 95% and 99% level.

Source: Authors own computations.

Against the background of the common difficulty of estimating supply relations, the results in the supply functions are remarkable. The supply elasticities are upward sloping in the factor prices of pork and beef with parameter values of 0.419 and 1.706 respectively. Likewise the demand curves are downward sloping in the prices of beef and pork. The estimated demand elasticity for beef is -2.741 and -0.588 for pork. The elasticities thereby have to be viewed against the background of the German BSE crisis, which is covered by the dataset.

Of particular interest is, of course, the estimated degree of oligoposny and oligopoly retail market power expressed by the conjectural elasticities θ^S and θ^D.

From Table 1 it is apparent that the estimated coefficients deviate significantly from zero and hence perfect competition for both individual products and oligopoly and oligopsony parameters. The hypotheses of perfect competition and retail price taking behaviour are soundly rejected. For the degree of retail oligopsony power in beef marketing the deviation from price taking behaviour is of higher magnitude but fails the 90 % level of significance. Anyhow, the alternative hypothesis of a unique monopsony is clearly rejected. The t-statistic is 7.74. For the case of pork there is a notable difference. The estimated deviation of retail behaviour from perfect competition is highly significant but of small magnitude. The extent of retail oligopsony power in the regional purchase of pork meat is still little severe. The coefficient conjectural elasticity is roughly 0.01. Thus, the hypothesis of $\theta = 1$ is also clearly rejected. The t-statistic is 124.25.

In case of oligopoly behaviour the estimated conjectural elasticities range from 0.0035 up to 0.08 and therefore show smaller deviations from the competitive benchmark for retailers sales to consumers. Again, the coefficient for beef exceeds the level of pork by far. However, the hypotheses of a pure monopoly have to be rejected with t-statistics of 61.76 and 924.15 for beef and pork respectively. All findings are very stable across model specifications. To summarize, the simultaneous equation model illustrates notable oligopsony-oligoply deviations in retail market behaviour in both product marketing channels. Second, despite the slight differences in magnitudes of conjectural elasticities retailers market behaviour, both in the purchase of processors product inputs and the sales of beef and pork to downstream consumers, rather has to be considered oligopolistic than competitive.

4 Summary

The public and legal discussion of considerable levels of retail concentration in most industrialized countries has raised concern about the effects of retail market power on welfare. Against this background, the paper presents empirical evidence on consumer price rigidity and market power in German retailing by applying two different methodological approaches. The analysis of price rigidity as the violation of the law of one price and the direct estimation of retail market power as the deviation of market behaviour from the benchmark of perfect competition.

As mean price's analysis of scanner data shows that the assumption of competitive markets in German grocery retailing seems to be at least questionable, since most of the analysed products for beef and pork are sold at different prices in the observed store types. This violation of the law of price suggests an environment with a certain degree of market power of some firms. A next hint of denying competitive markets gives the measurement of the price rigidity, i.e. the time which elapses between two price changes for several kinds of store types. To gain further insights in the price changing behaviour, a price change is portioned in a change caused by sales promotional activity and an adjustment based on a market shift. Differences between store types exist, but not all are at a level of significance. E.g., discounters bear a higher rigidity than self-service warehouses for beef for all price changes and small consumer markets change less often their prices than the self-service warehouses. For pork discounters are more price-stickier as self-service warehouses, too.

The analysis of retail market power in the distribution of beef and pork based on the production-theoretic approach of conjectural variation is used to parameterize the retail industries´ oligopoly and oligopsony equilibria. In particular, retailers´ coefficients of conjectural elasticity in the purchase of meat products and sales towards consumers indicate significant deviations from perfect competition and reflect a strong bias towards oligopsonistic-oligopolistic market behaviour. The estimated conjectural elasticties range from 0,0035 up to 0.1, indicating a rejection of the perfect competition hypothesis. However, the degree of market power is limited as indicated by calculated relative deviation on the basis of Lerner and monopoly indices. Finally both approaches clearly indicate that the hypothesis of perfect competition in German retailing is not valid. However, the results are far away from suggesting either monopolistic or monopsonistic retail behaviour.

5 References:

Ailawadi, K. L., N. Borin and P.W. Farris (1995), Market Power and Performance: A Cross-Industry Analysis of Manufacturers and Retailers. *Journal of Retailing*, Vol. 71, No. 3, pp. 211-248.

Appelbaum, E. (1982), The Estimation of the Degree of Oligopoly Power, *Journal of Econometrics*, 19: 287-299.

Blinder, A.S., E.R. Canetti, D.E. Lebow und J.B. Rudd (1998), Asking About Prices. - A New Approach to Understanding Price Stickiness. New York: Russel Sage Foundation.

Carlton, D.W. (1986), The Rigidity of Prices. *American Economic Review*, Vol. 76, No.4, pp.637-658.

Cotterill, R.W. (1986), Market Power in the Retail Food Industry: Evidence From Vermont. *The Review of Economics and Statistics*, Vol. 68, S. 379-386.

Dobson, P.W. and M. Waterson (1997), Countervailing Power and Consumer Prices. *The Economic Journal*, Vol. 107, S. 418-430.

Gasmi, F. and Q. Vuong (1991), An Econometric Analysis of Some Duopolistic Games in Prices and Advertising. In: Rhodes, G. und T. Fomby (eds.), *Advances in Econometrics*: Econometric Methods and Models for Industrial Organization, Greenwich, JAI Press.

Gasmi, F., J.J. Laffont and Q. Vuong (1992), Econometric Analysis of Collusive Behavior in a Softdrink Market. *Journal of Economics and Management Strategy*, Vol. 1, S. 277-311.

Gohin, A. und H. Guyomard (2000), Measuring Market Power for Food Retail Activities: French Evidence. *Journal of Agricultural Economics*, Vol. 51, No. 2, S. 181-195.

Gujarati, D.N. (1988), Basic Econometrics. 2. Edition, New York, McGraw-Hill Book.

Hausman, J.A. (1975), An Instrumental Variable Approach to Full-Information Estimators for Linear and Certain Nonlinear Models. *Econometrica*, Vol. 43, No. 4, S. 727-738.

Herrmann, R. und A. Moeser (2004), Psychological Prices of Branded Foods and Price Rigidity: Evidence from German Scanner Data. Giessen, mimeo.

Hoch, S. J., X. Drèze and M. E. Purk (1994), EDLP, Hi-Lo, and Margin Arithmetic. *Journal of Marketing*, Vol. 58, No. 4, pp. 16-27.

Hyde, C. E. and J.M. Perloff (1998), Multimarket Market Power Estimation: The Australian Retail Sector, *Applied Economics*, 30: 1169-1176.

Kashyap, A.K. (1995), Sticky Prices: New Evidence from Retail Catalogs. *Quarterly Journal of Economics*, Vol. 110, No.1, pp. 245-274.

Körner, J. (2004), Intertemporale Optimierung, Marktmacht und Wettbewerbsverhalten: Essays zur Preisbildung im deutschen Kaffeemarkt. Volkswirtschaftliche Forschung und Entwicklung, Bd. 94, Freie Universität Berlin, Berlin.

Levy, D., M. Bergen, S. Dutta und R. Venable (1997), The Magnitude of Menu Costs: Direct Evidence from Large U.S. Supermarket Chains. *Quarterly Journal of Economics*, Vol. 112, No. 3, Aug., pp. 791-825.

Levy, D., S. Dutta und M. Bergen (2002), Heterogeneity in Price Rigidity: Evidence from a Case Study Using Microlevel Data. *Journal of Money, Credit and Banking*, Vol. 34, No.1, pp. 197-220.

Levy, D., S. Dutta, M. Bergen und R. Venable (1998), Price Adjustment at Multiproduct Retailers. *Managerial and Decision Economics*, Vol. 19, No.2, pp. 81-120.

Means, G.C. (1935), Industrial Prices and Their Relative Inflexibility. U.S. Senate Document 13, 74th Congress, 1st Session, Washington.

Messinger, P.R. and C. Narasimhan (1995), Has Power shifted in the Grocery Channel? Marketing Science, Vol. 14, No. 2, S. 189-223.

Morrison-Paul, C.J. (1999), Cost Structure and the Measurement of Economic Performance, Productivity Utilization Cost Economics and Related Performance Indicators, Dordrecht: Kluwer Academic Publishers.

Owen, A. und D. Trzepacz (2002), Menu Costs, Firm Strategy, and Price Rigidity. Economics Letters, Vol. 76, No. 3, pp. 345-349.

Park, T. and A. Weliwita (1999), Competitive Behavoir in the US Food Retailing Industry. *Canadian Journal of Agricultural Economics*, Vol. 47, No. 2, S. 45-55.

Powers, E.T. und N.J. Powers (2001), The Size and Frequency of Price Changes: Evidence from the Grocery Stores. *Review of Industrial Organization*, Vol. 18, No. 4, pp. 397-416.

Rotemberg, J.J. und G. Saloner (1987), The Relative Rigidity of Monopoly Pricing. "American Economic Review", Vol. 77 (V), Dec., pp. 917-926.

Schroeter, J.R. und A.M. Azzam (1991), Marketing Margins, Market Power and Price Uncertainty. *American Journal of Agricultural Economics*, Vol. 73, No. 4, S. 990-999.

Sexton, R. J. and N. Lavoie (2001), Food Processing and Distribution: An Industrial Organization Approach, Gardner, B. and G. Rausser (eds.), Handbook of Agricultural Economics. Amsterdam: North Holland, Chapter 15.

Sexton, R.J. und M. Zhang (2001), An Assessment of the Impact of Food Industry Market Power on U.S. Consumers. *Agribusiness*, Vol. 17, No. 1, S. 59-79.

Slade, M.E. (1998), Optimal Pricing with Costly Adjustment: Evidence from Retail Grocery Prices. *Review of Economic Studies*, Vol. 65, No. 1, pp. 87-107.

Stigler, G. (1947), The Kinky Oligopoly Demand Curve and Rigid Prices. *Journal of Political Economy*, Vol. 55, Oct., pp. 432-449.

Wann, J.J. und R.J. Sexton (1992), Imperfect Competition in Multi Product Food Industries With Application to Pear Processing. *American Journal of Agricultural Economics*, Vol. 74, No. 4, S. 980-989.

Waldman, D.E. und E.J. Jensen (2001), Industrial Organization: Theory and Practice. 2. ed., Boston, Addison-Wesley.