The dark side of coffee.
Market power in the German market for roasted coffee.

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Abstract.
Germany is the second important coffee market in the world, just overshadowed by the United States. Coffee is the most famous beverage in Germany – even more popular than beer. On the supply side dominate few roasters. Market structure influences the market outcome and explains the processors' ability to exercise market power. This paper aims at studying the pricing behavior in the German market for roasted coffee. Respectively, it discusses the impact of three different explanations. First, market power may be due to low price elasticity related to a high level of consumption. Second, pricing behavior may be influenced by the industry concentration. And finally, pricing behavior may be change over time due to exogenous shocks. In particular, the degree of competition has changed as a consequences of a merger. Further, cyclical demand changes induce pricing behavior. Empirical results are derived using data on the aggregate market for roasted coffee in Germany during 1992:1 to 2000:12.

Keywords.
Market for roasted coffee; Germany; elasticity of conjectural variation; market power; simultaneous equation system; GMM.

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1. Introduction

Germany is the second largest coffee market in the world. With a share of 9.3% of total green coffee consumption, it is only overshadowed by the United States with a share of 21.6% (DKV 2001). Within Germany, coffee is the most popular beverage, in fact more popular than beer. Per capita consumption of green coffee in 2000 was 6.7 kg (corresponding to 162.4 liter of brewed coffee). In contrast, 'only' 127.5 liters of beer were consumed in the same year (GFK 2000). However, coffee is a stagnating market with negative rates of growth and fierce price competition. The average growth rate of nominal sales for the period 1995 to 2000 in Germany is –2.5% while the average growth rate of consumption is -1.6%. In 1996 F.O. LICHT'S observed that "[t]he Germany coffee market, unlike the United States, is characterized by fierce competition at processors, wholesale trade and grocery level". The degree of competition was expected to increase even further in 1997 as a result of a merger of two German coffee roasters (*Tschibo* and *Eduscho*). Market observes at the time of the merger expected substantial changes in firms' pricing behavior: "[the merger] could lead to devasting competition among roasters who could be inclined to cut prices for the sake of mere survival" (METHA 1997).

This paper examines the pricing behavior in the German market for roasted coffee. Additionally, it analyses whether the degree of competition has changed due to two exogenous shocks. After analyzing the impact of the merger, emphasis will be given to cyclical demand changes in pricing behavior. Cyclical consumption pattern occurs every year before Easter and Christmas. Given that these pieces of information are common knowledge, suppliers could implement it in their optimization and may adjust their pricing behavior.

In the formal model, we follow BETTENDORF/VERBOVEN (2000) and consider an aggregate model of oligopolistic interaction. The industry is made up of an exogenously determined number of firms producing a homogenous good. Competition is measured by the elasticity of conjectural variation. A simultaneous equation system of a demand and a supply equation explains the market outcome. Following APPELBAUM (1982) marginal costs are inferred from evolution of input prices. Roasters use the main input factors in fixed proportions, and economies of scale are limited. Therefore a linear marginal cost function is chosen. Non-linearity in parameters requires the generalized method of moments as estimation technique.

The analysis differs from previous work in two ways: It is the first to apply a simultaneous equation framework for the aggregate German market for roasted coffee. Before, a similar analysis has only been made for the Netherlands (BETTENDORF/VERBOVEN 1997 and 2000). Second, focus lies on the question whether suppliers of roasted coffee change their pricing behavior due to exogenous shocks.

The outline is as followed. The next section gives an overview of the German coffee market. Section 3 discusses the theoretical model of market demand and market supply. Demand is estimated as a function of prices (coffee and other beverages), income, and time. The supply function is derived from profit maximization under oligopoly competition. Section 4 describes the data and the empirical model. Estimation results follow in section 5. The estimated coefficients should give evidence for two questions: Whether and in which extent could suppliers determine prices for roasted coffee? And do they adjust their pricing behavior over time? Concluding remarks contain the last section 6.

2. The German market for roasted coffee.

In Germany coffee is the most popular beverage, in fact more popular than beer. Per capita consumption of green coffee in 2000 was 6.7 kg (corresponding to 162.4 liters of brewed coffee). In contrast, 'only' 127.5 liters of beer were consumed in the same year (GFK 2000). But since 1994 coffee demand has shown characteristics of stagnation. Per capita consumption has steadily declined at an average rate of 1.6% per year.[1, 2]

The supply side is composed of only a few companies offering roasted coffee. In 1999 the five biggest companies in the roasted coffee market have been *Jacobs* with a market share of 27% (measured by turnover), the merged company *Tchibo/Eduscho* with 24%, *Melitta* with 13.5% and *Aldi* with 12% as well as *Dallmayr* with 8% (LIENING 2000). These companies have a combined market share of 84.5%. In 1997 KOERNER observed "weak consumption despite fierce competition". This leads to the (first) question whether the demand and supply characteristics trigger exercising market power.

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[1] The government invents through the levying of the coffee tax and of the value added tax. The excise tax is 4.30 German Marks per kilogram of roasted coffee. The value added tax on food counts for 7%.

[2] Till 1992 there has been a tax of 1.80 German marks per pound on green coffee and the tax of 2.15 German marks per pound on roasted coffee. Because of the harmonization due to the European Single Market the indirect taxation has been abolished. But the member states have intervented for the right to raise national taxes. Germany keeps the tax on roasted coffee (FEUERSTEIN 1996b).

At the beginning of 1997 the two German roasters *Tchibo* and *Eduscho* officially merged.[3] At that time *Tchibo* was the second largest roaster and *Eduscho* the number three. METHA (1997) observed "uncertainty and fierce competition" in the German coffee market. In order to investigate the pricing behavior, the impact of the merger on pricing strategy is the (second) question.

Over the year, the coffee purchases are significantly higher before Easter and Christmas compared to other months. This consumption plan could be seen as cyclical demand fluctuations. MCDONALD (2000) described falling prices for seasonal food products due to demand peaks: Seasonal demand increases reduce information costs and costs of informative advertising. These price declines are linked to market concentration and strengthened by several rivals - instead of only one brand (MCDONALD 2000). PARKER (1997) argued that demand fluctuations are fluctuations in the elasticity of intertemporal substitution. Considering goods for which the timing of purchases is possible (e.g. stock holding) demand-driven rise in sales induce relatively low real price increases. Firms smooth prices over time.

ROTEMBERG/SALONER (1986) found evidence for a increasing degree of competition in periods of raising demand. Firms have an incentive to cheat on a collusive agreement because the most profitable strategy is to attract consumers via granting price reductions. Similar results obtained HALTIWANGER/HARRINGTON (1991) and FABRA (2001). Collusive behavior varies according to cyclical demand fluctuations and capacity constraints. In contrast, SPENCE (1977) identified the level of excess capacity and the degree of collusion to be negatively related. Collusive prices tending to move procyclically.

Based on the observation of cyclical demand fluctuations over the year the (third) question is whether these fluctuations cause systematically changes in pricing behavior. Competition changes could be detected by systematic increases or decreases in prices.

[3] In April 1997 the *BUNDESKARTELLAMT* (German Antitrust Authority) gave the permission for this merger.

3. Theoretical model and specification.

Following BETTENDORF/VERBOVEN (2000) a simultaneous model of demand and supply of roasted coffee is recommend. Because of aggregate data roasted coffee is assumed to be a homogenous good. Demand is specified as a linear demand curve homogenous of degree zero in prices and income. Consumption of roasted coffee is determined by the retail price of roasted coffee, the net income of households, prices of other goods (complementary and substitute) (KUTTY 2000). The demand function can be written as

(1) $$Q_t = a_0 + a_1 p_t + a_2 y_t + a_3 p_t^c + a_4 p_t^s$$

with Q_t as consumed quantity of roasted coffee, a_i as parameters to be estimated, p_t as price for roasted coffee, y_t is the net income of households, p_t^c denotes the retail price of a complementary good (soda water) and p_t^s the retail price of a substitute good (caffeine-containing soft drinks, tea or soluble coffee). The index t ($t = 1...T$) denotes the time.

Suppliers are assumed to maximize profits by choosing quantity as strategic variable.[4] The profit π of firm *i* ($i = 1...n$) at time *t* can be written as

(2a) $$\pi_{it} = p_t(Q_{it})Q_{it} - C_i(Q_{it}, w_t)$$

with Q_{it} as quantity sold by firm *i*, C_i as cost function of firm *i* depending on the quantity sold (Q_{it}) and a vector of input prices w_t. Since 1993 the roasters have to pay a specific tax on roasted coffee. The tax is symbolized by τ_c while the value added tax is given by τ_{vat}. The equation (2a) can be modified to

(2b) $$\pi_{it} = \frac{1}{1+\tau_{vat}} p_t(Q_{it})Q_{it} - C_i(Q_{it}, w_t) - \tau_c Q_{it} .$$

Solving the maximizing problem subject to the individual quantity Q_{it} it follows that

(3) $$p_t = (1+\tau_{vat})\frac{\partial C_i}{\partial Q_{it}} - \frac{\theta}{\eta} p_t + (1+\tau_{vat})\tau_c$$

with $\theta = \frac{\partial Q}{\partial Q_{it}} \frac{Q_{it}}{Q}$ and $\eta = \frac{\partial p_t}{\partial Q_t} \frac{Q_t}{p_t}$. θ is the conjectural elasticity of total output with respect to the output of the *i*th firm. η symbolizes the price elasticity of demand for roasted coffee. For a market model the individual supply functions

[4] The resulting model contains the possibility of imperfect competition as well as perfect competition by the value of the elasticity of conjectural variation.

The estimated parameters of the retail price is negative and significantly different from Zero. The average own price elasticity counts for –1.5034 in the basic model, -0.5969 in the holiday model and –1.3298 in the merger model. The average income elasticity is derived as –3.6198, as –1.4324 and as –2.9230, respectively. The magnitude and especially the sign of this elasticity seems surprising. Nevertheless one possible explanation for this finding may be that the analysis uses aggregated data. Though it might be possible that with increasing income households change consumption towards less quantity and more quality. Soft drinks with caffeine have a negative sign that indicates that they are complements to roasted coffee.[10] Except for the holiday model the price of 'coke' induces significant changes in roasted coffee consumption.

The estimated signs of the three different coffee varieties indicate that *Other Milds* and *Robustas* influence the retail price positively while a price increase in the *Colombian Excelso* variety reduces the retail price. This relationship is unexpected and may suggest that this variety is less important in the German market. Costs due to changes in the exchange rate as well as labor and freight costs do not significantly influence the consumer price for roasted coffee.

All estimated parameters for the conjectural variation deviate significantly from Zero. This favors the hypothesis that roasters exercise market power. In the basic model the coefficient is $\phi = 0.4869$. As well the parameter differs significantly from One (*t*-value of -2.9354) which stresses that the companies do not act as uniform cartel (monopoly).

The significance of the dummy variables gives evidence whether exogenous shocks have an effect on pricing behavior. The estimated coefficient of the dummy variable does not differ significantly form Zero. Hence, months without a holiday have the same elasticity of conjectural variation as months with a holiday ($\theta^0 = \theta^1 = 0.5111$). The annual consumption scheme does not induce structural adjustments in suppliers' prices. The 'peaceful times of the year' - Christmas and Easter – do not stimulate variations in the intensity of competition. This gives evidence for Parker (1997) who found that price responses to fluctuations in demand are minor for goods for which the timing of purchase is important.

[10] The estimated sign of the soft drinks is unexpected. And even more confusing are the results for the other goods that have been tested. All goods reveal a negative sign, that is, all goods are complements to roasted coffee even black tee and soluble coffee. This relationship must be an aspect of further research.

According to the merger the number of suppliers is lower affecting the market outcome. The dummy variable coefficient has the opposite sign of the conjectural variation and deviates significantly from Zero. The difference in pricing behavior before and after the merger is significant. Before the merger the conjectural variation was $\theta^0 = 0.3324$, after the merger $\theta^1 = 0.2459$. Hence the impact of the merger is a increasing degree of competition. Additionally, it could be concluded that the merger has induced a price war (close to BERTRAND-behavior), as expected by market observers. The empirical analysis designate that the lower number of suppliers changes the processors' behavior towards price competition. The degree of competition is intensified. The consumers benefit from diminishing prices related to a kind of "price war".

6. Conclusions.

This analysis examines the pricing behavior of coffee roasters in Germany for the period 1990: to 2000:12. The market for roasted coffee is characterized by oligopoly power. The suppliers of roasted coffee have influence on the retail price and they use their price setting potential to employ price competition. The estimated elasticity of conjectural variation deviates significantly from Zero. The pricing behavior varies over time due to exogenous influences. The exogenous influences are the merger of two coffee roasters and retailers *TCHIBO* and *EDUSCHO* in 1997 and the cyclical fluctuations in consumption (before Christmas and Easter). While the merger has intensified the price competition, the consumption scheme does not affect the firms' behavior.

Several restrictions had to be imposed. It is assumed, that the good 'roasted coffee' is homogenous, that the individual supply functions can be aggregated to one market supply function, and that adjustments to new equilibria are instantaneous. In reality, these assumptions are generally violated. Further research on differentiated duopoly should help to analyze pricing strategies on the firm-level data. In this context it would be possible to model BERTRAND-behavior directly with price as strategic variable and with heterogeneous products (FEUERSTEIN 2001, MCMANUS 2001, VICKNER/DAVIES 2000). Within such a framework the impact of the merger on rivals' pricing behavior could be tested straightforwardly. Future research should be done in the field of long-run and short-run effects and the persistence of commodity price responses (see e.g. CASHIN/LIANG/MCDERMOTT 2000 and GÓMEZ/CASTILLO 2001).

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