Competition in Nordic Coffee Markets

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Abstract

The purpose of this study is to investigate the cause of the large differences in the retail price of roasted coffee in Denmark, Finland and Sweden. Since the market concentration is high in all markets, the primary question is whether different levels of market power are a key driver for the price differences. The analysis of market power is carried out within the framework of the Breshnahan-Lau model, an oligopoly model that allows for the identification of market power using aggregated industry time series data. The econometric approach is to first test for long-run relationships between the data based on Johansen's (1995) procedure for co-integration analysis, and then to estimate single-equation equilibrium correction models for the pricing behavior. The analysis is based on quarterly data for the period 1988:1 – 2000:4. Our major finding is that no evidence of market power can be detected in any country using the Breshnahan-Lau model. However, the speed of price adjustment is generally quite low, which could be associated with asymmetric pricing. When testing for asymmetry with respect to price changes, we find that the coefficient for increases is larger than the one for decreases in all three countries, although the difference is only statistically significant in Finland. The price differences can partly be explained by large differences in costs and indirect taxes. When deducting VAT, coffee tax and the cost of beans from the retail price, we find that the most expensive county, Denmark, has the lowest mark-up.

1. Introduction

In this paper we investigate the determination of coffee prices in Sweden and two other Scandinavian countries, Denmark and Finland. The choice to analyze coffee is partly due the finding that according a recent survey Sweden had the highest EU prices for roasted coffee, with the exception of Great Britain, Ireland and Greece, which primarily consume instant coffee and tea. Swedish prices were 7 percent above the EU average (European Commission, 2002a).

The main purpose of the study is test for the presence of market power. We estimate the price sensitivity of demand (demand elasticity) and test whether consumer prices exceed marginal costs. In addition, we investigate the time it takes for cost increases to be transmitted to consumer prices and if there is asymmetric pricing, i.e. whether consumer prices rise faster when costs increase than vice versa.

Our approach has three advantages that merit a separate note. First, the analysis is dependent on price variations rather than actual price levels, which is important since actual price levels are difficult to measure correctly. Second, the use of time series yields average prices for the period in question; and if these averages are stable they provide more information than a price comparison at a fixed point in time does. Third, since each country is analyzed separately, the analysis is independent of currency variations.

There are several reasons why the coffee market is particularly suitable for a study of market power. Coffee is an important product, consumed daily by a majority of the adult population (with some exceptions such as Great Britain). With an annual coffee consumption of 8 kg per capita, Swedes are among the largest consumers of coffee in the world. There are also good reasons to expect there to be market power, as most of the national coffee markets are dominated by a couple of major roasting-houses; the four largest houses usually account for 70-80% of each national market. In addition, the exceptionally low world market price for coffee beans lately has brought the question of lack of

competition further into focus. Roasting-houses have been more or less openly accused of making significant profits, while farmers in developing countries are unable to cover their costs (see amongst others Moore, 2002; Oxfam, 2002).

Also, it is of importance for the analysis that coffee is a simple product with a low degree of value added. Because of this, quality differences are largely reflected in the cost of imported coffee beans, which account for a significant share of the market price for coffee. Furthermore, the most significant price changes are caused by fluctuations in the price of coffee beans rather than product differentiation.

The paper is structured as follows. The next section covers concepts and economic theory and gives a background for the empirical analysis. Section 3 provides a short description of the national coffee markets including a price comparison. Section 4 reports the results of the empirical analysis and section 5 summarizes the results and draws conclusions.

2. Theoretical background

This section starts with a short description of the theory underlying the empirical analysis of market power. After that follows a description of a complementary approach, tests for asymmetric pricing and a description of the empirical approach.

To study the degree of competition we must first define perfect competition and market power.[1] Assuming that companies in the market for a particular good maximize their profits, then perfect competition prevails when the price of the product equals each company's marginal cost. Since profits are maximized when marginal cost equals marginal revenue, and a company without market

[1] See Breshnahan (1989) for a thorough description of different approaches of measuring market power.

power cannot influence the price, its marginal revenue is the revenue received from the sale of the last unit, which equals the price of the product. This relationship can be written as,

$$mr = P = mc, \qquad (1)$$

where *mr* is marginal revenue, *P* the price of the product and *mc* marginal cost.

In the absence of perfect competition, market price and marginal revenue differ at profit maximization. A company with market power will act in such a way as to increase the price above both marginal revenue and marginal cost. In the extreme case, when there is either one sole company in a market, or several forming a well-functioning cartel, the relationship between marginal revenue, price and marginal cost is as follows,

$$mr = P + Q\frac{\Delta P}{\Delta Q} = mc, \qquad (2)$$

where *Q* is the quantity of the good and Δ represents a small change in *Q* and *P*. The additional term, $Q\frac{\Delta P}{\Delta Q}$, indicates that a change in the supplied quantity will affect the price and hence marginal revenue. The magnitude of the price change depends on the effect that a supply change has on demand, which can be measured by the demand elasticity, ε, i.e. the percentage decrease in demand caused by a one percent increase in price. Thus, equation (2) can be rewritten to include the price elasticity by multiplying and dividing (2) by *P*,

$$mr = P - \left(\frac{1}{\varepsilon}\right)P = mc, \qquad (3)$$

where ε is defined as the price elasticity multiplied by -1. After rearranging terms we obtain,

$$P = mc + \left(\frac{1}{\varepsilon}\right)P. \qquad (4)$$

According to equation (4), the monopoly price is determined by marginal costs and the inverted price elasticity times the price. The price exceeds marginal costs as long as the elasticity, in absolute terms, is not very high When ε is high the monopolist lacks market power since a price increase would cause a sharp reduction in demand for its products. Furthermore, according to this equation, ε must be equal or greater than one, or marginal cost would be negative, which is not possible.

In reality, most markets are neither perfectly competitive nor perfectly monopolistic and to describe these markets equation (4) must be modified. A major difference between a market with perfect competition and one where companies have market power is that in the latter one company's actions may affect the actions of other companies. This effect can be accounted for by introducing the term θ into Equation (4),

$$P = mc + \left(\frac{\theta}{\varepsilon}\right)P. \qquad (5)$$

If we interpret (5) as a summarizing the different companies' behaviour in a market, then θ describes the average degree of market power. Similarly 1-θ provides a measure of the intensity of competition. When θ equals 0 we have a situation of perfect competition, i.e. $P = mc$ and companies do not possess any market power. When θ equals 1 we have a monopoly situation as in Equation (4). A value between 0 and 1 indicates that there is an oligopolistic market.

From Equation (5) it is also clear that the price of a good depends on three factors; marginal cost, including VAT and other indirect taxes, the degree of market power and demand elasticity. Thus, the

coffee price can be high in a certain country, despite a relatively competitive market, if the elasticity of demand is low or if marginal costs are high.

One of the objectives of this study is to estimate the values of θ and ε for the different coffee markets. These estimates will enable us to show whether markets are perfectly competitive, $\theta = 0$, monopolistic, $\theta = 1$, and how much market power companies have, i.e. how close θ is to 0 or 1.

2.1 Asymmetric Pricing

To empirically estimate θ is technically complex and puts great demands on the availability of relevant data. Therefore, we also test for pricing asymmetries, i.e. that companies utilize their market power to increase prices quicker when costs rise than vice versa. One explanation for asymmetric pricing is that companies, via tacit collusion or by watching each other, refrain from lowering their price as long as nobody else does. It is reasonable to assume that such behaviour is common in markets with few producers and where production costs fluctuate significantly, such as the roasted coffee market. All players benefit from this kind of behaviour. However, since an individual company may increase profits even more by lowering its price when production costs decrease, prices are likely to gradually adjust to the new production cost level. A complete, but asymmetric, price adjustment can be viewed as an indication that companies possess short-term, but not long-term, market power.

Although asymmetric pricing usually is interpreted as a evidence of cooperation between producers or price leadership, there are other possible causes. Companies could for instance prefer to offer different sorts of discounts when costs fall rather than immediately adjust the price. Another possible reason is the need to hold stocks. Companies could prefer to not lower prices quickly when costs fall to prevent a stock depletion, which could create additional costs (see Borenstein et al., 1997). Examples of recent studies indicating the existence of asymmetric pricing include Feuerstein (2002)

on the German coffee market, Gomez and Koerner (2002) on the French, German and US coffee markets, and Asplund et al. (2000), on Swedish gasoline pricing.

2.2 Empirical Approach

The empirical analysis is based partly on Steen and Salvanes (1999) and partly on Bettendorf and Verboven (2000). Steen and Salvanes (1999) analyzed the market power of Norwegian salmon importers to France by using a dynamic model, which takes stochastic trends in the variables into account. Bettendorf and Verboven (2000) analyzed the Dutch coffee market.

To test whether θ differs from zero we estimate a pricing relation, which is used to test for asymmetry, and a demand function for each market. In addition, we calculate the time it takes until an increase in import prices affects consumer prices.

The pricing relation is based on the following formulation of equation (5)

$$P = (1+\tau)mc - \theta \frac{Q}{\Delta Q / \Delta P} + (1+\tau)a \qquad (6)$$

where *P* has been solved from price elasticity, and indirect taxes have been added; τ is VAT and a excise tax. Equation (6) is expressed in real terms; *P* is the real price and *mc* are real costs. To estimate (6) we must specify an approximation to the marginal cost function and estimate a demand function to obtain the value of $\frac{\Delta Q}{\Delta P}$.

The roasted coffee production process is relatively simple. Approximately 1.19 kg beans are required to produce 1 kg of ready coffee. Other costs include labor, packaging, energy and capital costs, each of which stands for less than 5 percent of total costs (Bettendorf and Verboven, 2000; Koerner, 2002b).

There are few economies of scale, which allows us to assume that companies have similar cost functions, in spite of being of different sizes (Sutton, 1991). This leads us to the following marginal cost function, also used by Bettendorf and Verboven (2000),

$$mc = \beta_O O + \beta_W W + \beta_{IP} IP \qquad (7)$$

where *IP* is the real import price for coffee beans, *W* are real labor costs, and O stands for all other costs. We have observations for *IP* in terms of coffee bean prices, and for *W*, labor costs or salaries, but not for O. We assume that other costs follow the general price evolution and thus are included in the constant in the econometric analysis. Genovese and Mullen (1998), made the same assumption in their analysis of the US sugar market.

The estimate for coffee demand is based on the following model,

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 B \qquad (8)$$

where *P* is the real coffee price, *Y* real income, and *B* the size of the population.

We assume that the demand for coffee is determined by the coffee price in relation to the price of the basket of goods included in the consumer price index. We could also have added relative prices for more specific coffee substitutes, e.g. tea, but it is unlikely that they influence coffee demand.[2] Instead, it seems more feasible that an increase in the price of coffee primarily leads to better utilization of already purchased coffee, since studies show that as much as 20 percent of purchased coffee is not actually drunk (Bettendorf and Verboven, 2000).

[2] Studies showing that the price of tea has no effect on coffee demand include Bettendorf and Verboven (2000) for the Netherlands and Feuerstein (2002) for Germany. Gomez and Koerner (2002), however, do find that Coca Cola is a complement to coffee in Germany.

The second variable in the demand function is income. Normally an increase in income leads to an increase in consumption. However, the coffee market is likely to be saturated in several countries, hence even if a consumer can afford to consume more coffee he/she will not.

The last variable is population. A common assumption is that large population leads to a high demand. However, since consumption pattern can differs significantly between different age groups, a population increase does not necessarily lead to an increase in demand. We assume that the population variable reflects long-term consumption changes that are not explained by changes in price or income. However, we do not carry out a detailed analysis of these changes, as the objective is to estimate price elasticities.

When analyzing demand functions it is important to ensure that the estimated entity is indeed demand and not supply. In the case of coffee, however, the estimation of demand is simplified by the heavy fluctuations of the coffee bean price. Because of these fluctuations, the observed relationship between consumer prices and quantities is likely to be describing demand, not supply.[3]

The data analysis is performed in several steps. Since the mean and variance of at least some variables are not constant over time, we first use a method developed by Johansen (1995) to test for integration and cointegration, i.e. whether variables are stationary or not and if not whether they co-vary in the long run. We start by analyzing the long-term relationships (cointegration relationships) separately for demand and pricing, and whenever necessary we analyze all the relevant variables simultaneously. Then we estimate equilibrium correction models, ECMs[4], for the pricing, and in some cases for demand.

[3] The demand function is identified because the supply equation fluctuates heavily.

[4] Originally the term ECM was used as an abbreviation for ”error correction model”, but lately ”equilibrium correction model” is more frequently used.

The formal test for the existence of market power consists of testing whether $Q^* = Q\left(\frac{\Delta P}{\Delta Q}\right)$ = in the pricing ECM influences consumer prices in the short- and long-run, given marginal costs. This is illustrated below using a stylized version of the ECM based on equation (7),

$$\begin{aligned}\Delta P_t &= c + b_1 \Delta P_{t-1} + b_2 \Delta X_t + b_3 \Delta X_{t-1} \\ &+ b_4 Q^*_{t-2} + b_5 Z_{t-2} + \alpha_1 \left(P - \beta_1 IP - \beta_2 W\right)_{t-2} + \varepsilon_t\end{aligned} \quad (9)$$

where ΔX is a vector including all the explanatory variables except ΔP_{t-1}, c is a vector of the constant and other deterministic variables, and ε_τ is a white noise random term. The long-run relationships between the variables are captured by $(P - B_1 IP - B_2 W)$, Q^* and Z, where Z represents the variables that determine Q in the long run, and consequently Q^*. The level variables are lagged two periods to ensure that they do not affect the short-term dynamics.[5] We test for market power by testing whether b_4, which is $-\theta$, is smaller than zero. In addition, we test whether ΔQ^*, which is included in ΔX, affects ΔP, which would indicate that companies have short-term market power.

To investigate the existence of pricing asymmetry we separate import price changes, ΔIP, which are part of ΔX in Equation (7), into positive and negative values and re-estimate the model. We then test whether the coefficients for the positive values are higher than those for the negative values.

[5] The choice of lag does not affect the long-run relations between the data but it has an impact on the short-term dynamics (see Hendry and Juselius, 2001).

3. Prices and Markets

The purpose of this section is to describe the national coffee markets and compare price levels for roasted coffee. We use data from two separate sources to demonstrate existing variations. Furthermore, we compare prices after adjusting for import costs and indirect taxes.

Table 1 reports data for the three national coffee markets. The per capita consumption figures show the popularity of coffee and indicate the size of the market. With its relatively large population, Sweden has the largest market. However, in terms of per capita consumption, Finland is the clear leader followed by Denmark and Sweden. The consumption of roasted coffee dominates over instant coffee in all three markets; Sweden has the highest consumption of instant coffee, which is 10 percent, in the other two countries it is only accounts 4 percent.

The quality of coffee is primarily driven by bean type. There are two main types, Arabica and Robusta. The Arabica bean is more expensive and mainly used in high quality coffee, while Robusta is used in cheap, low quality, coffee, instant coffee, and in espresso due to its high caffeine level. While Robusta accounts for only 3 and 2 percent of the Swedish and Finnish coffee imports respectively, it accounts for over 16 percent of Danish coffee imports. However, we do not know how much Robusta that is actually consumed and how much that is exported.

Another possible cause of the national price differences is the different indirect taxes. In Denmark VAT is 25 percent and there is an excise tax of 6.54 DKK per kg of roasted coffee. In the Finland VAT is 17 percent and in Sweden it is only 12 percent.

Table 1: National Coffee Markets, 2000

	SE	DK	FI
Per capita consumption, kg	8.0	8.6	9.9
Instant coffee, %	10	4	4
Arabica imports, %	97	84	98
VAT, %	12	25	17
Excise tax, per kg roasted coffee	-	DKK 6.54	-

Note: The following abbreviations have been used: SE = Sweden, DK = Denmark, FI = Finland.

Sources: Coffee-Digest 1 (2002), European Commission (2002) and Der Kaffee als Handelproduckt (2002)

The various national EU markets have similar structures. Each market consists of one or a couple of large and several small roasting-houses (see Sutton, 1992). The large ones usually account for more than 80 percent of the market together, while the market shares of each of the small ones is less than 5 percent. The large roasting-houses include both domestic and multi-national players, of which the largest are Kraft and Nestlé, with a 13 percent global market share each, followed by Sara Lee with 10 percent, and Procter & Gamble and Tchibo with 4 percent each (Oxfam, 2002). While Kraft, Nestlé and Sara Lee are present in many countries, Procter & Gamble is mainly active on the US market and Tchibo in Germany and Austria.

The market shares of the Swedish roasting-houses are shown in Table 2. Kraft, owned by Philip Morris, is the market leader with a 44 percent market share. Its brands are Gevalia, Maxwell House and Blå Mocca. Löfberg Lila is second largest with a market share somewhat below 20 percent, followed by Nestlé, with the Zoega brand, and Arvid Nordquist with the Classic brand, both with a 10 percent market share each. The smaller roasting-houses hold less than 3 percent of the Swedish market. A limited amount of coffee is also imported. COOP's Signum, for example, is roasted in Denmark.

Table 2. Swedish Market Shares for Roasted Coffee

Company	Brand	Market share %
Kraft Food	Gevalia, Maxwell House, Blå Mocca	44
Löfbergs Lila		18
Nestlé	Zoega	13
Arvid Nordquist	Classic	12
Lindvalls Kaffe		3
K W Karlberg		1.7
Kahls Kaffe		1.5
Bergstrands		1
Guldrutan		0.7
Övriga		5.1

Source: Företagaren Direkt (2002).

The distribution of market shares in Denmark is very similar to that in Sweden, but in Denmark Sara Lee, with the Merrild brand, is market leader with at 31 percent market share. Kraft Morris with 27 percent market share is the second largest player, followed by two domestic companies, BKI (B·K·I Kaffe A/S) with a 17 percent and DKK (Dansk Kaffekompagni A/S) with a 14 percent. The remaining roasting-houses hold 11 percent of the market.[6] The roasting-houses also do private label production, which if included would alter the market shares somewhat.

We do not have detailed information on the market share distribution in Finland. Nevertheless, Paulig is clear market leader with a market share of 50 percent (Paulig Group Journal, 2002). The other two large players are Meira, with a market share of 25 percent, and Viking Kaffe. Hence, in all national markets there are a small number of large companies and there are reasons to suspect the presence of market power. One can also expect large differences in price driven by different indirect taxes and possibly in differences in bean quality.

To provide a picture of the past few years' price level and evolution we have summarized data from two different sources, International Coffee Organization (ICO) and Economist Intelligence Unit (EIU). ICO's data is primarily collected by the various national statistics offices on a monthly basis, while EIU collects its own data in a number of large cities bi-annually.

Table 3 shows the average per kg coffee price in SEK for the 1998-2001 period based on ICO's monthly data. These are the prices used in the empirical analysis. During 1998, the price level was high in Denmark and a bit lower in Sweden. Finland was clearly the cheapest country. The ranking was similar in 2001, although the Swedish price declined more than the

[6] The source of Danish market shares is Max Havelaar Fonden in Copenhagen. This data should be regarded as preliminary.

others. A plausible explanation for the rapid decrease in Swedish prices was the depreciation of the SEK relative to the currencies of the other countries during the 1998-2001 period. Another possible explanation is that Swedish prices reacted faster than those of most other countries to the approximately 50 percent decrease in the price of coffee beans.

Table 3 Average Prices per kg Coffee

Year	SE	DK	FI
1998	77.33	86.24	59.93
1999	63.84	71.55	47.29
2000	61.03	69.38	46.12
2001	57.61	72.44	44.99

Source: International Coffee Organization and national statistics bureaus.

The involvement of several organizations in collecting the data in Table 3 and the fact that the figures are average prices for large regions complicate the comparison between countries. The data collected by the EIU resolves these problems, since it is collected from central retail outlets in large cities. The disadvantage of the EIU data, however, is that it overstates the average price level and is only reported on a yearly basis. Table 4 shows the price per kg for normal retail outlets. As shown in the table, the EIU data, Sweden was the most expensive country in 1998 with Denmark in the second place. In 2001 the relation is the same as with the other data set.

Table 4. Price per kg Roasted Coffee

	1998	1999	2000	2001
Stockholm	95.00	79.80	69.00	65.80
Copenhagen	90.24	94.52	72.42	84.30
Helsinki	68.24	67.84	59.38	55.70

Source: Economist Intelligence Unit. Data reflects prices in normal retail outlets in the city centers.

A more representative cost comparison includes adjustments for different coffee qualities and indirect taxes. The main quality difference stems from the beans used, Arabica or Robusta, which have seen differences in the world market price from 50 to 100 percent during the late 1990s. Table 5 shows the price levels of coffee relative to import costs of coffee beans, VAT and excise tax.[7] These values give an indication of the actual mark-ups, and depend to some extent on the degree of competition. However, note that all costs are not included and no adjustment has been made for the possibility that indirect taxes can influence pre-tax price levels. The EUI data for supermarkets were used in the calculations. Since these have been collected in the centers of major cities they are likely to lead to overestimation the price-cost margins.

Table 5 reports average values for the periods 1990-1995 and 1996-2001. There are relatively small differences between the periods, both for levels of 'mark-ups' and the ranking order. Finland and Denmark have the lowest margins; they are about 45 to 50 percent, while Sweden has 'mark-ups' of about 0.60.

Table 5 Prices in Relation to Certain Costs[a]

Country (capital)	1990-95	1996-2001
Sweden	0.61	0.61
Denmark	0.48	0.51
Finland	0.49	0.45

Source: Consumer prices are based on EIU data for supermarkets in the capital of each country, Import prices are based on ICO data.

a) The 'mark-up' is estimated as (P-Cost)/P. Costs include Import costs, VAT and excise tax.

[7] To calculate the cost we have assumed that 1.19 kg beans are necessary to produce 1 kg of roasted coffee, that VAT is added to the cost of beans and to coffee tax in Denmark. The cost was calculated as (1+VAT)*1,19*import price+ (1 + VAT)*excise tax.

4. Empirical Analysis

In this section we describe the results of the econometric analysis for Sweden, Denmark, Finland. First we perform the cointegration analysis, which provides information about the variables' stochastic characteristics, i.e. whether the variables are stationary and whether they co-vary in the long run. The cointegration analysis also allows us to test for long run simultaneity. Subsequently, we estimate dynamic one-equation models where we account for simultaneity when necessary. Since the statistical analysis used yields a large number of results, we only summarize the findings in this section, a more thorough description of the results can be obtained from the author.

The data are summarized in Table 6, while detailed information on sources and definitions are given in Appendix A. Apart from consumer prices, reported in Table 3, the following variables were used in the empirical analysis. Total coffee consumption was calculated as imports minus exports of roasted and un-roasted coffee. Import prices were obtained as the ratio between the value and volume of imported un-roasted coffee. Most of this data stems from ICO's database, with certain supplements and updates based on data from the national bureaus of statistics.

The availability of labor cost data varies between the countries. In Sweden hourly labor costs in the food sector are available on a quarterly basis; in other countries labor costs are only available as an index for the entire manufacturing sector. However, as we show below, the lack of detailed data on labor costs probably only has a limited effect on the results.

Income is measured directly as household expenditures according to the national accounts, which is the usual approach in demand studies.

Population data for Finland and Sweden are only available on an annual basis; hence we use interpolated variables. For Denmark quarterly data on population are reported. Since the purpose of the population variable is to reflect long-term evolution, we use it as a trend in the analysis and therefore interpolation should have a limited effect on results.

Since our main concern is the current state of the coffee market, we focus our analysis on the 1988-2001 period. The choice of 1988 as a starting point is due turbulence in the coffee market after the mid-1980s. Hence, including the mid-1980s would have significantly complicated the analysis. Nevertheless, in some cases data form the beginning of 1980 had to be used to detect long run relations.

Table 6. Description of Variables

Variable	Name	Comment/ Definition
P	Consumer price of coffee deflated by CPI, per kg	Average real prices in local currency.
IP	Price of imported coffee beans deflated by CPI, per kg	Average real prices in local currency. Adjusted for VAT.
W	Labour costs deflated by CPI	Labour costs or wages adjusted for VAT. Exact definition varies between countries.
O	Other costs deflated by CPI	Included in the constant term in the regression.
Q	Coffee consumption	Calculated as coffee imports minus exports.
*Q**	$(\Delta P/\Delta Q)\ Q$	Calculated as the derivative of P in the demand function multiplied by consumption.
KPI	Consumer price index	Used to calculate real prices. 1995 = 1.
Y	Real Income	Household expenditures on private consumption.
B	Population	Inhabitants in million

Note: See Appendix A for a detailed description of variables.

4.1 Coffee Demand

The first step in the analysis of coffee demand consists of integration and cointegration tests on consumption, *Q*, real consumer prices, *P*, income, *Y*, and population, *B*. The results reflect the different national consumption evolutions during the 1990s when Swedish and Danish

consumption decreased and Finnish consumption fluctuated around a constant level. Hence, the cointegration analysis showed that Swedish and Danish long-run consumption is only determined by the population evolution and consumption in Finland has no long-run trend. In general the population variable can be interpreted as measuring either consumption increasing due to population growth or changes in consumption driven by different preferences of the various age groups (see Durevall 2004). Empirically, the population variable works as a deterministic trend.

The implication of the cointegration analysis is that the relationship between Q^* and P as described by the supply relation in Equation (6) does not exist in Sweden and Denmark, i.e. consumption and prices are not related in the long run. Thus, when estimating the supply relation we must include the variables that determine consumption in the long run.

Table 7 reports the static equilibrium solutions of the estimated demand functions. These solutions are based on dynamic models and may be interpreted as averages for the period analysed. For all countries, the price coefficient is significant and negative in all three models. It is also worth noting that the income level does not affect long-run consumption; the markets are probably saturated in all three countries.

To facilitate comparison across countries of the price coefficient, the price elasticities were calculated. The average elasticities for 1990-2001 in absolute terms were 0.26 for Sweden, 0.22 for Denmark and 0.32 for Finland, which is below 1 in absolute terms. Other studies that have obtained coffee-demand elasticities around 0.20 are Feuerstein (2002) for Germany and Bettendorf and Verboven (2000) for the Netherlands.

Table 7. Long-Run Demand Functions for Coffee

	Sweden	Period 1988:1 - 2001:4		
	Constant	*P*	*B*	
Coefficient	110,4**	-0,084**	-9,69**	
t-ratio	6,57	-3,72	-5,07	
	Denmark	Period: 1989:1 - 2001:4		
	Constant	*P*	*B*	
Coefficient	52,58**	-0,045**	-7,11**	
t- ratio	10	-4,49	-7,2	
	Finland	Period: 1988:1 - 2001:4		
	Constant	*P*	*ΔY*	*Dum*
Coefficient	19,69**	-0,134**	1,185**	-2,63**
t- ratio	14	-2,84	3,1	-5,02

Note: Coefficients with a 95 and 99 percent significance are market with * and ** respectively. A dummy equal to one has been included for Finland for the 1995:1-2001:4 period. The dummy most likely takes care of changes in the data collection of imports.

Since θ must be smaller than the absolute value of demand elasticity, we conclude that cartel cooperation does not occur in Sweden, Denmark or Finland. The difference between price and marginal cost may, nevertheless, be large since an increase in price only has a small effect on demand.

4.2 Testing for Market Power

The second step in the analysis consisted of testing for long-run relationships between the various supply-relation variables. In no case did Q^* have a significant long-run effect on consumer prices. We continued by estimating an ECM, based on equation 7, for each country and tested whether Q^* affects consumer-price changes. We commenced by placing five lags on ΔP, ΔW, ΔIP, and ΔQ^* and included P, W, IP and Q^* lagged by two periods to ensure that they do not affect the short-run dynamics. We also included those variables that affected Q in the long run in the demand analysis. W and IP stand for 1+VAT multiplied by real labour costs and real import prices, respectively. The Danish coffee tax was included as a separate variable, defined as the excise tax multiplied by 1+VAT. A few impulse dummy variables were also included to attain well-specified models. These variables are unity when consumer

prices exhibit increases or decreases which cannot be explained by the other variables, and zero otherwise.

The empirical models of the price equations were developed by starting with general models, and excluding all variables that did not have significant coefficients, except for Q^* and those that determine Q^* in the long run. Moreover, a number of misspecification tests were implemented to ensure that the models were statistically valid. Detailed results from the regression analysis can be obtained upon request from the author.

The price equation is formulated such that the Q^* coefficient must be negative whenever θ is positive, which it is in two of the three models, as shown in Table 8. However, none of the coefficients are significant and the estimated values are close to zero. Furthermore, the coefficients for the change in Q^*, ΔQ_t^* for t = 0…5 are not significant either. Thus, we cannot reject that $\theta=0$ for any of the countries.

The long-run relationship between the consumer price and its determining factors is implicitly included in the ECM. The import price, after adjusting for VAT, significantly affects the average consumer price level in all countries. In Sweden a permanent 1 SEK increase in the import price leads to a 1.70 SEK increase in the consumer price, which we can see by dividing the coefficients for *IP* with that of *P* and changing the sign. This exceeds the technical relationship between coffee beans and coffee of 1.19 kg beans per 1 kg roasted coffee. A possible explanation for the high value is that the coefficient also reflects other costs that are directly proportional to the import price, e.g. the retail mark-up, which is usually set as a percentage of the purchase price. Thus, we conclude that the long-run marginal cost function for Sweden, i.e. *mc* in equation (7), consists of 1.7**IP* and a constant term of

approximately 20 SEK in 1995 Kronor. The constant term reflects labour costs minus productivity improvements, as well as other costs and profits.

The results differ somewhat for Denmark and Finland. In Denmark we observe a weak trend in the relationship between *P* and *IP*, and hence used $IP^T = IP - 0{,}062*trend$ in the regression. The long-run effect of a permanent 1 DK increase in *IP* is 1.3, which is clearly lower than in Sweden. In Finland it is as low as 1.18.

Furthermore, the ECMs also show that import price changes have strong and significant affects on ΔP in the all three models. Both the simultaneous and lagged coefficient for ΔIP are clearly significant, although they add to very different values for the different countries due to the inclusion of lagged ΔP for Sweden and Finland. In all three countries the total effect of an increase in ΔIP is somewhat below one, when taking short-term dynamics into account.

The labour cost variable is only significant in Sweden where ΔP increases by 0.10 SEK for every 1 SEK increase in real hourly labour costs, but the t-ratio of the cost variable is just above 2. A possible explanation for the labour cost variable's weak effect on prices is that profit margins decrease when real wages increase.

Table 8. ECM for ΔP and Testing for Market Power

	SE[a]	DK[b]	FI[a]
Variable	Coefficients		
Constant	-17.4	27.7*	2.7
ΔP_1	-0.498**		-0.185*
ΔP_2	-0.151*		0.233**
ΔIP	0.641**	0.596**	0.311**
ΔIP_1	0.811**	0.475**	0.444**
ΔW_3	0.183*		
P_2	-0.572**	-0.297**	-0.284**
IP_2	0.969**		0.334**
IP^T _2		0.384**	
B_2	3.402	-2.402	
Q*_2	-0.0002 (0.014)	0.006 (0.005)	-0.009 (0.005)

Note: The 95 and 99 percent significant coefficients are market with * and ** respectively. Some of the equations contain dummy variables, which have not been reported. See appendix B.

a) Time period 1988:1 – 2001:4; b) Time period 1989:2 – 2001:4; c) Time period 1988:2 – 2001:4.

Finally, it is interesting to determine the time it takes for a change in import prices to affect consumer prices, since if there is a significant lag one may suspect asymmetric pricing. This can be illustrated using cumulative responses, which shows how an increase in an explanatory variable affects the dependent variable (see Doornik and Hendry, 1994). The results are summarized in Table 9. The Swedish price response is also plotted in Figure 2. It shows the effect of an increase in the coffee bean price on the consumer price over time as a share of the total effect, which is normalized to one; i.e. 50 percent of an increase is passed on to consumers after one to two months, and the entire increase after one year. Two important reasons for this delay are the time it takes for imported coffee beans to reach retail outlets as roasted coffee, and active inventory management. However, it is also possible that

asymmetric pricing or preferences for relatively stable consumer prices play a role. Outright contracts delaying the price adjustment do not exist in Sweden.[8]

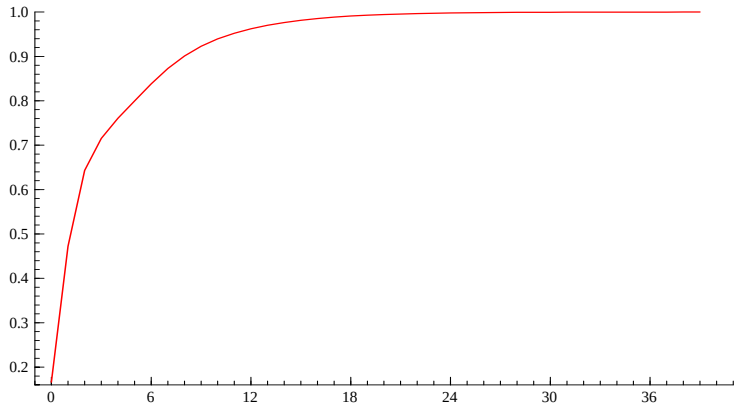
Table 9. Cumulative Effect on Consumer Price by Import Price Increase

Country/Months	0	1	3	6	12
Sweden	0.17	0.46	0.75	0.81	0.96
Denmark	0.24	0.56	0.77	0.94	0.97
Finland	0.05	0.22	0.66	0.88	0.98

Note: The calculation shows the share of the price adjustment which has occurred after x months. Complete adjustment is set to 1

Danish price adjustment is somewhat more rapid. Roughly 50 percent is passed on to consumers within a month, but for the full effect a year is required just as in Sweden. In Finland price flexibility is significantly lower, at least during the first couple of months. After one month only 20 percent of the price increase has been passed on, and for 50 percent three months are required.

Figure 2. Cumulative Effect on Monthly Consumer Prices Caused by an Increase in Import Prices



Note: The y-axis shows the share of the import price increase that has been passed on to the consumer price at a given month. The x-axis shows the number of months since the price increase. The total effect is normalized to one. The calculations are based on monthly data.

[8] According to Calle Åkerstedt, Svensk Kaffeinformation

4.3 Price Response and Asymmetry

As a last step we investigated whether consumer prices react asymmetrically to changes in the coffee bean price. To this end, we separated the change in the import price, *ΔIP*, into two variables, one for negative observations, *ΔIPneg*, and one for positive observations, *ΔIPpos*. We replaced *ΔIP* by these variables in the models shown in Table 9 and tested for differences between the values of *ΔIPneg* and *ΔIPpos* in each quarter and for differences in the sum of the two variables' coefficients. The estimated variables as well as the results of the tests are shown in Table 10.

As shown in Table 10 the coefficient for *ΔIPpos* exceeds that for *ΔIPneg* in all countries, which indicates that companies raise consumer prices faster than they lower them. Furthermore, the sum of the coefficients for *ΔIPpos* exceeds that of *ΔIPneg*. However, when we test the difference of the sums, we find that they are only significant for Finland (see the last row of Table 5.11). The same results are obtained when testing for the contemporaneous effect of import price changes.

We can thus conclude that there is some evidence of asymmetry in Finland. Furthermore, in Finland consumer and import prices follow a similar long-run trend, i.e. are co-integrated, and thus the asymmetry is only short term. It is important to note that the existence of asymmetric pricing does not necessarily indicate market power (see Borenstein et al. 1997). There are several other possible explanations for asymmetric pricing, e.g. companies may offer rebates rather than lower prices, or they may refrain from lowering prices to avoid too rapid depletion of inventories. Hence, further analysis is required to both validate and extend the results for all the three countries.

Table 10. Asymmetry Tests for *ΔP*

	SE	DK	FI
ΔIPneg	0.621**	0.531**	0.139
ΔIPneg_1	0.577**	0.409**	0.403**
ΔIPpos	0.634**	0.712**	0.388**
ΔIPpos_1	0.939**	0.423**	0.542**
Sum of the coefficients			
ΔIPneg	0.739**	0.940**	0.523**
ΔIPpos	0.970**	1.135**	0.898**
Asymmetry test $\chi^2(1)$	1.13 [0.29]	1.61 [0.20]	12.54 [0.0004]

Note: Coefficients, which are significant at the 95 and 99 percent level are market with * and **. The estimated models are identical to the equations in Table 9, with one exception, the separation of *ΔIP* into *ΔIPneg* and *ΔIPpos*. The asymmetry test is a test for equality between *ΔIPneg* and *ΔIPpos*. It is χ^2 distributed with 1 degree of freedom. The probability that the values are equal is shown in brackets. The test for Finland is made under the assumption that *IPneg* is zero, since the t-ratio is 1.22.

5. Summary and Conclusions

The purpose if this study was to investigate why there are large price differences of roasted coffee across the Nordic countries. Since concentration is quite high in all national markets, there are reasons to believe that leading players have market power. Therefore, differences in the degree of market power between the countries, and the effect of this on pricing, was the key question in the study.

Nonetheless, there are several other reasons for large price differences beside market power. Two of these are quality differences in imported beans and large variations in indirect taxes.

Imports of cheap Robusta beans vary from 10 percent in Denmark to about 2 percent in Sweden and Finland. Since the world market price for Arabica can be up to twice that of Robusta, national differences in bean affect the price level.

In Denmark there is an excise tax of 6.54 DKK per kg and VAT is 25 percent, while the Swedish VAT is only 12 percent and there is no excise tax. Hence, taxes are likely to account for a significant part of the price differences.

The market structure is rather similar in the three countries with a few large players accounting for roughly 70-80 percent of each market, and a large number of small companies sharing the rest. Concentrated markets such as these typically occur when technical barriers to entry are low and product branding, hence, must be supported by aggressive marketing to maintain a given market share level (Sutton, 1992).

Despite the high market concentration it turned out to be difficult to find clear indications of market power. We were unable to show that prices are higher than marginal costs in any of the countries. Similar results have also been obtained in recent studies of the German and Dutch coffee markets (see Koerner, 2002a, 2002b; Bettendorf and Verboven, 1998, 2000).[9]

There are, however, some differences in how prices are determined. In all countries we find a long-run relationship between the import and the consumer price, such that the average consumer price is determined by the price of imported coffee together with a constant. But the value of the coefficient, which determines how much the consumer price increases as a result of an increase in import prices, varies from 1.18 in Finland to 1.30 in Denmark, and 1.70 in

[9] Bettendorf and Verboven (2000) found that θ had a positive, although a very low, value.

Sweden. A possible explanation for these differences is that the margins of retailing sectors, usually set in percent of the wholesale price, vary across the countries.

In general, it takes a year or longer for an increase in the import price to be fully transmitted to the consumer price. The slow price adjustment is partly due to the time it takes for imported beans to reach retail outlets as roasted coffee, and partly to the existence of inventories, but asymmetric pricing could also cause it. We therefore investigated whether asymmetry exists in the sense that an increase in import prices more rapidly affects consumer prices than vice versa. We find asymmetry tendencies in all countries, but the was only a statistically significant difference between the coefficients of import-price increases and decreases in Finland. In Sweden and Denmark the differences are rather small. Feuerstein (2002), Gomez and Koerner (2002), and Bettendorf and Verboven (2000) find evidence of asymmetric pricing in Germany, France and the Netherlands, respectively.

Although we did not find evidence of market power, the existence of asymmetric pricing and the slow response to changes in coffee bean prices nevertheless indicate that coffee markets do not function perfectly. Several potential explanations exist for this asymmetry.[10] It could, for example, be a matter of tacit collusion or price leadership during short periods of time. It is in the interest of all roasting houses to keep prices stable when costs decrease if the price elasticity is below one in absolute terms. However, individual roasting houses can benefit even more by lowering their price, assuming others do not follow suit. Therefore, it is reasonable to believe that delays in adjusting the consumer price are only short-term. There could also be a general tendency of roasting houses to avoid lowering the price when costs fall, since they make a larger profit per unit if they keep prices unchanged. The explanation

[10] See Borenstein et al. (1997) for explanations for the existence of asymmetric pricing.

could also be related to the interaction between retailers and producers. If retail chains have market power it will be difficult for producers to raise the price when costs rise, which in turn would make them reluctant to lower the price when costs fall. Still another possible explanation is that producers refrain from lowering the price too quickly to avoid a too rapid depletion of inventories; a similar restriction naturally does not exist in case of a price increase. Finally, pricing asymmetry could arise because companies prefer to give quantity rebates, which are not registered as price decreases, when costs decline. However, since quantity rebates are uncommon in Finland where asymmetry exists, but quite common in Sweden, where we do not find asymmetry, this is not a plausible explanation.

According to our results, market power does not automatically follow from a high market concentration. It might suffice that one of the leaders has an aggressive pricing policy, which is the case in Germany where Aldi has acted as price leader and put significant pressure on prices. Koerner (2002a) even claims that prices in Germany were below marginal costs during certain periods in the 1990s. In Sweden there are some small brands that seem to compete with low prices, whereas some large brands such as Gevalia, while using marketing to a great extent as a means to compete, also regularly offer substantial rebates.

Our conclusion is that the Nordic coffee market seems to function well although we cannot exclude the possibility that there is market power in Sweden, or in the other markets. It is possible that an analysis based on price and quantity data for individual brands would have yielded different results, but such data was not available. Furthermore, our analysis sheds no light on the role played by the retailing sector in setting the price.

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Appendix A: Description of Data

The following variables have been used in the empirical analysis:

Coffee consumer prices

Data from the International Coffee Organisation (ICO). Additional data from SCB

Coffee imports and exports, roasted and unroasted, volume and value terms

Data from ICO. Additional data from SCB, Danish Statistics, and the custom authorities in Finland. Spain.

VAT and excise tax

Data from the European Commission (2002b), Kaffe-Digest 1 (2002) and the various national tax authorities.

Labor costs

Sweden: Labor cost per hour for employees in the food and beverage industry. Source: SCB.

Denmark: Wage index for the entire industry sector until 1995:4 and wage index for the food and beverage sector 1996:1-2001:4. Source: Danish Statistics.

Finland: Hourly wages in the manufacturing industry sector. Source: Ecowin database.

Consumer price index (CPI)

CPI based on data from International Financial Statistics database.

Population

Population statistics are based on data from The International Data Base (IDB), U.S. Bureau of the Census, for all countries but Denmark, which is based on Danish Statistics. Since population data is available on an annual basis we have used interpolated quarterly data for all countries except Denmark, where quarterly data is available.

Income

Income is measured as household expenditures divided by CPI. Source: International Financial Statistics.