

Demand for Coffee: The Role of Prices, Preferences and Market Power

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Abstract

The purpose of this paper is to evaluate the role of prices in determining demand for roasted coffee in Sweden. This is of interest because many believe that consumer prices are high relative to green coffee-bean prices, and that lower consumer prices would increase demand for coffee beans. Coffee demand is estimated on data for the period 1968-2002. In the long run, changing preferences appear to determine demand for roasted coffee, and a reduction in consumer prices would only have a temporary impact on consumption. Hence a permanent decrease in consumer prices would only increase exports of coffee beans to Sweden for a couple of years.

Keywords: Coffee exports, Coffee Prices, Market Power, Multinationals, Preferences, Sweden.

JEL Classification: F14, F23, L13, L66, L81.

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1. Introduction

Coffee-bean prices started to decline in the late 1990s and by 2002 they were on average more than 60 percent lower than in 1997. An illustration of the extent of the decline is that the US dollar price of Santos coffee beans returned to the same level in 2002 as it had been in the 1960s.¹ One consequence of the price collapse was a large drop in export revenue for several developing countries and the impoverishment of many coffee farmers.

The sharp price decline has revived interest in the question of market power in coffee markets. Since large multinational companies are active both as buyers of green coffee and suppliers of roasted coffee, they are often held responsible, directly or indirectly, for keeping bean prices down while maintaining high consumers prices, and thereby limiting demand for green coffee beans (see Dicum and Luttinger, 1999; Fitter and Kaplinsky 2001; Galiano, 2003; Gooding 2003; Oxfam, 2002; Ponte, 2002).

The issue of market power in commodity markets was analysed in some detail by Morisset (1997, 1998). He looked at coffee markets, as well as several other markets, and found symptoms of market power in all of them. Due to asymmetric transmission of changes in world prices of coffee beans to consumer prices, the average spread between consumer prices and world prices, in a sample of six industrialised countries, increased on averaged by 186 percent from 1975 to 1994. To evaluate the

¹ The information on prices is from the International Financial Statistics database of the IMF and refers to the composite indicator of the International Coffee Organization and Santos coffee traded in the New York market.

consequences of the increase in the spread on export revenue in developing countries, Morisset (1997) simulated the impact of a reduction in the spread due to lower consumer prices. He found it would increase export earnings significantly, at least in the order 20-60 percent annually.

Talbot (1997) also addressed the issue of market power in coffee markets using a different approach, global value chain analysis. He found that the collapse of the International Coffee Agreement at end of the 1980's led to an increase in market power and a massive shift of surplus from coffee producing countries to multinationals. According to Talbot, multinational companies exercised market power as buyers by holding down prices of green coffee, and as sellers of processed coffee by inflating consumer prices.

Although multinational companies, both trading companies and roasters, may have market power as buyers of green coffee (see Krivonos, 2004 and Ponte, 2002) there is not strong evidence of market power in national consumer markets. Recent studies that have attempted to test directly for the presence of market power, such as Bettendorf and Verboven (1998; 2000), Durevall (2004) and Koerner (2002a), find that markets for roasted coffee in the Netherlands, Sweden and Germany are quite competitive, while Koerner (2002b) reports evidence of some market power in the US.

The objective of this paper is to evaluate the potential gain for coffee growers from a reduction in Swedish consumer prices. This is done by estimating demand for roasted coffee with a focus on how much of the variation in demand that can be explained by

prices, and what role other factors play. The approach differs from earlier studies of national coffee markets that estimated oligopoly models since it emphasises the long-run impact of price changes. Before carrying out the analysis, we illustrate how trends in consumption, which commonly are found in empirical studies, can provide information about the presence of market power and how they affect the interpretation of the impact of price changes in demand functions. This is done with a simple oligopoly model. The conclusion is that when there is a stochastic or deterministic trend in the quantity consumed, but not in relative prices, a price change will only have a temporary impact on demand. Moreover, in this case firms do not control quantities with prices, or vice versa, in the long run; prices are likely to be determined by marginal costs and there is no market power. The exception would be when the trend also is present in marginal costs, which seems to be unlikely in real life.

Demand for roasted coffee in Sweden is estimated for the period 1968-2002. To model coffee demand, we start by specifying the long-run equilibrium. Then we develop an empirically stable dynamic model. In estimating the model, we first test for (and find) stationary vectors using the Johansen maximum likelihood procedure (Johansen 1988, 1995). The stationary vectors are identified and then included in a general dynamic model, which is tested in order to make sure that the assumptions regarding its stochastic properties are fulfilled. Next, the model is reduced in order to obtain a parsimonious representation. Finally, the stability of the model is investigated using recursive estimation, and diagnostic tests.

Our main findings are that the long-run evolution of coffee consumption per adult is determined by differences in preferences across generations in combination with

population dynamics, while permanent changes in prices only have short-run effects on demand. Our results thus indicate that there is a high degree of competition in the Swedish market for roasted coffee since prices and consumption are unrelated in the long run. A reduction in spreads, due to lower consumer prices, will not permanently improve export revenue for coffee-producing countries.

The paper is organised as follows: Section 2 provides theoretical background by illustrating the importance of trends in consumption and prices using a Cournot model. Section 3 presents the empirical approach, Section 4 describes the data and in Section 5 the results from the empirical analysis are reported. Section 6 summarises and draws some conclusions.

2. The Role of Trends in Oligopoly Models: Some Illustrations

In studies of market power little attention is usually paid to trends in data.² Although they sometimes are captured by a deterministic trend, typically there are no comments about trends when the results are interpreted (see for example, Bettendorf and Verboven 2000; Genovese and Mullen 1998; Koerner 2002a, 2002b). To show how the presence of a trend in consumption may affect the impact of price changes, and how one can evaluate the adequacy of oligopoly models relative to perfect competition by estimating demand functions, we use a simple Cournot model where firms determine quantities. The same point can easily be made with the Bertrand model with differentiated products, where firms set prices.

² One exception is Steen and Salvenes (1999).

To keep the model as simple as possible, assume two firms that have the same marginal costs, w . They face the demand function,

$$q = \alpha - p + t, \quad (1)$$

where q is the sum of output of the two firms ($q_1 + q_2$), α is a constant, p is the relative price, and t is a trend that could be stochastic or deterministic.³ The trend is usually due to income or population growth, but could also result from different preferences across population cohorts. We omit the random disturbance term from Equation (1) for simplicity. Note that there could be a trend in p as well.

Both firms maximize profit by setting marginal revenue equal to marginal costs, taking the output of the other firm as given. Their first order conditions are,

$$\begin{aligned} MR_1 &= q_1 + \frac{1}{3}t + \frac{1}{3}\alpha = w \\ MR_2 &= q_2 + \frac{1}{3}t + \frac{1}{3}\alpha = w. \end{aligned} \quad (2)$$

By calculating the response functions and solving for Cournot equilibrium, here $q_1 = q_2$, and plugging in the values in the demand function, we get the determinants of the price level,

$$p = \frac{1}{3}\alpha + \frac{1}{3}t + 2w. \quad (3)$$

³ A time series has a stochastic trend if each shock leads to a permanent change in its conditional mean, one example being the random walk model. For details see Enders (2004).

Equation (3) shows that the price is a function of the constant, marginal costs and the trend. When t represents a stochastic trend, either p or w , or both, have to contain the same stochastic trend for Equation (3) to be valid, in other words, t should be cointegrated with either p or w , or both. When t is a deterministic trend, either p or w , or both have to be stationary around a deterministic trend.

This example shows that when there is a trend in the demand function, it should appear in prices, marginal costs, or as a linear combination of prices and marginal costs. If it does not, the oligopoly model does not describe the data well. Then we have the alternative, perfect competition, where price is equal to marginal cost and the trend in demand does not influence prices. Since it seems unlikely that marginal cost has the same trend as demand while the price variable is stationary, except by coincidence, these insights can be used to evaluate whether there is market power or not.⁴ In coffee roasting and marketing, in the Swedish market as well as in many other markets, changes in costs seem to be almost completely dominated by variations in coffee-bean prices, as indicated by the close correlation between consumer prices and import prices (see Durevall, 2004). In fact, there is a very tight relation between the amount of coffee beans required to make roasted coffee, and marginal costs are often considered to be constant (Bettendorf and Verboven, 2000, Sutton, 1991). Hence, to accept an oligopoly model as a description of the behaviour in the Swedish coffee market, we require price to have the same trend that we find in coffee consumption. If it has not, a price change will only have a short-run impact on consumption, while the long-run evolution is determined by the trend.

⁴ In general productivity growth, capital formation and variations in input prices are likely to make marginal costs independent of demand in the long run.

3. The Empirical Approach

Demand for non-durable consumer goods is usually assumed to depend on income, the price of the good modelled, and prices of substitutes. When modelling demand at an aggregate level we also have to include population, and possibly some other variables. Equation (4) shows a static linear demand function supposed to represent long-run equilibrium demand for coffee in Sweden:⁵

$$Q = \beta_0 + \beta_1 P + \beta_2 Y + \beta_3 G. \quad (4)$$

In Equation (4) Q is the quantity of roasted coffee per adult, P is the relative price of coffee, Y is income, G is a variable capturing other factors influencing demand, and $\beta_0, \beta_1, \beta_2$ and β_3 are parameters. The relative price of coffee is defined as the nominal price divided by the consumer price index since it is hard to find substitutes or complements for roasted coffee. Tea is sometimes considered to be a relevant substitute. However, tea is unlikely to be an important substitute in Sweden where coffee drinking dominates heavily, though it might be different in tea-drinking countries such as Great Britain. Other empirical studies have failed to find a significant effect from tea prices (see Bettendorf and Verboven, 2000, for the Netherlands, and Feuerstein, 2002, for Germany). It seems that price increases affect consumption mainly because people reduce wastage of coffee; according to a study in

⁵ The functional form used in studies of coffee demand varies but linear and log-linear models are the most common ones, although Bettendorf and Verboven (2000) also estimate a non-linear model, and Olekalns and Bardsley (1996) estimate a model with forward looking expectations. We tried all four specifications; the linear and log-linear version did equally well, while there was little empirical support for the other two.

the Netherlands spilling can be as much as 25% of total consumption (Bettendorf and Verboven, 1998).

The second variable in the demand function is income. In general an increase in income is expected to increase consumption. Nonetheless, this might not be the case in a market that is saturated where practically all consumers can afford to buy the product.

Finally we have G , which is supposed to capture population dynamics. Intuitively, a growing population generates higher demand, given prices. However, consumption patterns can differ significantly between different age groups. According to the Swedish coffee industry, there has been a slowdown in coffee consumption due to a change in preferences; people born around 1960 and later do not drink as much coffee as those born before the 1960s, who quite often consume about six cups per day.⁶ This process seems to have started at the end of the 1970s, and continues as the number of those born before 1960 declines. We measure this change in preferences in the population with the variable G , defined as the share of the population at the age of 18 and above who are born before 1960 in total population at the age of 18 and above.

An important aspect of Equation (4) is that it describes the static state of a dynamic process. Hence, even though the variables do not have time indexes they evolve over time. Moreover, as most economic time series they are likely to contain stochastic

⁶ See the homepage of the Swedish National Coffee Association (www.kaffeinformation.se) on the causes of the decline in consumption.

and/or deterministic trends. The model we end up estimating is a restricted version of the following autoregressive distributed lag model:

$$Q_t = \pi_0 + \sum_{i=1}^k \pi_{1i} Q_{t-i} + \sum_{i=0}^k \pi_{2i} P_{t-i} + \sum_{i=0}^k \pi_{3i} Y_{t-i} + \pi_4 G_t + \varepsilon_t \quad (5)$$

where π_0 contains the constant and a dummy variable capturing the effects of frost in Brazil in 1977, the variable G is treated as a deterministic variable because it changes very slowly over time, and ε_t is a mean zero white noise process. The long-run solution of Equation (5) gives the static state of Equation (4).

Since some or all of the variables in Equation (5) might be non-stationary we start the econometric analysis by using Johansen's (1988, 1995) procedure to test whether some individual variables are stationary and if some of them are cointegrated.⁷ This is done by estimating a vector autoregressive model, VAR, in error correction form. The long-run responses of the system are collected in an n times n matrix defined as Π and the hypothesis of cointegration is about the rank of Π . When it is of reduced rank we can write $\Pi = \alpha\beta'$, and there are $r \leq (n-1)$ cointegrating vectors, where $r = \text{rank}$. The rank is tested with the trace test, a likelihood ratio procedure, and it amounts to finding the number of linearly independent columns in Π . By testing for the significance of the components in β' , the coefficients of the cointegrating vector, we can then evaluate what variables that enter the cointegrating vector, and by testing the

⁷ See Juselius (2001) for a very nice illustration of the use of the Johansen approach in a study on demand for cigarettes.

components of α , the adjustment coefficients, we can determine whether there is feedback between Q and P , that is, whether P is weakly exogenous or not. If it is weakly exogenous, we only need to estimate a single-equation model.

4. A Look at the Data⁸

The two core variables explaining demand are usually assumed to be price and income. In Figure 1, coffee consumption, measured in kilos per person at the age of 18 or older, is depicted together with per capita income, measured by total consumer expenditure. Note that the mean and variance of the income variable has been adjusted to highlight the relation between the two variables. Coffee consumption was stable until the 1975, when it declined due to a sharp, but temporary, increase in prices. From the end of the 1970s there was a downward trend in consumption until 2002. Income per capita, on the other hand, grew almost continuously between 1968 and 2002. It is thus obvious that income did not determine coffee consumption during the period of analysis. The reason is probably that the level of income was so high already in the 1960s that the vast majority of the population could afford to buy all the coffee it needed. Hence, there must be other factors driving coffee consumption in the long run.

Figure 1 about here

Figure 2 illustrates the evolution of coffee consumption per adult and the mean and variance adjusted relative price of coffee (the retail price of roasted coffee divided by the consumer price index, set to unity in 1995). The negative relation is visible during

⁸ Appendix I gives a description of the data.

the end of the 1970s and around 1995, but in general the two variables move in the same direction. It is thus apparent that price and income cannot explain coffee consumption by themselves.

Figure 2 about here

Since the slowdown in coffee consumption has been attributed to differences in preferences between those born around the 1960s and later and older generations, Figure 3 shows the preference variable, G , and per-capita consumption. The preference effect started at the end of the 1970s and continued as the share of those born before 1960 declined. Hence, its evolution coincides with coffee consumption.

Figure 3 about here

Finally we graphed the price series and consumption net of the preference effect, that is, a series obtained by regressing G on Q . As shown by Figure 4, there is a strong negative relation between the two series. Hence, the change in preferences seems to capture the long run evolution of coffee consumption well, while the relative price level explains the movements around the trend.

Figure 4 about here

5. Empirical Analysis

The data analysis is performed in two steps. First, we use the Johansen (1988, 1995) approach to test for integration and cointegration, and then we estimate a general

single-equation autoregressive model, which tested to make sure that the assumptions regarding its stochastic properties are fulfilled. After that the single-equation autoregressive model is reduced in order to obtain a parsimonious model. Finally, the stability of the model is investigated using recursive estimation.

The cointegration analysis was carried out for the period 1968-2002 with Q and P , as endogenous variables, where Q is coffee consumption per adult, P is the retail price of roasted coffee per kilo relative to the consumer price index, measured in constant 1995 Swedish kronor. The variable capturing changes in preferences between age groups, G , was entered as a deterministic variable, and income was included as a weakly exogenous variable in first differences (ΔY) since, as evident from Figure 1, the level of consumption does not affect coffee consumption. We also included an impulse dummy for the sharp increase in coffee-bean prices in 1977. The number of lags was determined by first estimating the model with two lags over the period 1969-2002 and testing for misspecification. None of the tests for autocorrelation, non-normality, and heteroscedasticity were significant at the 5 percent level. Then a likelihood ratio test for reducing the model to one lag was implemented. It was not significant so one lag of Q and P seems to capture the dynamics adequately. The first lag of ΔY was insignificant so it was also removed. The test statistics for the likelihood ratio test and the diagnostic tests are reported in Table 1.

Table 2 reports the main results from the application of the maximum likelihood procedure. The first row lists the estimated eigenvalues of the II -matrix, the matrix with the coefficients of the long-run solution of the model. The smallest one is 0.35,

so both of them are all clearly larger than zero, indicating the rank is two. On the following lines the trace test for the rank of the Π -matrix and critical values are reported. Since the trace test has low power in small samples, the 90 percent critical values were used, and since G behaves as a deterministic variable, the critical values are based on the asymptotic distributions for restricted trend and unrestricted constant. The null hypotheses of a rank of zero and one are clearly rejected. Information about the rank of the Π -matrix is also provided by the adjustment coefficients. In both columns of the α -matrix, reported in the lower panel of Table 2, there are entries with high t-values. This is support for the presence of two stationary relations in the data. Since visual inspection of graphs of the cointegrating vectors⁹ also indicates that there are two stationary relations, we proceed under the assumption that the rank of the Π -matrix is two.

The importance of including G for the stability of the system, and the finding of two cointegrating vectors, is indicated on the last two lines in the upper panel of Table 2. The largest root of the companion matrix process is 0.60 when G is included in the VAR, while the largest root is 1.02 without G .

To identify the stationary vectors, the significance of each individual variable was first tested; all three tests statistics were highly significant as shown by the last line in Table 2. Then we tested if Q and G form one stationary relation, while P is stationary by itself. The test was not significant at the 10% level. Table 3 reports the test statistics for the restricted cointegrating vectors, the standardized eigenvectors, β , and

⁹ The unrestricted cointegrating vectors are not reported, but Figure 4 shows the restricted ones.

the adjustment coefficients α . The first long run relation is $Q = 13.5G$ while the other one is made up of P only. Since α_{11} is negative and highly significant, coffee consumption adjusts to changes in G , as expected. Furthermore α_{12} is also negative and significant, showing that the price level affects coffee consumption. However, there is no feedback from coffee consumption on prices since α_{21} is insignificant. This implies that we can treat prices as weakly exogenous and model coffee demand using single-equation analysis.

In the second step we estimated a single-equation model. To ensure that all variables are stationary Q was replaced by $Q^* = Q - 13.5G$. Moreover, an impulse dummy for 1976 was added to capture the rise in consumption preceding the price increase.¹⁰ By including two impulse dummies (*Dum76* and *Dum77*) we allow the effect of the price shock to be transitory. First a general model was estimated (see Table 1a in Appendix II) and the variables with insignificant coefficients were removed, e.g. lagged Q^* . The model obtained is,

$$\begin{aligned}
 Q_t^* = & 2.5 - 0.017P_t - 0.013P_{t-1} + 0.074\Delta Y_t + 0.98Dum76 - 1.5Dum77 \\
 & (0.24) \quad (0.005) \quad (0.004) \quad (0.029) \quad (0.36) \quad (0.48)
 \end{aligned}$$

$$\begin{aligned}
 R^2 = 0.866 \quad \hat{\sigma} = 0.331 \quad T = 1968 - 2002 \quad F_{ar}(2, 27) = 0.59 [0.56] \\
 F_{arch}(1, 27) = 0.468 [0.50] \quad F_{het}(8, 20) = 0.26 [0.97] \quad \chi_{norm}^2(2) = 3.99 [0.14] \\
 F_{reset}(1, 28) = 0.15 [0.70] \quad Q_t^* = Q_t - 13.5G_t
 \end{aligned}
 \tag{6}$$

where coefficient standard errors are shown in parentheses, $\hat{\sigma}$ is the residual standard deviation, and T is the sample period. The diagnostic tests are for serial correlation of

¹⁰ The increase in consumption in 1976 is likely to be due to hoarding.

order 2, F_{ar} , autoregressive conditional heteroscedasticity of order 1, F_{arch} , heteroscedasticity, F_{het} , nonlinearity, the RESET test, F_{reset} , and a chi-square test for normality, $\chi^2_{Norm}(2)$ (see Hendry and Doornik, 2001, for details).

In equation (6) both contemporaneous and lagged prices enter with negative, and clearly significant, coefficients, income growth has a positive coefficient, and the dummy variables have opposite signs. Hence, the model appears to make economic sense. Since all the diagnostic tests are insignificant the model is statistically well-specified.

By estimating the model recursively its empirical constancy was assessed (see Hendry and Doornik, 2001 on recursive estimation). The output from this exercise is summarized in graphs for the period 1980-2002. The four graphs in the upper panel of Figure 5, depict the recursively estimated coefficients and their ± 2 standard errors. Considering the small number of observations and the long time period, they are quite stable, in particular during the period 1985-2002. The one-step residuals and their ± 2 standard errors are depicted in the fifth graph; since all the estimates are within the standard error region there is no indication of outliers. The last three graphs report test statistics from three Chow tests, one-step, break-point and forecast Chow tests. They are graphed such that the straight line matches the 1% significance level. Only one Chow test statistic is significant, and it is just about significant at the 1% level, while all the others are insignificant.

To relate Equation (6) to, our theoretical model, Equation (4), the static solution of (6) was calculated, yielding

$$Q = 2.6 - 0.029P + 0.072\Delta Y_t + 13.28G - 0.53Dum \quad (7)$$

(0.38) (0.004) (0.03) (0.48) (0.67)

where coefficient standard errors are shown in parentheses. Equation (7) shows that the price variable is negative and highly significant; its t -value is -7.9. A decline in coffee prices by one krona per kilo increases demand by 29 gram per adult, controlling for all the other variables. In 2002 this would correspond to a total increase of 2.3 ton, which should be compared to an actual consumption of 66000 ton; the impact of a change in price is thus very small. Equation (7) also shows that the sum of the two dummy variables is not statically different from zero, indicating that the price shock in 1977 did not have a lasting effect on coffee demand. Moreover, the generation variable, G , has the same coefficient as in the cointegration test, and growth in per capita income is significant but the t -value is only 2.4.

To obtain more information on the role of the prices, we calculated the price elasticity. Its mean is -0.19 and the standard deviation is 0.058. Figure 6 shows how the elasticity has varied over time; the minimum value is -0.38. It is thus evident that competition in the coffee market keeps the elasticity well above -1, which is the maximum we would expect if there was perfect collusion among the roasters, i.e., as in the case of a monopoly. Our finding that the elasticity is well above -1 is consistent with other studies on coffee demand such as Bettendorf and Verboven, (2000),

Durevall (2004), Feuerstein (2002), Koerner (2002b) and Olekalns and Bardsley (1996).

An interesting question is how demand would respond to a reduction in the spread between green coffee-bean prices and consumer prices. Morisset (1997) found that a reduction in the spread of some primary commodities, including coffee, due to a drop in consumer prices in U.S. and some European countries, would have a strong impact on export revenue in developing countries. However, in our case, the trend in coffee demand makes the impact of a permanent decrease in coffee prices temporary. This is illustrated by the recent decline in real coffee prices; they went from 76 SEK in 1998 to 51 SEK in 2002 while consumption dropped from 9.6 kg per adult to 9.4 kg.

To further highlight the role of prices, we simulated the response of coffee consumption to a permanent decline in consumer prices from 51 SEK in 2002 to 35 SEK in 2003. We assumed that G continued to decline at the rate it had during the period 1993-2002, that is at 2.13 percent per year, and that ΔY was constant at the average value it had over the same period, 2.13. Furthermore, we used the fitted value for the base year 2002. The result of the decline in prices would be an increase in coffee consumption by 3.6 percent in 2003 and a small increase in 2004. However, consumption would decline in 2005, and in 2006 it would be below the 2002 level. Our analysis thus shows that the preference effect is the dominant factor in determining demand, since it explains the trend. It is possible that Morisset obtained a strong effect on export revenue because he disregarded the dynamics of demand.

6. Conclusion

The objective of this paper was to evaluate the role of prices in determining demand for roasted coffee in Sweden. This is of interest because it can shed light on the functioning of coffee markets, and how demand for coffee beans is likely to respond to changes in consumer prices.

Demand for roasted coffee was estimated using market data from Sweden over the period 1968-2002. In the long run, demand is determined by differences in preferences across generations in combination with population dynamics; those born before the 1960s consume more coffee than younger generations. This result is in accordance with industry wisdom. The relative consumer price of coffee also influences demand but it only explains deviations from trend. Consequently a reduction in coffee prices can only have a temporary impact on demand.

Since the evolution of coffee consumption is independent of prices, there appears to be a high degree of competition in the Swedish market for roasted coffee, at least in the long run; coffee prices are likely to be determined by marginal costs and firms do not seem to control prices or quantities. This implies that market power does not explain the level of the spread between bean prices and consumer prices. A corollary of the lack of market power is that a permanent reduction in the spread between world prices and consumer prices, due to lower consumer prices, would not lead to a permanent increase in demand for coffee beans; a price decrease would only improve export revenue for coffee-bean producing countries during a short period.

Although our results are obtained from the Swedish market, they are likely to apply to several other markets for roasted coffee as well. Most industrialised countries have a market structure that is very similar to the one in Sweden, where the market share of the multinationals was 57 percent, and the share of the four largest roasters was 87 percent in 2002 (Durevall, 2004). In almost all consumer markets there are some large multinationals present and the concentration of the four largest firms is very high (see Clarke, et al., 2002; Durevall, 2003; Sutton, 1992). Moreover, trends are often present in coffee consumption, see Koerner (2002b) and Olekalns and Bardsley (1996) for the US, Feuerstein, (2002 and Koerner (2002a) for Germany. In addition, the technology used in coffee roasting is fairly simple and similar in most markets.

It is possible that large roasters have market power as buyers in the market for green coffee, as argued by, among others, Ponte (2002). We have not analyzed this issue but if they influence prices of green coffee, increased competition would have a beneficial effect on export revenue of coffee producing countries. It is also possible that roasters have some market power as sellers of roasted coffee, but in Sweden, at least, it seems to be of a short-run nature since firms do not appear to be able to influence the evolution of coffee-bean imports.

Appendix I: Description of Data

The following variables are used in the empirical analysis:

Consumer price of coffee

Price per kilo of roasted coffee. The price is based on 500-gram packets. Source: Statistics Sweden.

Consumer price index (CPI)

CPI is from the International Financial Statistics database of the IMF. The base year is 1995.

Consumption of Roasted Coffee

The quantity of yearly consumption is published by the Swedish Board of Agriculture.

Income

Income is measured as household expenditures. Source: International Financial Statistics database of the IMF.

Population

The demographic data are from The International Data Base (IDB), U.S. Bureau of the Census, and Statistics Sweden.

Appendix II: Regression Results

Table 1a: General model for coffee demand, 1968-2002

Equation for Q^*	Coefficient	Std. Error	t-value
Q^*_{t-1}	-0.092	0.162	-0.568
P_t	-0.017	0.005	-3.160
P_{t-1}	-0.016	0.007	-2.350
ΔY_t	0.085	0.034	2.450
$Dum76_t$	0.979	0.369	2.650
$Dum77_t$	-1.330	0.602	-2.210
Constant	2.768	0.506	5.470

$$R^2 = 0.867 \quad \hat{\sigma} = 0.335 \quad T = 1968 - 2002 \quad F_{ar}(2, 26) = 0.20 [0.82]$$

$$F_{arch}(1, 26) = 1.01 [0.32] \quad F_{het}(10, 17) = 0.29 [0.97] \quad \chi^2_{norm}(2) = 3.46 [0.17]$$

$$F_{reset}(1, 27) = 0.49 [0.48] \quad DW = 2.12 \quad Q^*_t = Q_t - 13.5G_t$$

References

- Bettendorf, L., and F. Verboven, (1998), "Competition on the Dutch Coffee Market" Research Memorandum No. 141, Central Planning Bureau, The Hague.
- Bettendorf, L., and F. Verboven, (2000), "Incomplete Transmission of Coffee Bean Prices: Evidence from the Netherlands" *European Review of Agricultural Economics*, Vol. 27, (1).
- Clarke, R. S., Davis, P. Dobson, and M. Waterson, (2002), *Buyer Power and Competition in European Food Retailing*, Edward Elgar Publishing, Cheltenham.
- Dicum, G. and N. Luttinger, (1999), *The Coffee Book: Anatomy of an Industry From Crop to the Last Drop*, New York: New Press.
- Durevall, D., (2003), "Competition and Pricing: An Analysis of the Market for Roasted Coffee" Chap. 5 in *High Prices in Sweden – a Result of Poor Competition?* Swedish Competition Authority Report, Stockholm.
- Durevall, D., (2004), "Competition in the Swedish Coffee Market" Scandinavian Working Papers in Economics (S-WoPEc), No. 134. Dept. of Economics with Statistics, University of Göteborg.
- Enders, W., (2004), *Applied Econometric Time Series*, John Wiley & Sons.
- Feuerstein, S., (2002), "Do Coffee Roasters Benefit from High Prices of Green Coffee?", *International Journal of Industrial Organization*, Vol. 20, pp. 89 – 118.
- Fitter, R. and R. Kaplinsky, (2001), "Who Gains from Product Rents as the Coffee Market Becomes More Differentiated? A Value Chain Analysis" *IDS Bulletin* Vol. 32 No. 3, pp. 69-82.
- Företagaren Direkt (2002), No. 3, Nordea, Stockholm.
- Genesove, D., W. P. Mullin, (1998), "Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890-1914", *RAND Journal of Economics*, Vol. 29, No. 2 pp. 355-377.
- Galeano, E., (2003), "Our World is a Great Paradox that Turns Around the Universe" Published on www.portoalegre2003.org.
- Gooding, K., (2003) "Sweet like Chocolate: Making the Coffee and Cocoa Trade Work for Biodiversity and Livelihoods" Report to Royal Society for the Protection of Birds (RSPB), London.
- Hendry, D.F. and J. A. Doornik,, (2001). *Empirical Econometric Modelling Using PcGive Volume I*, Timberlake Consultants Press, London.

Johansen, S., (1988), "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, Vol. 12 No. 2/3, pp. 231-254.

Johansen, S., (1995), *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press, Oxford.

Juselius, K., (2001), "Unit roots and the demand for cigarettes in Turkey: Pitfalls and Possibilities" Discussion Paper No. 02, Institute of Economics, University of Copenhagen.

Koerner, J., (2002a), "The dark side of coffee: price war in the German market for roasted coffee" Working Paper EWP 0204, Dept. of Food Economics and Consumption Studies, University of Kiel.

Koerner, J., (2002b), "A Good Cup of Joe? Market Power in the German and the U.S. Coffee Market". Paper presented at Annual Conference of the European Association for Research in Industrial Economics, Madrid, 2002.

Krivosos, E., (2004), "The Impact of Coffee Market Reforms on Producer Prices and Price Transmission" World Bank Policy Research Working Paper 3358, Washington.

Morisset, J., (1997), "Unfair Trade? Empirical Evidence in World Commodity Markets over the Past 25 Years" World Bank Policy Working Paper No 1815

Morisset, J., (1998), "Unfair Trade? The Increasing Gap between World and Domestic Prices in Commodity Markets during the Past 25 Years" *World Bank Economic Review*, 12 (3), pp. 503-26

Olekalns, N. and P. Bardsley, (1996), "Rational Addiction to Caffeine: An Analysis of Coffee Consumption" *Journal of Political Economy*, Vol. 104, Issue 5, pp. 1100-1004.

Oxfam, (2002), "Mugged: Poverty in your Coffee Cup" Oxfam International and Make Fair Trade, London.

Ponte, S., (2002), "The 'Latte revolution'? Regulation, markets and Consumption in the Global Coffee Chain" *World Development*, Vol. 30, Num. 7, pp. 1099-1122.

Steen, F. and K. G. Salvanes (1999) "Testing for Market Power Using a Dynamic Oligopoly Model" *International Journal of Industrial Organization* Vol. 17, pp.147-177.

Sutton, J., (1991), *Sunk Cost and Market Structure*, MIT Press, Cambridge, Massachusetts.

Talbot, J. M., (1997), "Where Does Your Coffee Dollar Go? The Division of Income and Surplus along the Coffee Commodity Chain" *Studies in Comparative International Development*, Vol. 32, No. 1, pp. 56-91.

Table 1: Determination of lags and diagnostic tests, 1969-2002

Multivariate tests		
AR 1-2 test	F(8,46) = 0.846 [0.567]	
Normality test	$\chi^2(4) = 7.280$ [0.122]	
Hetero test	F(18,54) = 0.945 [0.531]	
Hetero-X test	F(27,47) = 0.881 [0.631]	
Schwartz Criteria	Two lags	One lag
	10.07	9.53
Tests of model reduction,		
2 to 1 lag: F(4,48) = 0.394 [0.812]		
1 to 0 lag of ΔY : F(2,26) = 0.731 [0.491]		

Table 2: Cointegration analysis, 1968-2002

Eigenvalue of Π -matrix	0.62	0.35
Null hypothesis	$r = 0$	$r = 1$
Trace test	48.75	14.79
90% critical value	22.76	10.49
Roots of process	0.60	0.16
Roots without G	1.02	0.61

Variable	Q	P	G
β'_1	1.000	0.028	-13.42
β'_2	4.80	1.00	-113.06
α_1	-1.47 (0.18)	0.005 (0.004)	
α_2	1.20 (5.39)	-0.48 (0.12)	

Test of significance a given variable			
	Q	P	G
$\chi^2(3)$	31.83**	26.54**	33.23**

Note: The estimation period is 1968 - 2002. The vector autoregression includes one lag on Q and P , and G_t , ΔY_t , a constant and an impulse dummies that takes a value of unity in 1977. Critical values are for the trace tests are from Johansen (1995). They are based on the asymptotic distributions for restricted trend and unrestricted constant. Standard errors are reported in parentheses, and *** indicate significance at the 1% level.

Table 3: Restricted cointegrated vectors and adjustment coefficients

Variable	Q	P	G
β'_1	1.00	0.00	-13.49
β'_2	0.00	1.00	0.00
α_1	-1.09 (0.18)	-0.03 (0.007)	
α_2	-3.19 (5.56)	-0.46 (0.21)	

Test for restricted cointegrating vectors $\chi^2(1) = 2.30$ [0.13]

Standard errors are reported in parentheses and p -values in brackets.

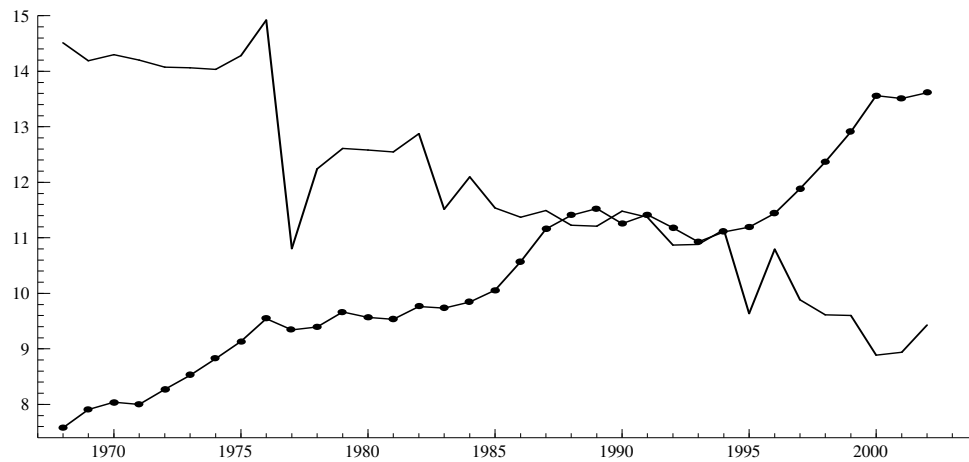


Figure 1: Coffee consumption, kilo per adult —, and mean and variance adjusted income •---•---•.



Figure 2: Coffee consumption, kilo per adult —, and mean and variance adjusted price of coffee in 1995 Swedish kronor •---•---•.

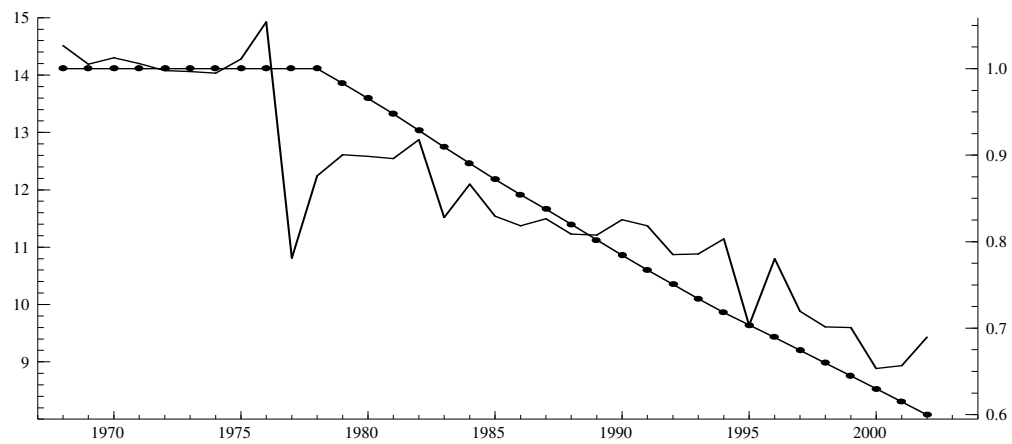


Figure 3: Coffee consumption per adult (left scale), —, and the share of adults born after 1959 in total adult population (right scale), •---•.



Figure 4: Price of roasted coffee, —, and coffee consumption net of preference effect, G , mean and variance adjusted, •---•.

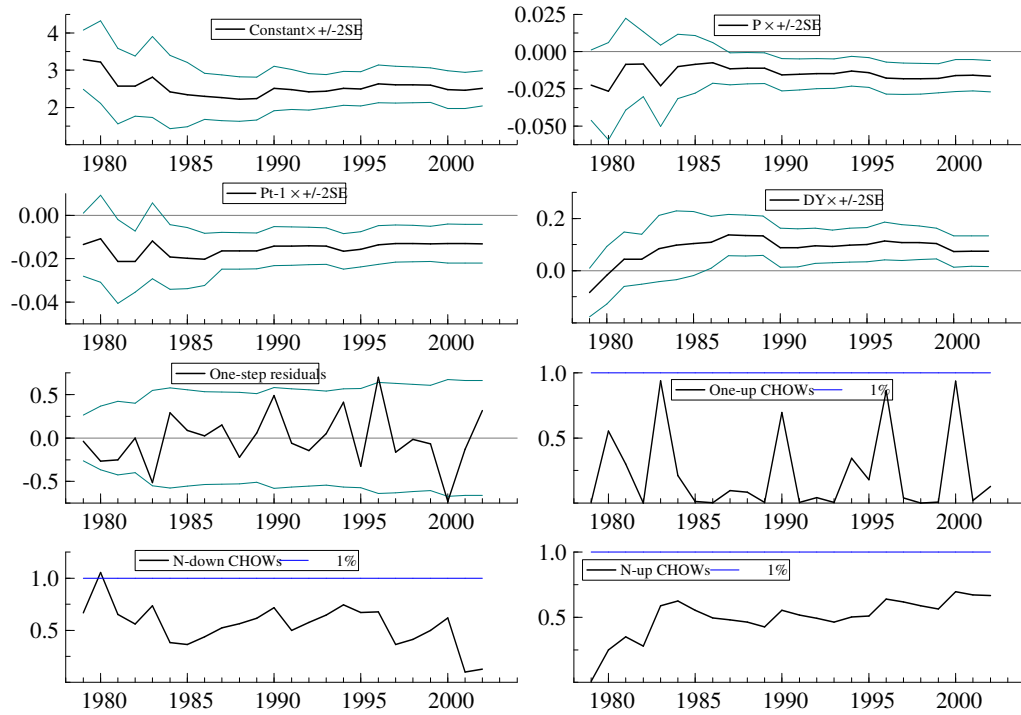


Figure 5: Recursive estimates of the coefficients with ± 2 standard error (top four graphs), one-step residuals with ± 2 estimated standard errors (left in third row), one-step (right in third row), break-point (left in bottom row) and forecast (right in bottom row). Chow statistics scaled with their 1% critical values. The straight line at unity shows the 1% critical level.



Figure 6: Price elasticity, 1968-2002.