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Economic Techniques to Estimate the Demand for Sustainable Products: A Case Study for Fair Trade and Organic Coffee in the United Kingdom

Ibon Galarraga and Anil Markandya

SUMMARY: The hedonic approach is used in this paper to estimate how much is paid for the fair trade/organic characteristic of the coffee in the British market. This information is later combined with the Quantity Based Demand System (QBDS) model –developed by the authors— and the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980) to completely determine the demand function for different coffees. The QBDS model is easier to handle and less data demanding than the AIDS model in this study.

KEYWORDS: demand systems, hedonic method, coffee demand, labelling.

JEL classification: C13, C21, D12.

Técnicas económicas para la estimación de la demanda de productos sostenibles: Un estudio para el café de comercio justo y orgánico en el Reino Unido

RESUMEN: El presente artículo se basa en la utilización del método hedónico para la estimación de la cantidad que se paga por la característica de «Orgánico/Comercio Justo» del café en el mercado

Corresponding author: Ibon Galarraga, Partner in NAIDER, S.L., Ribera de Axpe 6, 48950 Erandio, BILBAO, Bizkaia, Spain. Tel: +34 94 431 4150. Fax: +34 94 463 0439. E-mail: igalarraga@naider.com. Web: www.naider.com

Anil Markandya. Professor in Economics. DEID, University of Bath, Claverton Down, Bath BA2 7AY. Tel: +44 (0) 1225 386954. Fax: +44 (0) 1225 323423. E-mail: A.Markandya@bath.ac.uk

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británico. La información obtenida se combina después con el modelo Sistema de Demanda Basado en Cantidades (QBDS) – desarrollado por los autores— y el Sistema de Demanda Casi Ideal (AIDS) (Deaton and Muellbauer, 1980) para determinar por completo la función de demanda de los diferentes tipos de café. El modelo QBDS es más sencillo en su utilización y necesita de menos datos que el modelo AIDS.

PALABRAS CLAVE: Sistemas de demanda, método hedónico, demanda de café, etiquetado.

Clasificación JEL: C13, C21, D12.

1. Introduction

Within the economic literature, questionnaire information has been used to elicit the price premium that environmentally friendly goods attract (Haji Gazali and Simula, 1994, Smith, 1990 and Levin, 1990). This has been especially criticised due to the difference between «customer attitude» and «customer behaviour», i.e. what consumers claim they are «ready to pay» and what they «really pay». While it is generally acknowledged that the existence of environmental awareness among consumers is necessary for the success of the eco-labelling schemes, it has also been noted that, unfortunately, increases in awareness may not always lead to changes in purchasing behaviour (Hemmelskamp & Brockmann, 1997).

One of the reasons given in the literature for the disparity between what consumers say they do and what they actually do is that 'green' products might not meet the consumer criteria of price, performance and quality (Hurtado, 1998). In other words, an environmentally friendly consumer might not buy 'green' because the product repeatedly turns out not meet his/her expectations.

In this paper we, first, estimate actual willingness to pay for a green product using the hedonic price technique. This technique analyses prices resulting from the demand side and supply side equilibria, adjusting for variations in quality. It allows us to estimate, *ceteris paribus*, a proxy of what the consumer pays for a single characteristic of the good.

This method has been extensively used to estimate durable goods' characteristics such as: automobile demand (Griliches, 1961, Atkinson and Halverson, 1985, Couton *et al.*, 1996) and the housing market (Cropper *et al.*, 1988 and Palmquist, 1984). There also exist some studies for non-durables – the wine market, such as Oczkowski (1994), Combris *et al.* (1997), and Nerlove (1995); breakfast cereals (Stanley and Tschirhart, 1991) and food items (Ladd and Suvannunt, 1976). Finally virtually no studies have been carried out for the environmental/fair trade characteristics of goods. There is one exception carried out by Nimon and Beghin (1999) who estimated a premium of 33.8% on the use of organic fibres in the apparel industry, based on the hedonic estimation technique.

This study is devoted to the UK market for an environmentally important commodity - coffee. From the hedonic price function estimates are calculated for what the consumer pays for different characteristics of the coffee in the market, including the

environmental characteristic as represented through the Fair Trade or Organic label [1]. Although Fair Trade Labels are not strictly speaking Ecolabels as it is explained later in this paper, the method presented here can be equally be used for the so-called Ecolabels such as German Blue Angel o Nordic Swan [2].

The second part of the paper presents a demand system, the Quantity Based Demand System (QBDS) that has been developed by the authors. The aim is to show how, with a limited data on own price elasticities and income elasticities, one could estimate the effect and changes in prices on demands for close substitutes for those goods for which long series of data do not exist –this is the case for eco-labelled goods—and, thus, traditional econometric tools cannot be applied. The model, combined with the information given by the hedonic function, allows the full determination of demand equations for fair trade and other coffees. The QBDS is later compared with an application of the well-known Almost Ideal Demand System (AIDS) model (Deaton and Muellbauer, 1980). The QBDS is easier to handle, although implies more restrictions that should be relaxed in future studies.

This paper is innovative in two senses. It is the first attempt, to the best of our knowledge, to analyse the coffee market using this approach. It is also the first time that this method has been used to estimate the demand system for closely related substitutes and to use that system to analyse policies with respect to eco-labelling.

2. Introduction to Fair Trade [3]

Fair-trade coffee is a relatively new good. It was only in 1990 that the European Fair Trade Association (EFTA) was established and 1997 when the International Fair Trade Labelling Organisation (FLO) started co-ordinating fair trade for all of Europe, Canada, Japan and the US. It is estimated that the annual retail turnover of this market is over 200 million Euros in Europe, with an annual growth rate of 5%. (EFTA, 1998).

Data on world sales of fair trade coffee are given in table 1. The table shows that, even though it still is a niche market, the demand for fair trade coffee is growing fast. At the time of writing, most of the British retailers and supermarkets sold one or two varieties of labelled coffee. The tendency is similar for organic coffee.

It is important to note that the Fair Trade Label is not a «type I» environmental label. Type I labels —the so-called eco-labels such as Blue Angel and Green Seal— refer to the environmental quality of the product compared to the rest of the products and are meant to encourage switches towards more friendly consumption habits. They are third party certification programs and are voluntary. The Fair Trade label

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[1] Due to a lack of data it is very difficult to treat both labels separately, i.e. to distinguish between organic and fair-trade labels.

[2] See Zarrilli, *et al.* (1997) for more information on ecolabels.

[3] More information in www.cafedirect.co.uk.--------www.maxhavelaar.com.

TABLE 1

Market Share for Fair Traded Coffees in Europe

Country	Market share 1994 (%)	Started
Switzerland	3.5	1993
Netherlands	2.4	1988
Belgium	1	1991
France	1	1993
Germany	1	1993
Luxembourg	1 (in January 1996)	1993
United Kingdom	1	1994
Japan	< 1	1994
Austria	< 1	1994

Source: Bradshaw (mimeo).

also takes into account the social conditions of producers. The Cafédirect label guarantees the following,

- A good minimum price to cover the cost of production however low the international market falls.
- A 10% premium for investments in local communities.
- Availability of prepayments for growers.
- Working for the growers in the market place as well as with them locally.
- Protection of the environment.

3. The Hedonic Approach

The data and the model

The data analysed here was collected from five different British supermarkets (Asda, Sainsbury's, Mark & Spencer, Waitrose and Somerfield), and one coffee specialist (Whittard Coffees & Teas). Due to difficulty in obtaining uniform information about the intrinsic characteristics of most of the products, a separate expert assessment of coffee characteristics was carried out, using a well-known coffee tasting service [4] to rate, on a consistent scale, 164 varieties of coffee according to three different characteristics (roast quality, arabica taste and residual quality). **The 164 varieties of coffee led to 228 observations,** as some coffees are sold in more than one supermarket. A total of **40 explanatory (dummy) variables** were used to estimate the price (in Euros) per gram of the different coffees sold in the market and hence identify the hedonic price function. The data was collected during 1997-98. These variables are grouped as follows:

a) *Intrinsic Characteristics–Arabica Taste: 5 dummies (low, low-medium, medium, medium-high and high).*

[4] The chief taster, Mr. H. Bradshaw, is a highly qualified specialist with 30 years experience with several coffee buyers in the UK.

b) *Intrinsic Characteristics–Roast Quality: 3 dummies (low roast, medium roast and high roast).*

c) *Intrinsic Characteristics–Residual Quality Index: 5 dummies (low, low-medium, medium, medium-high and high).*

d) *Production Region: 5 dummies (Latin America, Africa, Asia, Oceania and unknown and/or mixture).*

e) *Species: two dummies (arabica, robusta and mixture).*

f) *Physical State: three dummies (bean, ground and instant).*

g) *Environmental Characteristics: 2 dummies (Normal and Fair Trade/Organic label).*

h) *Caffeine: 2 dummies (caffeinated and decaffeinated coffees).*

i) *Retailer: six dummies (Whittard, Asda, Sainsbury's, M&S, Waitrose and Somerfield).*

j) *Brands: seven dummies (Nescafe, Kenco, Douwe Egberts, Waitrose, Sainsbury, Somerfield and other brands).*

Full details are given in table 2. As is standard for the estimation of regressions with dummy variables, one set of dummies represents the base case and is excluded from the regression. In this sample the base case is represented by the dummy variable that is underlined in the above listing.

Further adjustments to the data were made as follows:

- Under 'Physical State' it was not possible to separate out bean and ground, as there was no price difference between them for any given set of characteristics. Hence the two types were merged into one.
- Out of a total of 228 observations, three varieties of coffee were excluded from the analysis: Sainsbury's Economy, Asda Economy and Gold Mill Roast coffees. The reason is that these coffees have very low overall quality, are very inexpensive (less than one pound or 0.0147 Euro/gr.), and have very low arabica taste. Their presence created serious estimation problems and the data on their intrinsic characteristics lie well outside the range for all the other coffees. A much better model in terms of the diagnostic statistics is obtained by excluding these outliers and the results in terms of coefficients do not change too much.

After considerable experimentation [5] the preferred model can be written as follows,

$$LX1 = \alpha + \sum_{2}^{41} \beta_i Xi + u, \text{ where } LX1 = \log(X1) \qquad [1]$$

[5] Tables 3, 4, 5 and 6 refer to some of the models tested: the Linear model ($X1 = \alpha + \sum_{2}^{41} \beta_i Xi + u$) and the Log-lin model where all the variables are included. The diagnostic tests, the parameters estimates and related statistics are included to show the robustness of the results presented.

TABLE 2

Variables Used for Estimation

X1:	**Price per gram (EUROs)**	
X2:	Low residual quality (r.q.)	If rated as low = 1, otherwise = 0
X3:	Low-Medium r.q.	If low-med = 1, otherwise = 0
X4:	Medium r.q.	If medium = 1, otherwise = 0
X5:	Medium-high r.q	If medium-high = 1, otherwise = 0
X6:	High r.q	If high = 1, otherwise = 0
X7:	Low roast	If rated as low roast = 1, otherwise = 0
X8:	Medium roast	If medium roast = 1, otherwise = 0
X9:	High roast	If high roast = 1, otherwise = 0
X10:	Low arabica taste	If rated as low arabica taste = 1, otherwise = 0
X11:	Low-med arabica taste	If low-med = 1, otherwise = 0
X12:	Med a.t.	If med = 1, otherwise = 0
X13:	Med-high a.t	If med-high = 1, otherwise = 0
X14:	High a.t.	If high = 1, otherwise = 0
X15:	Latin America dummy	If produced in LA = 1, otherwise = 0
X16:	Africa dummy	If produced in Af = 1, otherwise = 0
X17:	Asia dummy	If produced in Asia = 1, otherwise = 0
X18:	Oceania dummy	If produced in Oceania = 1, otherwise = 0
X19:	Unknown/mixture dummy	If unknown/mixture of different regions = 1, otherwise = 0
X20:	Arabica 100% dummy	If arabica = 1, otherwise = 0
X21:	Robusta-mixture dummy	If robusta/mixture = 1, otherwise = 0
X22:	Bean dummy	If bean = 1, otherwise = 0
X23:	Ground dummy	If ground = 1, otherwise = 0
X24:	Instant dummy	If instant = 1, otherwise = 0
X25:	Label dummy	If fair trade/organic label = 1, otherwise = 0
X26:	Normal (no-label) dummy	If no-label = 1, otherwise = 0
X27:	Decaffeinated dummy	If decaffeinated = 1, otherwise = 0
X28:	Caffeinated dummy	If caffeinated = 1, otherwise = 0
X29:	Somerfield dummy	If sold in Somerfield = 1, otherwise = 0
X30:	Waitrose dummy	If sold in Waitrose = 1, otherwise = 0
X31:	M&S dummy	If sold in M&S = 1, otherwise = 0
X32:	Sainsbury's dummy	If sold in Sainsbury's = 1, otherwise = 0
X33:	Asda dummy	If sold in Asda = 1, otherwise = 0
X34:	Whittard dummy	If sold in Whittard = 1, otherwise = 0
X35:	Nescafe brand dummy	If Nescafe brand = 1, otherwise = 0
X36:	Kenco brand dummy	If Kenco brand = 1, otherwise = 0
X37:	D. Egberts brand dummy	If D. Egberts brand = 1, otherwise = 0
X38:	Waitrose brand dummy	If Waitrose brand = 1, otherwise = 0
X39:	Sainsbury's brand dummy	If Sainsbury's brand = 1, otherwise = 0
X40:	Somerfield brand dummy	If Somerfield brand = 1, otherwise = 0
X41:	Other brands	If other brand = 1, otherwise = 0

When this model is estimated using the Ordinary Least Squares (OLS) the diagnostic tests [6] results show that heteroscedasticity is not present, and the functional

[6] The econometric package used is Microfit 4.0.

TABLE 3

Diagnostic test for the linear OLS model

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(1) = 19.9323[0.000]	F(1,194) = 18.8566[0.000]
B: Functional Form	CHSQ(1) = 54.6505[0.000]	F(1,194) = 62.2379[0.000]
C: Normality	CHSQ(2) = 98.0766[0.000]	Not applicable
D: Heteroscedasticity	CHSQ(1) = 24.5613[0.000]	F(1,223) = 27.3259[0.000]

A: Lagrange multiplier test of residual serial correlation.
B: Ramsey's RESET test using the square of the fitted values.
C: Based on a test of skewness and kurtosis of residuals.
D: Based on the regression of squared residuals on squared fitted values.

TABLE 4

Parameter estimates and related statistics for the linear OLS model

Variables	Estimated Coefficients	Standard error	T ratio (prob.)
CONS	0.0258	0.0029	[.000]
X2 Low residual quality	0.1919E-3	0.0035	[.957]
X3 Low-Medium r.q.	0.1287E-3	0.0037	[.972]
X5 Medium-high r.q	0.0011	0.0033	[.739]
X6 High r.q	0.0015	0.0036	[.680]
X7 Low roast	0.8764E-3	0.0012	[.480]
X9 High roast	0.0011	0.0012	[.374]
X10 Low arabica taste	–0.0022	0.0035	[.531]
X11 Low-med arabica taste	–0.3111E-3	0.0034	[.928]
X13 Med-high a.t	0.0023	0.0029	[.426]
X14 High a.t.	0.0040	0.0033	[.224]
X15 L.A.	–0.0056	0.0023	[.017]
X16 Africa dummy	–0.0042	0.0026	[.109]
X18 Oceania dummy	–0.0050	0.0039	[.204]
X19 Unknown/mixture	–0.0072	0.0023	[.002]
X20 Arabica specie	0.0012	0.7117E-3	[.080]
X24 Instant dummy	0.0225	0.8453E-3	[.000]
X25 FairTrade/Organic	0.0028	0.0011317	[.012]
X28 Caffeinated	–0.0010	0.9504E-3	[.266]
X29 Somerfield	–0.0063	0.0013	[.000]
X30 Waitrose	–0.0074	0.0012	[.000]
X31 Mark & Spencer	–0.0094	0.0017	[.000]
X32 Sainsbury’s	–0.0071	0.0011	[.000]
X33 Asda	–0.0068	0.0020	[.001]
X35 Nescafe brand	0.0020	0.0015	[.169]
X36 Kenco brand	0.0035	0.0012	[.003]
X37 Douwe Egberts	0.0028	0.0013	[.041]
X38 Waitrose brand	–0.0026	0.0012	[.037]
X39 Sainsbury’s brand	–0.0018	0.0011	[.107]
X40 Somerfield brand	–0.0071	0.0018	[.000]

form is not rejected [7]. We have an R-Bar-Squared of 0.90, which suggests that the model broadly fits the data well and explains a large share of the variation in price. (See table 5) [8].

TABLE 5

Diagnostic test for the Log Lin OLS model (all variables)

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(1) = 10.5241[0.001]	F(1, 194) = 9.5194 [0.002]
B: Functional Form	CHSQ(1) = 1.3507 [0.245]	F(1, 194) = 1.1717 [0.280]
C: Normality	CHSQ(2) = 105.218 [0.000]	Not applicable
D: Heteroscedasticity	CHSQ(1) = 0.0011 [0.973]	F(1, 223) = 0.0010 [0.974]

A: Lagrange multiplier test of residual serial correlation.
B: Ramsey's RESET test using the square of the fitted values.
C: Based on a test of skewness and kurtosis of residuals.
D: Based on the regression of squared residuals on squared fitted values.

From the results of the regression we exclude six variables due to lack of significance (see table 6) [9]. These are: dummy for low-medium residual quality. (X3), dummy for medium-high residual quality (X5), dummy for high residual quality (X6), dummy for low roast (X7), dummy for medium-high arabica taste (X13), and dummy for Nescafe brand (X35). The excluded variables are merged with the base case dummies in the revised regression. Two production region variables are also excluded from the regression for the same reason. These are the dummy for coffees produced in Africa (X16) and those produced in Oceania (X18) [10]. We suspect that these last two variables are not highly significant, because most of the coffees sold in the

[7] Ramsey´s RESET test reported in the diagnostic tests table refers to the case where only the square of fitted values are included in the extended regression of the residuals on the regressors and the squares of the fitted values. Higher order RESET tests, until order 10, have been carried out with same results. Applying the White (1980) test, as a more robust heteroskedasticity test, has, also, been considered. The latter, however, does not seem appropriate in this study due to the high number of dummy variables. The White test involves regressing the square of the residuals against the independent variables x_i , thes quare of the independent variables (x_i^2) and square variables ($x_i x_j$) for all i = 2, ..., 41 and $j \neq i$. In this case, due to the high number of dummies, all of the square variables take the same values, and need to be excluded from the regression. In addititition, the cross-product terms will consume a large number of available degrees of freedom. Consequently, the test is not recommended for the purposes of this study.

[8] Regressions unweighted by market share data are likely to be heteroscedastic, in this case however, this does not appear to be a problem and so the data has not been weighted.

[9] A deletion test (variables individually and also grouped) was carried out to assure the correctness of the exclusion.

[10] Note that these two variables were excluded for not being significant at 95%. However, another three variables not significant at 95% were not excluded from the final regression due to their importance. These three are: caffeinated dummy (X28), high roast (X9) and arabica specie (X20). The inclusion or exclusion of these variables does not change the estimates significantly nor the signs of the estimates. More specifically, the coefficient for Fair Trade/Organic label (X25) estimated including all these variables into the regression is 0.1087 and significant at 95%. Very similar to the estimate of our final model.

TABLE 6

Parameter estimates and related statistics for the Log Lin OLS model (all the variables)

Variables	Estimated Coefficients	Standard error	T ratio (prob.)
CONS	–3.6017	0.0978	[0.000]
X2 Low residual quality	–0.0668	0.1169	[0.568]
X3 Low-Medium r.q.	0.0133	0.1226	[0.913]
X5 Medium-high r.q	0.0217	0.1104	[0.844]
X6 High r.q	0.0174	0.1212	[0.886]
X7 Low roast	0.0193	0.0409	[0.638]
X9 High roast	0.0470	0.0413	[0.256]
X10 Low arabica taste	–0.0738	0.1166	[0.527]
X11 Low-med arabica taste	–0.0734	0.1140	[0.520]
X13 Med-high a.t	0.0506	0.0980	[0.606]
X14 High a.t.	0.1226	0.1107	[0.270]
X15 L.A.	–0.2359	0.0777	[0.003]
X16 Africa dummy	–0.1566	0.0865	[0.072]
X18 Oceania dummy	–0.1709	0.1307	[0.192]
X19 Unknown/mixture	–0.2742	0.0773	[0.000]
X20 Arabica specie	0.0391	0.0235	[0.098]
X24 Instant dummy	0.8655	0.0279	[0.000]
X25 FairTrade/Organic	0.1087	0.0374	[0.004]
X28 Caffeinated	–0.0514	0.0314	[0.103]
X29 Somerfield	–0.2939	0.0438	[0.000]
X30 Waitrose	–0.3530	0.0419	[0.000]
X31 Mark & Spencer	–0.4306	0.0567	[0.000]
X32 Sainsbury's	–0.3432	0.0386	[0.000]
X33 Asda	–0.3140	0.0675	[0.000]
X35 Nescafe brand	0.0042	0.0499	[0.933]
X36 Kenco brand	0.1078	0.0400	[0.008]
X37 Douwe Egberts	0.0967	0.0455	[0.035]
X38 Waitrose brand	–0.0946	0.0415	[0.024]
X39 Sainsbury's brand	–0.1124	0.0371	[0.003]
X40 Somerfield brand	–0.2686	0.0616	[0.000]

British market do not specify on the label where they are produced, or they are blends of coffees from different regions (generally Latin American and African).

Hedonic Function and Interpretation of Results

Once we exclude the non-significant variables and re-estimate the equation, we obtain the results shown in table 7. The goodness of fit remains much the same, the functional form is still not rejected and the tests for heteroscedasticity are satisfactory. However, the Jarque-Bera test for normality still detects a non-normal distribution of residuals. Since the tests for residuals normality are quite weak, comparing with the graphic analysis, we analyse the histogram of residuals and the normal density graphic presented in figure 1 (Trocóniz, 1987). According to this one could argue that we have an approximately normal distribution of residuals and thus, we can trust the inference and tests.

TABLE 7

Diagnostic Test for the Log lin OLS Model (variables excluded)

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(1) = 9.5503[0.002]	F(1, 202) = 8.9541[0.003]
B: Functional Form	CHSQ(1) = 0.57605[0.448]	F(1, 202) = 0.51849[0.472]
C: Normality	CHSQ(2) = 84.9143[0.000]	Not applicable
D: Heteroscedasticity	CHSQ(1) = 0.16619[0.684]	F(1, 223) = 0.16483[0.685]

A: Lagrange multiplier test of residual serial correlation.
B: Ramsey's RESET test using the square of the fitted values.
C: Based on a test of skewness and kurtosis of residuals.
D: Based on the regression of squared residuals on squared fitted values.

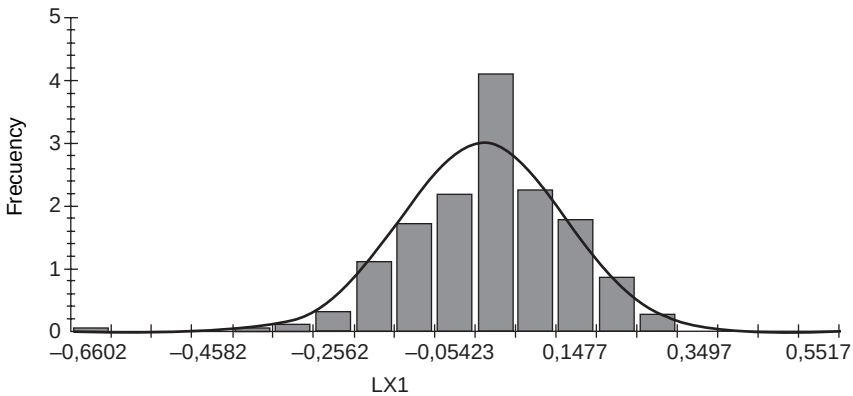

Figure 1. *Histogram of Residuals and the Normal Density.*

Multicollinearity problems are common in such studies and therefore, a more careful analysis is necessary. This is investigated using the method suggested by Belsley *et al.* (1980), which asserts that multicollinearity is not a problem when the condition number is smaller than 20 [11]. We have calculated the condition number of our regression and it takes the value 17.11. This further strengthens the conclusion that multicollinearity is not a problem.

Let us interpret the results in table 8. The fair trade label guarantees a good minimum price for producers however low the international market price falls (see endnote 1). Since the cost of producing organic coffees (the other label considered) is always assumed to be higher, the effect of the variable for labels is expected to be positive and significant. According to our estimates, the coefficient for the variable for labels (X25) is 0.10670 and significant at 95%. **At the market equilibrium**

[11] The condition number for the moment matrix X'X is,

$\gamma = \left(\frac{\lambda_{\max}}{\lambda_{\min}}\right)^{1/2}$, where lmax in the largest eigenvalue of the matrix and lmin the smallest one.

TABLE 8

Parameter Estimates and Related Statistics for the Log Lin OLS model (variables excluded)

Variables	Estimated Coefficients	Standard error	T ratio (prob) Significant at
CONS	–3.6385	0.055972	[0.000] 95%
X2 Low residual quality	–0.085148	0.040667	[0.038] 95%
X9 High roast	0.037243	0.020449	[0.070] 90%
X10 Low Arabica taste	–0.11377	0.056180	[0.044] 95%
X11 Low-med a.t.	–0.13013	0.036973	[0.001] 95%
X14 High a.t.	0.066089	0.025810	[0.011] 95%
X15 L.A.	–0.11378	0.038810	[0.004] 95%
X19 Unknown-mixture p.r.	–0.14901	0.037712	[0.000] 95%
X20 Arabica specie	0.044533	0.022979	[0.054] 90%
X24 Instant dummy	0.86817	0.023601	[0.000] 95%
X25 Fair Trade/Organic	0.10670	0.035972	[0.003] 95%
X28 Caffeinated dummy	–0.044926	0.029248	[0.126] 85%
X29 Somerfield	–0.31161	0.041629	[0.000] 95%
X30 Waitrose	–0.37394	0.039873	[0.000] 95%
X31 Mark & Spencer	–0.44631	0.053356	[0.000] 95%
X32 Sainsbury's	–0.35881	0.037207	[0.000] 95%
X33 Asda	–0.32557	0.066584	[0.000] 95%
X36 Kenco brand	0.11048	0.034983	[0.002] 95%
X37 Douwe Egberts	0.083348	0.040165	[0.039] 95%
X38 Waitrose brand	–0.092804	0.038952	[0.018] 95%
X39 Sainsbury's brand	–0.10914	0.035586	[0.002] 95%
X40 Somerfield brand	–0.26543	0.059480	[0.000] 95%

price, the presence of the label will increase the variable LX1 by 0.10670. That is, ceteris paribus, the presence of the «green» characteristic will multiply the price of coffee by (expX25) 1.1126. Thus, for an average price of regular coffee of 0.025814 Euro per gram the «green» characteristic will increase the price of the coffee by 11.26% ceteris paribus.

All the other statistically significant results (at 95% confidence unless otherwise stated) have the expected signs and reasonable numerical values.

Analysis

The estimated coefficient for the 'fair trade/environmental coffee' label is an important result, which gives an estimate of **how the use of labels in the coffee market affects the final price taking into account variations in quality and the interactions of consumers and suppliers.** The hedonic method allows to isolate the effect of the environmental characteristic on the final price of the good, but excludes the cases in which the consumer buy the 'green' good due to its intrinsically different quality or other factors. This isolation has not been achieved in any previous analysis of green goods [12].

[12] We are aware of only one exception: Nimon and Beghin (1999).

The price premium estimated by this method falls within the ranges of the estimates available in the literature for different 'green' goods. Some of these values are presented in table 9, which consists of estimates made either from rudimentary CVM studies or from casual empiricism (studies of market price differentials, not correcting for quality differences). Hence they must be viewed with some scepticism. Nevertheless they are of some interest. The coffee 'study' in the UK is based on asking Cafédirect the premium it charges over commercial brands – which turns out to be 5-

TABLE 9

Price Premiums Reported in the Literature

Country	Estimated Premium	Source
United Kingdom	13% price premium for certified tropical timber products.	Haji Gazali and Simula *op. cit.*
United Kingdom	33% of the surveyed public willing to pay an average of 13% premium for sustainably produced timber.	Survey carried out by MORI and WWF. Quoted in Simula (1997) in Zarrilli *et al.* (1997).
United Kingdom	Cafédirect has a price premium of 5-10 % over commercial premium brands.	Bird and Hughes (1997).
United Kingdom	Of consumers surveyed [...] premiums suggested (for ethical products) ranged between 10 and 18 pence.	Mintel marketing Intelligence (1994), quoted in Bird and Hughes *op. cit.*
The Netherlands	Price for «GEA» labelled flowers is about 30% higher.	Verbruggen, H. *et al.* in Zarrilli *op. cit.*
Europe	Consumers willing to pay a 5-15% price premium for sustainable timber products.	Varangis *et al.* (1993).
United States	34% of consumers surveyed willing to pay a 6-10% price premium for sustainable wood.	Winterhalter and Cassels (1993).
United States	68% of consumers surveyed willing to pay a 1-15% premium.	Ibid.
United States	75% of consumers surveyed willing to pay 1-5% price premium.	Survey by Gerstman and Meyer. Quoted in Crossley *et al.* in Zarrilli *op. cit.*
United States	WTP for environmental /health attributes between 5-7%.	Ravensway and Hoehn (1991).
United States	60% of consumers willing to pay 10% (or higher) premium for some 'green' products.	Quoted in Morris (1997).
Canada	64% of respondents willing to pay a 10% premium for a product bearing the Ecologo.	Hickling Corporation public survey (1993). Quoted in Guevara *et al.* in Zarrilli *op. cit.*
Singapore	5 % premium for the Singapore Green Label.	Jha *et al.* (1993).

10%. The estimates in this paper are not much higher but they indicate that, correcting for quality and other characteristics, the premium is closer to 11 percent. Other studies for other products indicate that the premium for environmental/fair trade products that consumers would be willing to pay is also in the same range: 5-15%.

The robustness of the premium estimate is worth further investigation, but that is not the task of this paper. Instead, we are more interested in the use of hedonic price estimates in developing the hedonic price estimation method to analyse further the market for commercial and labelled coffees. This can be done *combining the hedonic method with a demand system model to estimate own-cross-price elasticities.*

The information on price differentials between fair trade and other coffee is useful but not sufficient for policy purposes, or not even the most important factor. What is needed in addition is the sensitivity of demand for fair trade coffee with respect to the prices of both fair trade and other coffees, and some guidance on the cost of supply of fair trade and other coffees. Ideally such estimates should be based on panel data of household consumption of different types of coffee, and on a detailed analysis of the conditions of supply. Both these pieces of research however, remain to be done. Once completed, policy makers will be able to use the demand-supply system to evaluate policies, such as differential taxation or infrastructure support to suppliers of fair trade coffee.

4. Demand Systems

While there is no alternative to a more detailed supply side analysis, some information on the demand side can be obtained from the work that has been done so far. In this section we report on the use of a demand system for close substitutes to estimate the own price elasticity for fair trade coffee and the cross price elasticities between fair trade and other coffees for the U.K, given the data from the hedonic estimation presented above. The results of this model are then compared with a more commonly used Almost Ideal Demand System (AIDS) model. There are a number of good examples of applications. For instance: Deaton and Muellbauer *(op. cit.*) looked at the demand for eight non-durable groups; food, clothing, housing services, fuel, drink and tobacco, transport and communication services, other goods and other services. Anderson and Blundell (1983) analysed consumers' expenditure in Canada with the following 5 groups; food, clothing, energy, transport and communications. Molina (1994) studied the demand for food in Spain. The food categories were divided into 6 groups, bread and cereals, meat, fish, milk and eggs, vegetables and fruit and other food. Some other interesting studies in this vein are Molina (1993) and Blanciforti and Green (1982). These studies, however, only deal with aggregate goods, they do not specify much about the effects in a given market of a good.

Less work has been done in the case of close substitutes. Some studies are, Chen and Veeman (1991) where meat demand is analysed dividing it into 4 categories, chicken, beef, pork and turkey, Wellman (1992) for fish products and Pierani and Rizzi (1991) for the olive oil market. The substitutability of chicken with other meat is clearly substantial, however, we still need to deal with almost perfect or close subs-

titutes as the cases of fair trade/organic Vs regular coffee and ecolabelled Vs non-ecolabelled goods. Some studies that have dealt with almost perfect substitutes are Huang *et al.* (1980) —not based in any demand system does not provide estimates of cross price elasticities— and Abaelu and Manderscheid (1968) on coffee [13].

All the studies are base in log time series data. However, when looking at labelled goods markets, it is often the case that these data series are not available, mainly because they are relatively new goods. This, of course, adds an extra difficulty to the analysis, since the traditional econometric tools cannot be applied. For instance, Blend and van Ravenswaay (1999) estimate own price elasticities for eco-labelled and regular apples but they are not based in demand systems but on questionnaire information.

A Quantity Based Demand System for Close Substitutes (QBDS): the model

Based on consumer theory and following the standard structure of demand systems, the authors develop the following model for the analysis of close substitutes. This model is a first simplified approach that should help to unravel future work in the field and should be evaluated as such.

The following variables are defined:

V_i : demand for quality i of good V in physical units.

P_i : price of quality i of good V.

M : total expenditure.

$\bar{P}$: aggregate price of good V.

$\bar{w}_i$: expenditure share of quality i of good V.

It is assumed that the different qualities of the good can be measured in comparable units (e.g. in grams in the case of coffee & tea). We define the demand for quality i of good V as

$$\frac{V_i}{V} = \beta_i \left(\frac{P_i}{\bar{P}} \right)^{-\bar{\alpha}} \qquad [2]$$

where $\beta_i \geq 0$ is a constant, and $\bar{\alpha} \geq 0$ is the price sensitivity parameter.

Further we define a price index $\bar{P}$ as,

$$\bar{P} = \prod_i P_i^{Si} \text{ where } s_i \geq 0 \text{ and } \sum_s S_i = 1 \qquad [3]$$

and the aggregate demand for all quality types as

$$V = A \left(\frac{\bar{P}}{M} \right)^{-\mu} \qquad [4]$$

s_i is the weight for quality i good in the price index for good V. $A > 0$ is a constant and μ is the expenditure sensitivity parameter for the aggregate demand for the good.

[13] Other interesting studies are Fulponi (1989) and Parsons (1986).

It is easy to confirm that the demands for each quality i of good V are **homogeneous of degree zero** in prices and income and that the price elasticity is given by

$$e_{ii} = -\bar{\alpha} + (\bar{\alpha} - \mu)s_i \qquad [5]$$

and the cross price elasticity for good i with respect to the price of good j, e_{ii} , is given by

$$e_{ij} = (\bar{\alpha} - \mu)s_j \qquad [6]$$

Finally we note that the **Slutsky equation** requires

$$\frac{s_j}{s_i} = \frac{\bar{w}_j}{\bar{w}_{ji}} \qquad [7]$$

which can be satisfied locally by selecting the values of s appropriately [14].

If we now differentiate the budget constraint with respect to M we obtain the additivity condition;

$$\sum_i \bar{w}_i e_i = 1 \qquad [8]$$

This system is similar to the Deaton & Muellbauer's *(op. cit.)* AIDS demand system, except that it is defined **in terms of quantity shares,** not expenditure shares. It requires that quantities be broadly comparable, which is a limitation, but the advantage of working with this system is that subgroups of close substitutes are easier to handle, and one can derive plausible own and cross price elasticities from limited data.

There are 2 elasticities (income or price) that need to be assumed in order to use the model. The number of substitute goods one can analyse is, however, quite limited because, first it is unclear how realistic it is to assume the same income elasticity for a great number of different goods – it is unlikely that you have more than three or four goods that are very close substitutes. Second, the way the model is developed gives the elasticities so that $e_{ji} = e_{si}$ for all $i \neq j$ and $i \neq s$. That is, for a four goods example, $e_{21} = e_{31}$ and $e_{12} = e_{32}$ [15].

[14] There is of course no reason why the Slutsky equation should be satisfied in an aggregate demand equation. However imposing it is often used as a condition to ensure that the system is well behaved and that the welfare analysis is not misleading.

[15] For instance, for four goods (three subsitute goods called 1,2, and 3, and a composite good, 4) if we have empirical data for two elasticities —generally this data can be easily obtained from different studies— it is possible to estimate nine elasticities with this model. We could, for instance, knowing the common income elasticity for goods 1-3 and the own price elasticity for good 1, estimate all the other own and cross price elasticities as well as the income elasticity for the composite good (See Table below):

QBDS	Good 1	Good 2	Good 3	Good 4
Good 1	Given	DBS	DBS	n/a
Good 2	DBS	DBS	DBS	n/a
Good 3	DBS	DBS	DBS	n/a
Good 4	n/a	n/a	n/a	n/a
Income	Given	DBS	DBS	Possible to obtain

DBS stands for 'determined by the system', that is, these elasticities can be estimated with the model.
n/a: not applicable.

In any case the model proves of good use in situations in which the quoted limitations are not too restrictive.

A Quantity Based Demand System for Close Substitutes (QBDS): the application

In the case of coffee, we have some information on market share and, as a result of the hedonic analysis of this paper, on relative prices -- using the price information from the hedonic function allows us to treat regular coffee as one good and fair trade organic as another [16]. If, instead, an average price of both types of coffee is used, we would not control for differences in the rest of characteristics and the estimates might reflect other differences such as quality, origin and so on. We also have, from other studies, some estimates of the overall expenditure elasticities of demand for coffee. Let us consider the above model in the context of the demand for coffee & tea and, for simplicity define two types of coffee ('fair trade' and other) and one type of tea (T) [17]. We use the abbreviation 'ft' and 'ot' respectively for these two coffees. We include a fourth good, the composite good «x» that stands for all the rest of the goods of the economy [18]. The data available provide us with the following [19],

$$\mu = 0{,}5, \quad \overline{w}_{ot} = 0{,}0016, \quad \overline{w}_{ft} = 0{,}000046, \quad \overline{w}_T = 0{,}0013, \quad \overline{w}_x = 0{,}9971$$

The evidence suggests that the price elasticities of demand for 'ot' coffee ($\in ii$ in equation 5) by itself could be anything from –1 to –5 according to the values from

[16] This information from the hedonic function consists on the price premium estimated for fair trade/organic label, i.e. variable X25. This estimate has been added to the average price of regular coffee to calculate the average price of fair trade coffee. The value used (exp 0.1067) is significant at 95 % confidence level in the preferred model.

[17] The data used for the reported below analysis was obtained from Max Havelaar, The UK National Statistical Office and the British Ministry of Agricultural Fisheries and Food. We have not distinguish between fair trade and regular tea for simplicity reasons. A possible extension of this work is, thus, the inclusion of fair trade and non-fair trade tea in the model.

[18] We are assuming that coffee and tea are close substitutes and have same income elasticity (μ). This demand function represents only tea and two types of coffee. The composite good it is not therefore included in this demand function and thus, $\sum_{i}^{3} s_i = 1$. However, the composite good it is included in the budget constraint and in the additivity condition derived from it, i.e. $\sum_{1}^{4} \overline{w}_i e_i = 1$.

[19] Although there is considerable variation in the different studies an average overall elasticity for expenditure of around 0.5 is within each of the ranges (Heien and Pompelli, 1989 and Huang *et al.,* op. cit.). Coffee consumption and coffee expenditure figures for both 'ft' and 'ot' coffee are for 1997. The prices however, are for 1998. The conversion table of the National Statistics Service of the British Government justifies the use of the latter as 1997 prices. The data has been calculated from the total expenditure in the UK for 1997 (National Statistics Service), the consumer price index for the UK 1997 (National Statistics Service), average price of tea and coffee in the British market (from supermarkets and retailers), average price of fair trade coffee (hedonic function), per-capita expenditure in tea and coffee in the UK (MAFF, 1998) and fair trade coffee sales (Max-Havelaar's National Fair Trade Roasted Coffee Sales-version June 24, 1998).

Abaelu and Manderscheid (1968) for mild, robusta and Brazil coffee varieties as reported in Okunade (1992).

From equation [7], given that $\sum_{1}^{3} s_i = 1$ and the above values of $\mu, \overline{w}_{ot}, \overline{w}_{ft}, \overline{w}_T$, and e_{ii}, we obtain the elasticities shown below in table 10. Such demand equations, combined with supply cost data, allow us to estimate the impact of change in supply conditions, change in taxation etc. on the equilibrium prices and quantities in the coffee market. Although a more comprehensive analysis of the parameters is warranted, given the large uncertainties surrounding the overall price elasticities, the results seem to indicate that the estimated impact of a one percent change in the price of regular coffee on the demand for fair trade/environmentally coffee ranges from 0.6% to 5.3%, depending on the assumed own-price elasticity of demand for other coffee. This information is of great importance in analysing the market for fair trade coffee, as it tells us how much demand can be shifted over to the ethically/environmentally preferred brand.

We can, then, obtain from equation [8] the values for the composite good expenditure elasticity (e_x).

In the model we are assuming that small changes in the composite good price would not affect the coffee market, i.e., $\frac{\partial V_i}{\partial P^x} = 0$. We are thus assuming that there are no cross effects between the coffee market and the market for the composite good.

TABLE 10

Elasticities Calculated with the QBDS

Elasticity		QBDS					
		cross ot/ft	**own for «ft»**	**cross ft/ot (=cross tea/ot)**	**cross ot/tea (= cross ft/tea)**	**own for tea**	**cross tea/ft (= cross ot/ft)**
own income	–1 0.5	0.014	–1.57	0.5926	0.4851	–1.10	0.014
own income	1.5 0.5	0.028	–2.65	1.18	0.9762	–1.71	0.028
own income	–2 0.5	0.042	–3.73	1.77	1.45	–2.32	0.042
own income	–3 0.5	0.070	–5.89	2.96	2.42	–3.53	0.0702
own income	–5 0.5	0.126	–10.20	5.33	4.36	–5.96	0.1263

Note: For a own price elasticity for regular coffee (ot) of –1 and and income elasticity of 0.5, the cross price elasticity for regular (ot) and fair trade (ft) coffee is 0.014, own price elast. for ft is –1.57, cross price elast. ft and ot 0.59, cross price ot and tea 0.48 and so on.

Given that this market is very small relative to the composite good market [20], this assumption is not unreasonable.

This data analysis is only indicative of what can be done. With more complex systems involving many different types of coffee, a larger set of parameters has to be determined but the method is the same as that developed here.

The Almost Ideal Demand System: the model [21]

Using the traditional notation, the demand function here is defined as,

$$w_i = \alpha_i + \sum_{j} \gamma_{ij} \log P_j + \beta_i \log (M/\overline{P}) \qquad [9]$$

α_i and γ_{ij} being parameters, w_i the expenditure share of good i, M the total expenditure, P_j the price of good j, and $\overline{P}$ is the price index defined by,

$$\log \overline{P} = \alpha_0 + \sum_{k} \alpha_k \log p_k + \frac{1}{2} \sum_{j} \sum_{k} \gamma_{kj} \log p_k \log p_j \qquad [10]$$

From the additivity, homogeneity and symmetry conditions respectively we know that,

$$\sum_{i} \alpha_i + 1, \ \sum_{i} \gamma_{ij} = \sum_{i} \beta_i = 0 \ \ (j = 1, ..., n) \qquad [11]$$

$$\sum_{j} \gamma_{ij} = 0 \ \ (i = 1, ..., n) \qquad [12]$$

$$\gamma_{ij} = \gamma_{ji} \ (\mathrm{i} \neq j, \ j = \mathrm{i}, ..., n) \qquad [13]$$

The elasticity formulae derived from this model are presented in table 11.

TABLE 11

Uncompensated Price and Income Elasticities Formulae

Elasticity	Formulae
Own price for good i	$e_{i/i} = \frac{\gamma_{i/i}}{w_i} - \beta_i - 1$
Cross price good i and j	$e_{i/j} = \frac{\gamma_{i/j}}{w_i} - \beta_i \frac{w_j}{w_i}$
Income	$e_i = 1 + \frac{\beta_i}{w_i}$

[20] For the case in which we allow the coffee & tea market to affect the composite but not the other way around, Slutsky equation holds and cross elasticities between “ot”, “ft” and tea with respect to x can be calculated. It is however unrealistic to do such assumption when the inverse is not assumed. Slutsky equation does not hold for the composite good in the case in which no cross effect at all exist.

[21] For more details see Deaton and Muellbauer *(op. cit)*, Blanciforti and Green *(op. cit)* and Lanza (1998).

The AIDS model allows us to estimate $[(n^2 + n)/2] + 1$ elasticities out of the total $(n^2 + n)$ elasticities by inserting —generally assuming values from other studies— $[(n^2 + n)/2] - 1$ elasticities. This is done using the expressions for e_{ii}, e_{ij} and e_i, and the conditions of additivity ($\sum_i \beta_i = 0$), homogeneity and symmetry displayed in 11-13 [22]. That is, we have a total of $\left(\frac{3n^2 + 3n + 2}{2}\right)$ **equations** made up as follows:

- n equations for the own price elasticities,
- $n(n-1)$ for the cross price elasticities,
- n for the income elasticities,
- 1 for the additivity condition,
- n for the homogeneity condition and
- $\frac{n(n-1)}{2}$ for symmetry condition.

These are used to determine the values of $2(n^2 + n)$ **unknowns,** $(n^2 + n)$ of which are **elasticities,** n are equations for β_i and n^2 equations for γ_{ii}.

The number of unknowns we need to assume [23], i.e. the expression $[(n^2 + n)/2] - 1$ can be easily derived by subtracting the number of equations from the number of unknowns [24].

For the four goods case given, we use a total of 31 equations (4 equations for the own price elasticities, 12 for the cross price elasticities, 4 for the income elasticities, 1 for the additivity condition, 4 for the homogeneity condition and 6 for symmetry condition) to find the values of 40 unknown (20 of which are elasticities). With that purpose we assume 9 elasticities and solve the system to obtain the remaining 11 [25].

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[22] Note that equations (9) and (10) are not used to solve the system.

[23] Note that all the unknowns we assume are elasticities.

[24] Similarly, the expression $[(n^2 + n)/2] + 1$ can be derived subtracting the number of values needed to be assumed, that is, $[(n^2 + n)/2] - 1$, from the total number of elasticities, i.e. $(n^2 + n)$.

[25] For example, assuming the income elasticity for good 1 (e_1), the income elasticity for good 2 (e_2), the income elasticity for good 3 (e_3), the own price elasticity for good 1 (e_{11}), the own price elasticity good 3 (e_{13}), the own price elasticity for the composite good 4 (e_{44}), the cross price elasticity for good 1 with respect to good 2 (e_{12}), the cross price elasticity for good 3 with respect to good 1 (e_{31}), and the cross price elasticity for good 3 with respect to good 2 (e_{32}), we can estimate the following values:

— The income elasticity for the composite good 4 (e_4),
— The own price elasticity for good 2 (e_{22}), and
— The cross price elasticities e_{13}, e_{14}, e_{21}, e_{23}, e_{24}, e_{41}, e_{42} and e_{43}. See below.

AIDS	Good 1	Good 2	Good 3	Good 4
Good 1	Given	Given	DBS	DBS
Good 2	DBS	DBS	DBS	DBS
Good 3	Given	Given	Given	DBS
Good 4	DBS	DBS	DBS	Given
Income	Given	Given	Given	DBS

The Almost Ideal Demand System: the application

For our analysis we have «ot» & «ft» coffees, tea «T» and the composite good «x» [26]. Therefore our model for 'ot' coffee can be written as,

$$w_{ot} = \alpha_{ot} + \gamma_{ot/ft} \text{ In } P_{ft} + \gamma_{ot/T} \text{ In } P_T + \gamma_{ot/x} \, In \, P_x + \gamma_{ot/ot} \text{ In } P_{ot} + \beta_{ot} \text{ In}(M/\overline{P}) \quad [14]$$

The three conditions are,

- *Additivity:*

$$\alpha_{ot} + \alpha_{ft} + \alpha_T + \alpha_x = 1 \quad [15]$$

$$\gamma_{ot/ot} + \gamma_{ft/ot} + \gamma_{T/ot} + \gamma_{x/ot} = 0 \quad [16]$$

$$\beta_{ot} + \beta_{ft} + \beta_T + \beta_x = 0 \quad [17]$$

- *Homogeneity:*

$$\gamma_{ot/ft} + \gamma_{ot/ot} + \gamma_{ot/T} + \gamma_{ot/x} = 0 \quad [18]$$

- Symmetry:

$$\gamma_{ot/ft} = \gamma_{ft/ot} \quad [19]$$

$$\gamma_{ot/x} = \gamma_{x/ot} \quad [20]$$

$$\gamma_{ot/T} = \gamma_{T/ot} \quad [21]$$

As the AIDS is much more data demanding than the QBDS, in order to compare results of both models some restrictions have to be imposed, that is, some more elasticity values have to be taken as given. The 'extra' values we use for this purpose are some of the values already calculated with the QBDS model as this seems to be the only reasonable method to compare both models. These elasticities are:

- Income elasticity for «ot», «ft» and «T» goods are equal to 0.5,
- Own price elasticity for «x» is equal to –1,
- Own price elasticity for «T», cross price elasticity «ot/ft», «T/ot» and «ft/T» take the values calculated with the QBDS,
- Own price elasticity for «ot» takes, as in the QBDS model, the values –1, –1.5, –2, –3, –5.

The formulae used for the calculation are reported in table 11.

Applying these formulae to the data for UK we obtain the values reported in table 12.

Comparing the results obtained from the AIDS model with the ones obtained from the QBDS model, we find that the values estimated are very similar. **The limitations for the QBDS are, first that the own price elasticity has to be greater**

[26] Most of the data used in this study correspond to Fair Trade coffees only as we were unable to obtain data on organic coffees.

TABLE 12

Elasticities Calculated with the AIDS

		AIDS $e_{ot} = e_{ft} = e_T = 0.5$ $e_{x/x} = -1$							
Elasticities		**cross ot/ft**	**cross T/ot**	**own T/T**	**cross ft/T**	**own ft/ft**	**cross T/ft**	**cross ft/ot**	**income x**
own	–1	0.014	0.592	–1.10	0.485	–1.73	0.017	0.484	1.0014
income	0.5								
own	–1.5	0.028	1.18	–1.71	0.976	–2.4	0.034	0.968	1.0014
income	0.5								
own	–2	0.042	1.77	–2.32	1.45	–3.18	0.051	1.452	1.0014
income	0.5								
own	–3	0.07	2.96	–3.53	2.42	–5.64	0.085	2.42	1.0014
income	0.5								
own	–5	0.126	5.33	–5.96	4.36	–9.71	0.153	4.35	1.0014
income	0.5								

* The numbers in bold are the values we have assumed as given in the model.

than the income elasticity (in absolute value). Second, that it assumes the same income elasticity for «fair trade», «other» coffees and tea. The latter would restrict the use of this model to close substitutes where the income elasticity is assumed to be equal or very similar [27]. It is, however, a very appropriate model to be used in labelling policies analysis that allows us to estimate elasticities and is less 'parameter hungry' than the AIDS.

Differences Between the Two Models

The advantage of working with the QBDS is that it is much easier to handle than the AIDS and less data demanding, as it has been shown. There is, however, a condition that has to be met in order to use the QBDS; the income elasticity for close substitute goods has to be the same. For cases where this assumption is too restrictive, that is, if we want to allow for income elasticities to be different, we still have to use the AIDS model in the way we present here. An empirical application of such case for the tire market in Hungary can be found in Galarraga & Markandya (2003).

Since it is reasonable to expect that all the cross price elasticities of close substitutes are positive, one can derive the following conditions from the homogeneity restriction:

- If $e_i > |e_{ii}|$ then $\sum_j e_{ij} < 0$ for all $j \neq i$. Therefore at least one of the cross price elasticities has to be negative, and

[27] This assumption however, does not mean that the demand for “ft” coffee reacts, in absolute terms, to changes in income the same way as the “ot” demand, but in relative terms only. It, thus, assumes that the changes on demand due to changes on income, in absolute terms, on the fair trade market are smaller than on the “ot” market.

- If $e_i < |e_{ii}|$ then $\sum_j e_{ij} > 0$ for all $j \neq i$. and thus, all the cross price elasticities could be positive.

The condition for the QBDS model is simplified by the fact that information on the composite good is not required. Having $e_i < |e_{ii}|$, which can be further simplified to $\overline{\alpha} > \mu$ is, thus, enough to have positive cross price elasticities for all close substitutes

For the AIDS model, the condition is not very clear. We can, however, suggest that using the latter condition works as a rule of thumb to have positive cross price elasticities for close substitutes [28].

Comparing Results with Both Models

Comparing the results obtained from the AIDS model with the ones obtained from the QBDS model, we find that the values **estimated are very similar.** In the QBDS we have, therefore, developed and applied a model that is much easier to handle than the AIDS, and needs less parameters to be known. The limitations of the QBDS are, first, that the own price elasticity has to be greater than the income elasticity (in absolute value), and second, that it assumes the same income elasticity for 'fair trade', 'other' coffees, and tea. The latter would restrict the use of this model to close substitutes where the income elasticity is assumed to be equal or very similar [29]. It is, however, a very appropriate model to analyse labelling policies as it allows us to estimate elasticities being less 'parameter hungry' than the AIDS.

The results obtained with both models suggest that the demand for 'ft' coffee is more elastic than the demand for 'ot' coffee. Some reasoning can be given to support this fact. First, the 'ft' coffee is a new good in the market and there are just few brands selling with such a label, while a number of different 'ot' coffee brands are sold. Hence, if the prices of both 'ft' and 'ot' coffee rise, one can expect much more substitution to take part within 'ot' coffee brands (switching from one 'ot' brand to another), and less towards 'ft' coffee. With respect to 'ft' coffee, there is not much scope for substitution within them due to the small number of brands. One can, thus, expect more substitution between 'ft' and 'ot' to take place [30]. Second, 'ft' coffee is a relatively new product and it might, therefore, take some time before the demand is fully consolidated. Third, one could argue that the demand for certain 'green' goods it is far from being elastic as concerned consumers will only buy 'green'. There is, however, a case for consumers buying 'green' due to less firm beliefs. That is, there might exist a fashion component within some 'ft' coffee consumption that also explains a greater elasticity. Therefore, if the number of consumers buying due to fashion is gre-

[28] It does, however, return some negative cross price elasticities for the composite good, which is reasonable according to economic theory.

[29] This assumption, however, does not mean that the demand for 'ft' coffee reacts, in absolute terms, to changes in income the same way as the 'ot' demand, but in relative terms only. It, thus, assumes that the changes in demand due to changes on income in absolute terms on fair trade market are smaller than on the 'ot' market.

[30] The estimates obtained for the cross price elasticities of demand support this reasoning.

ater than the number of consumers buying out of 'true concern', the aggregate demand can be expected to be much more elastic.

Whether this tendency might be reverted as the number of 'ft' coffee brands increase is yet to be answered, but one would expect that differences in elasticities will tend to diminish in the medium/long term, as 'ft' coffee demand will become more inelastic.

5. Conclusion

This paper has applied the hedonic approach for the coffee market in order to analyse eco-labelling policies. We first estimate the relative impact over the market price of different characteristics of the coffee. The important result for the labelling literature is the estimate for the use of labels. This estimate is strongly significant and positive. **It implies that, ceteris paribus, the presence of the «green» characteristic will increase the price of an average grade of coffee by 11.26%. For the UK market this average price is 0.025814 Euro per gr. Hence the increase due to the «green» characteristic» is 0.003 Euro per gram.**

The result provides evidence from real market data on what consumers are «ready to pay» and what they «really pay». This is in contrast with questionnaire approaches, which have been subject to the criticism that the answers are hypothetical. Other studies for eco-labelled goods find a price premia of between 5-15 percent of the price of the non-labelled good. These studies tend to be crude and do not correct for quality differences but the fact that the broad range is consistent with this more careful study is worth noting.

Given the lack of demand side data, and the likelihood that this will continue to be a problem, it is useful to have models that determine demand parameters from limited information. That is, since there are many cases in which policy makers do not have all the relevant data but part of it is available, it is important to have models that allow them to use the data available and to infer the values of the remaining parameters. For this purpose, we developed the QBDS model for Close Substitutes to estimate cross and own elasticities that, combined with the information given by the hedonic function, allow us to calculate the own and cross elasticities for fair trade and regular coffee. These results are compared with the ones obtained from the AIDS model. This latter is a well known and frequently used model and we present a method to use it that is less data demanding. The QBDS model, on the other hand, can be applied in a very particular case of close substitutes, when the income elasticity of the substitutes can be assumed to be equal. When applying the conditions needed for the use of the QBDS to both models, the results imply that both are compatible as they give very similar estimates. They are however complementary in the sense that the QBDS is easier to handle and besides the AIDS can be used when the assumptions needed for the QBDS do not hold.

We have presented an example of the use of both models for the coffee market that allow, combining with price data obtained from applying the hedonic technique, to calculate the elasticities straightforward, stating that the derived estimates are, ac-

cording to the existing evidence, plausible values. The hedonic technique allows to estimate the relative impact over the market price of different characteristics of the coffee. The result needed for the calculation of elasticities with the models is the estimate for the use of labels. This estimate is strongly significant and positive. It implies that, ceteris paribus, the presence of the «green» characteristic will increase the price of an average grade of coffee by 11.26%. For the UK market this average price is 0.025814 Euro per gr. Hence the increase due to the «green» characteristic» is 0.003 Euro per gram. This estimate has been added to average price of regular coffee to calculate the average price of fair trade coffee.

The models can be applied for a variety of empirical examples--labelled goods is good example indeed as are very close substitutes of the non-labelled ones-- and can also be developed further for a more comprehensive study of close substitutes. The results indicate that the price elasticity for fair trade coffee demand is higher than the price elasticity for regular coffee. The models we present here are important tools for the analysis of welfare effects of taxation (subsidies), which is in the scope of our future research.

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