Economía Agraria y Recursos Naturales. *ISSN: 1578-0732*. Vol. 6, 12. (2006). pp. 145-167

A Proposal to Correct External Effects in the Coffee Market: A tax on Regular Coffee and Tea to Subsidise the Fair Trade Coffee

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SUMMARY: This paper justifies the need to introduce a tax on regular coffee drinkers in the UK to subsidise the fair trade/organic coffee production. This policy will allow to take full account of the negative external effect of regular coffee production while internalising the positive effect of fair trade initiatives. Designing such a policy is possible and the benefits of it can be calculated. This paper shows how.

KEY WORDS: Coffee market. Fair trade.

JEL classification: Q18, H23.

Propuesta para corregir las externalidades en el mercado de café: un impuesto sobre el té y el café regular y una subvención sobre el café de Comercio Justo

RESUMEN: El presente artículo justifica la necesidad de introducir un impuesto sobre los consumidores de café y té en el Reino Unido para subvencionar la producción de café orgánico y de Comercio Justo. La propuesta permite corregir los efectos externos negativos que se generan en el proceso de producción del café a la vez que sirve para internalizar las externalidades o efectos positivos de los cultivos de café de Comercio Justo. El trabajo muestra que el diseño de esta política es factible y que los beneficios resultantes de ponerla en práctica pueden ser debidamente calculados.

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Acknowledgements: Funding for Ibon Galarraga was provided by the Education, University and Research Department of the Basque Government.

PALABRAS CLAVE: Mercado café. Mercado justo.

Clasificación JEL: Q18, H23.

1. Introduction

Fair Trade coffee can be now bought in any regular store, but it is not so long since it first appeared in the market, it appeared in the British market in 1994. The concept of Fair Trade is quite simple, the products sold under Fair Trade label guarantee:

- A good minimum price to cover the cost of production, however low the international market falls.
- A 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.

According to the International Federation for Alternative Trade's (IFAT) Fairtrade is:

«Fairtrade is a trading partnership, based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalised producers. Fairtrade organisations are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practice of conventional international trade.»

The fair trade system consist in two strategies, (a) eliminating middlemen in the coffee market that get part of the benefits and (b) charging a price premium to final consumers willing to purchase socially responsible products.

The Fair Trade movement is not new but it is since 1997 that fair trade in Europe, Canada, Japan and the US is being coordinated by the International Fair Trade Labelling Organisation (FLO).

World sales of fair trade coffee amounted to 5,000 tons in 1991. For 1994 it is estimated that world sales were more than 11,000 tons. By 1996 they had increased to 14,000 tons, representing a growth rate of 17% per annum over the period.

Organic coffee is, mainly, sold by fair trade organisations and some organic coffee specialists. Hence, its full potential may not yet be fulfilled. The main coffee brands (Kenco, Nescafe, Lyons amongst others) have not yet started producing this type of coffee, but, for instance, brands such as Waitrose have already marketed an organic coffee.

Organic coffee is considered «the most important organic product exported by developing countries», and accounts for 0.5% of the world coffee exports with a production in 25,000 tons a year. In terms of market share, organic coffee is also considered a niche market, with a 0.3% market share in France and Italy, 0.1% in

Germany, and 0.2% in USA. The biggest markets, in absolute terms, are the USA with 66% of world sales, Germany with 18%, the Netherlands with 5%, and France with 4%. (UNCTAD, 1996).

Fair trade and organic initiatives are very much linked in many cases. That is, many organic coffees are fair trade coffees as well (e.g., Cafe Natura and Café Latino). It is, therefore, very difficult to treat fair trade and organic labels as separate seals. Consequently, we have treated both labels as one in the empirical analysis developed later in this paper.

Fair trade market is growing fast, but it still represent a niche market competing with gigantic coffee manufacturing companies such as nestle, Procter and Gamble, Kraft and Sara Lee.

This paper pretends to draw the attention into the need to support the Fair Trade Market through innovative and coherent economic policies. The economic rationale justifies the need of intervention and this works shows how: introducing a tax into the regular coffee market to be used to subsidize the fair trade coffee production.

2. Justification of the policy

Starting from the fact that fair trade/organic coffee is produced under tighter environmental and social conditions than the regular coffee, one can argue that a social benefit or positive externality is generated when fair trade/organic good is produced. Moreover, this suggests that a negative externality or a social and environmental cost is imposed when regular coffee and tea is produced. Although it often argued that the environmental benefit generated by fair trade and organic production is internalised with the price premium consumers pay for them –it does not seem to be the case, though, that the entire social and environmental benefit is internalised in this premium–, it is important to note that «their competitiveness is still hampered by the absence of an internalisation of environmental (and social) costs, i.e. the fact that environment unfriendly practices are not only not penalized, but sometimes even encouraged» (UNCTAD, *op. cit*). This leads to the following line of argument; on the hand, the activity that generates a social and environmental benefit is identified (and not fully internalised), the fair trade coffee production. On the other hand, the one that generates the cost is also identified, the regular coffee production. There is, thus, room to say that fair trade activities should be subsidised in order to internalise, partially at least, the additional benefit they generate. Moreover, it is often argued that the administration should be the one to pay for such subsidy, which in other words means that all taxpayers are being considered accountable for paying that cost. It is the case that the activities that create the social and environmental cost are easily identified, i.e. regular coffee and tea production, and, thus, following the «polluter pays» principle, should be the ones taxed to account for the burden they impose.

The literature in public economics is well known and has dealt with issues like the one presented here. One of the most traditional solutions to the above problem presented within this literature is the use of the framework developed by Pigou in the 1930's (Baumol and Oates, 1988). Ideally, according to Pigou, we could internalise

social costs with a Pigouvian tax, and social benefits with a Pigouvian subsidy, leading the economy towards the social optima. This issue has been deeply discussed in many contributions (see Galarraga, 2001). The idea presented above is simple, but there are many practical problems in implementing the system (Rosen, 1999). In most cases, estimating the marginal damage (benefit) that the activity generates is very difficult, and, hence, setting the tax (subsidy) rates efficiently to obtain social optimum production levels is very hard. Unlike the tax (subsidies) introduced in this ideal scenario, a non-efficient scheme will likely generate some welfare losses, i.e. a dead weight loss. For the issue we are studying, achieving the social optima becomes even more problematic, as the environmental cost might be scattered in more than one country. It is, therefore, certain that we are far from a first best scenario, which in other words means that most policy options suggested will create distortions, and consequently welfare gains and losses. Identifying the winners and the losers, and determining whether the cost and benefits could be more fairly attributed is a crucial task. (Marcucci, 1999).

In addition to this, the practicability and political feasibility of implementing different policies have to be also taken into account when developing any policy. With this in mind, the idea of imposing a Pigovian tax on the production of regular coffee to account for the cost generated seems quite difficult to achieve for many reasons. Some of these reasons are: (a) we cannot properly estimate the environmental and social cost of regular coffee production; and (b) coffee is the most important commodity in terms of volume and value of trade in the world. The coffee companies are, therefore, very powerful and can lobby against such measures. One could instead, as a second best policy, introduce, on the one hand, a subsidy for the production of labelled goods that internalises the externalities that the «green» good generates, and, on the other hand, as the activities that generate the cost are identified (i.e. the regular coffee production), insert a very small tax to finance the subsidy scheme. The reason why this tax is more likely to be feasible is that it is considerably smaller than the Pigovian tax. One needs to be aware, again, that the policy we are suggesting will not achieve the socially optimal outcome, but it will push the economy in that direction.

Therefore, the ideal we try to develop in this paper is a combination of small taxes on regular coffee and tea consumption so as to be able to subsidise the production of fair trade/organic coffee, keeping in mind that the social optimum is not achievable and that a dead weight loss will occur. The aim of the policy is, thus, twofold: to discourage the (inappropriate) use of a product that causes environmental damage (regular coffee and tea), and to raise the revenue to finance the subsidy scheme for fair trade coffee.

With such scheme, the consumers that contribute to the environmental and social cost pay a tax, while the money collected is used to subsidise the activities that generate an environmental and social benefit. This argument follows the line of the discussion developed in transport economics (see Marcucci, op cit.) concerning the social cost cars generate (pollution, noise, traffic, accidents). Some economists have argued that, since the agents that create the cost are easy to identify, i.e., the car users, they are the ones that should fiscally contribute to alleviate the problem. Additionally,

activities that help to reduce such costs –public transport for instance– should be subsidised, and, moreover, the scheme should be financed by taxing car users.

There is still a major difference between the argument explained above and the case of fair trade/organic coffee. In the case of transport, the idea is to tax road users to subsidise public transport (or other initiatives), but everything is done in the same country. However, in the case developed here, the tax is applied in one country and the subsidy is given in another; that is, coffee and tea consumers in the UK are the ones who have to bear the tax burden, while the subsidy is given to producers in other countries. The latter points complicate the analysis, making some further discussion necessary.

3. The Coffee Market

Coffee is, according to Cafédirect[1], one of the most important commodities in international trade, in terms of volume traded and also in terms of value traded. Total production of coffee is around 90 million bags per year, of which almost 78% percent is exported. North America, Europe and Japan's imports account for 85% of the world imports.

The international market is mainly based on the New York and London markets, which include futures markets. The market is characterised by the volatility of the coffee prices –especially after the collapse, in 1989, of the International Coffee Agreement quota system– that vary frequently according to the size of the coffee stocks, the weather, and speculation rumours in the future markets. Additionally, the trade of unroasted coffee beans is concentrated in the hands of four major traders: the Neumann group, Volcafe, Cargill, and E.D. & F., while the soluble coffee roasting and processing activities are controlled by three main multinational companies: General Foods (Phillip Morris), Sara Lee (Douwe Egberts & Van Nelle brands), and Nestlé.

After the collapse of world coffee prices in 1989, many farmers sold their coffee at a price that did not allow them to cover production costs, while the price of the final coffee product –roasted, processed and packaged coffee– did not experience major changes. In response to such a situation, fair trade initiatives guaranteed growers an agreed minimum price that ensured that production costs were covered. In Figure 1, fair trade and international prices are compared.

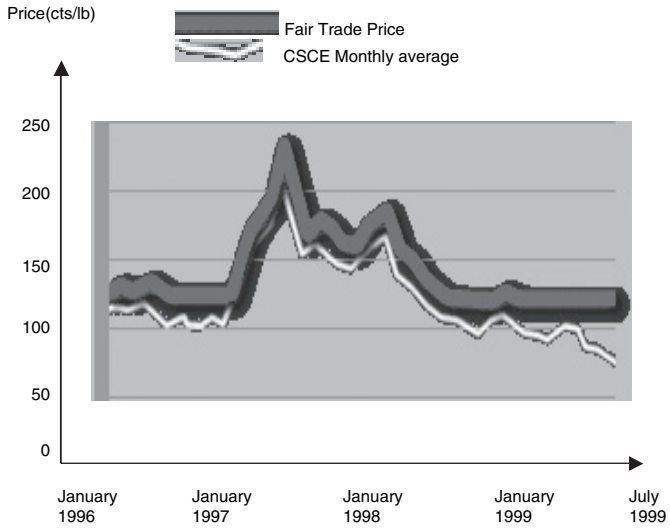
The supply of fair trade/organic coffee is a particular case, as, unlike the case of regular coffee, no international market exists for such commodities. The coffee is grown in small communities and sold directly to fair trade companies (usually one or very few). The initiative bypasses local intermediaries and «takes the sting out of the farmers dependence on the price determination process of the world market» (EFTA, *op cit*.).

In the case of Café Direct, the coffee is brought directly from cooperatives in nine different countries: Nicaragua, Haiti, Mexico, Costa Rica, Cameroon, Uganda,

[1] www.cafedirect.co.uk

FIGURE 1

New York futures Vs fair trade coffee price



Tanzania, Peru, and the Dominican Republic. These cooperatives are presented in Table 1.

Data on the price structure of the coffee chain can be obtained from Rabobank International (1998). This data allows us to compare the price distribution in each part of the production chain of both regular and labelled coffee. This information, combined with the results of the hedonic study presented in Chapter 2, allows us to calculate the price structure in the coffee chain of fair trade and regular coffee in the British market. We present the latter in Table 2[2].

The data suggests that fair trade farmers get one percent more of the final price of the good than regular coffee farmers, that is they receive 27% of the final price versus the 26% that the regular coffee producers receive. This means that, out of the 25.81 euros per kilo at which the regular coffee is sold, around 6.71 euros per kg is paid to the farmers, while fair trade/organic farmers get 7.75 euro/kg of the 28.71 euro/kg at which the coffee is sold in the British market. The income of the fair trade/organic farmers is, thus, around 16% higher than that of non-fair trade/organic farmers.

There are many other features that it is important to note from this table. First, the margin given to retailers for fair trade coffee is almost twice that for regular coffee. With higher prices this means that 3.36 euro/kg is paid for regular coffee —which accounts for 13% of the price— while 5.74 euro/kg —20%— is paid for certificated coffee. So it is not only in absolute terms that the amount paid to retailers is higher, but in relative terms as well. Fair trade organisations argued that this is the mecha-

[2] For the calculation of table 4.2 it has been assumed that the distribution of percentages of the price on the coffee chain, once the VAT has been discounted, has not been altered.

TABLE 1

Café Direct supply of coffee

Country	Co-operative	Year Founded	Members (approx.)	Production
Mexico	Union de Ejidos San Fernando	1984	1,450	Washed Arabica coffee, all now certified organic
Costa Rica	Consorcio de Cooperativas de Caficultores de Guanacaste y Montes de Oro R.L. (COOCAFE)	1988	3,500	Green and roasted Arabica coffee
Nicaragua	Promotora de Desarrollo Cooperativo de Las Segovias S.A. (PRODECOOP)	1993	2,420	Strictly High Grown washed Arabica coffee –a third of which is certified organic
Haiti	Réseau des Coopèratives de Cafè du Region Nord (RECOCARNO)	1997	2,500	Coffee is the main crop, mangoes and other cash crops
Peru	Co-operativa Bagua Grande	late 1970s	138	
	Co-operativa San Juan del Oro	1961	900	
	Central de Cooperativas Agrarias Cafetaleros (COCLA)	1967	4,500	Arabica coffee including both certified organic and gourmet coffees
Dominican Republic	Federacion de Caficultores de la Region Sur (FEDECARES)	1985	5,000	Washed Arabica coffee
Tanzania	Karagwe District Co-operative Union Limited (KDCU)	1990	150,000	Arabica and Robusta
	Kilimanjaro Native Co-operative Union Ltd (KNCU)	1925	135,000	High quality Kilimanjaro Arabica coffee
	Kagera Co-operative Union Ltd (KCU)	1950	50,000	Robusta and unwashed Arabica
Uganda	Gumutindo project	1998	150	
	Bugisu Co-operative Union (BCU) Ltd	1954	20,000 families	
Cameroon	Mamfe Central Farmers Co-operative (MACEFCOOP)		More than 1,500	

Elaborated from data from www.cafedirect.co.uk.

TABLE 2

Average price structure in the coffee chain in the UK

	Market EURO per kg	%	Max-Havelaar EURO per kg	%
Consumer Price	25.81	100	28.71	100
VAT (6%)	0	0	0	0
Margin Retailer	3.36	13	5.74	20
M-H licence rights	0	0	0.86	3
Cost for roasting, storage, transport, finance+margin roaster & importer	13.40	52	12.30	43
FOB-Price	9.03	35	9.76	34
Export tax and fees	0.52	2	0.57	2
Trade cost, including finance, transport, bags and margin	1.81	7	1.44	5
Farmers price	6.71	26	7.75	27

Source: Rabobank report and own elaboration.

nism which gives incentives to retailers to introduce fair trade coffee into the marketplace. Hence, one could expect that such margin differences will disappear once the market is consolidated.

Second, some good regarding the cost of roasting, storage, and so on can be highlighted, as the proportion of the price directed here is smaller for certified coffee, 43%, than for the regular coffee, 52%. Moreover, the absolute cost is still higher for regular coffee producers than for fair trade producers. It is also the case that a smaller amount (absolute and as percentage) is paid for trade cost, finance and transport parts of the process.

In addition to this data, one would need some supply elasticity estimates in order to properly assess labelling policies. As stated before, these estimates are not available for the case of fair trade/organic coffee. Carrying out the estimation of supply elasticities, however, is far beyond the scope of this paper, but we would like to report on some of the values found in the literature that are used later in calculations.

For the case of regular coffee, some interesting studies where supplies of coffee are analysed are Parikh (1979), and Guillaumont and Bonjean (1991). In the latter, an elasticity of supply of 0.5 is estimated for non-scarcity years. Other values for the supply elasticity of regular coffee that are estimated in the literature range from 0.05 to 0.65 (Mshomba, 1989, Maitha, 1969 and 1970, Akiyama & Duncan, 1984, Pollard & Graham, 1992 and Dercon and Ayalew, 1995).

Other estimates have been calculated for many agricultural products. For instance, Foster and Mwanaumo (1995) estimate that the short-run elasticity of supply for maize is 0.54, while the estimated long-run elasticity is 1.57.

For organic products some estimates for the long and short run elasticities are calculated in Lohr and Park (1995). The following organic goods are analysed: broccoli, carrots, celery, romaine lettuce, strawberries and watermelons. Their results suggest that the supply elasticities for organic products range between 0.14 and 0.93 in the short run, and between 0.15 and 2.13 in the long run. The authors state that, for the

case of organic products, it is reasonable to expect a more elastic supply function than for the supply of regular goods, as the organic farmers have the option of selling in regular markets as well as in organic markets.

In the case of fair trade/organic coffee, unlike that of organic vegetables, one would expect the supply to be more inelastic than for regular coffee supply since, as stated before, no international market exists for them. Bilateral deals are used to sell green coffee to labelling organisations, and it is very unlikely that the coffee grown to be sold to a fair trade organisation is sold in the international market of regular coffee.

We use the information presented in this section for the policy analysis developed in the following sections.

4. The Effects of the policy

General information

Estimating the environmental and social benefit that the production of fair trade goods generates is very complicated and beyond the scope of this paper. For policy design purposes, however, we need to establish a figure for the subsidy we want to insert. With this in mind, and taking into account the fact that Café Direct guarantees a 10% premium above the market rate for investment in local communities, we use this number to approximate the potential benefit of such production. We acknowledge that this figure is likely to underestimate the social benefits of fair trade coffee.

Some data on the price structure of the coffee chain has been presented in Table 2. This shows that fair trade producers are paid 7.75 euro per kg of coffee produced. Around 0.775 euro per kg is, thus, the (underestimated) social-environmental benefit that «FT» coffee generates. So as not to be too restrictive with the value used for the environmental-social benefit, we consider three different options: 0.5 euro/kg, 1 euro/kg and 2 euro/kg. Consequently, we propose, and analyse, the inserting of a subsidy on the production of fair trade coffee of the amounts above. Working these figures along the price structure they represent shifts in the UK supply of 1.86, 3.71 and 7.41 euro per kg. These shifts can be calculated by extracting the after subsidy prices from the pre-subsidy prices shown in Table 3. In such cases, farmers will receive with each policy respectively: 7.25 euro/kg from direct sales of coffee, plus 0.5 euro/kg subsidy; 6.75 euro/kg from direct sales, and, a 1 euro/kg subsidy; and, finally, 5.75 euro/kg from direct sales, and, a 2 euro/kg subsidy. While the prices at which coffee manufacturers buy fair trade coffee will be reduced to 7.25, 6.75 and 5.75 —which are prices slightly higher than, similar to and lower than the price of regular coffee, 6.71 euro/kg. Working the price change along the chain leaves final prices in the UK for fair trade coffee after subsidy of 26.85, 25 and 21.3 euros per kg; that is, almost 2, 4 and 8 euro per kilo cheaper than before the subsidy. (See Table 3).

Since coffee and tea are not produced in the UK, but the brands have to purchase it in the international market, one could argue that the supply of coffee and tea in the UK is very much the supply of tea and coffee in the rest of the world.

TABLE 3

Average price structure for the fair trade coffee chain in the UK with and without the subsidy

Max-Havelaar (euro per kg)			Max Havelaar with subsidy (euro per kg)		
		%	0.5	1	2
Consumer Price	28.71	100	26.85	25	21.30
VAT (0%)	0	0	0	0	0
Margin Retailer	5.74	20	5.37	5	4.26
M-H licence rights	0.86	3	0.81	0.75	0.64
Cost for roasting, storage, transport, finance + margin roaster & importer	12.30	43	11.55	10.75	9.16
FOB-Price	9.76	34	9.12	8.50	7.24
Export tax and fees	0.57	2	0.54	0.50	0.43
Trade cost, including finance, transport, bags and margin	1.44	5	1.34	1.25	1.06
Farmers price minus subsidy	7.75	27	7.25	6.75	5.75
Farmers price	7.75		7.75	7.75	7.75

Source: Rabobank International (1998) and own elaboration.

Then, again, it is assumed that the community that produces the fair trade coffee does it only for the British market, and, thus, the quantity of fair trade coffee supplied to the UK is the same as the output in our producing country. This allows us to translate a shift in the supply of the producing country to a shift in the supply in the UK. This assumption is not too restrictive, as fair trade organisations usually have unilateral deals with coffee producing communities to produce the «FT» good for them[3]. These communities only produce fair trade coffee, and only for that specific organisation, which means that there does not exist an international market for fair trade coffee parallel to that for regular coffee. According to Cafédirect, they buy their coffee from 16 communities in 9 different countries (see Table 1); Nicaragua, Haiti, Mexico, Costa Rica, Cameroon, Uganda, Tanzania, Peru and Dominican Republic. Additionally, the fact that fair trade coffee is grown to be sold to the fair trade organisations, and can usually not be sold in the international market, allows us to assume a more inelastic supply function for fair trade coffee than regular coffee.

The paragraph above allows us, thus, to function with a supply of fair trade coffee in the UK which is: (a) very much the same as the supply from all the communities together –as all the «FT» coffee produced in those communities is directed to the UK; and (b) more inelastic than regular coffee and tea supplies; and, therefore, to analyse the case of a subsidy (we use three different values for this subsidy) for the fair trade coffee production of the group of communities as a whole.

Finally, there are two additional concerns when suggesting such a policy: how do you distribute the subsidies in the (several) producing countries if the tax is collected in the UK?; and whether this policy is against WTO trade rules?

[3] There exist some deals between different fair trade brands to help each other commercialise the coffee, but in most of cases a direct contract with communities is used.

The answer to the first question is that the government could collect the tax on «OT» and «T» consumption in the UK (similar to the VAT). The British Government cannot, of course, transfer this money to fair trade/organic coffee producing communities in 16 different countries, but, instead, it could transfer this money to fair trade NGOs, which will ensure that producers are compensated.

The answer to the second question is far more complex[4]. The policy does not seem to go against the Most Favoured Nation (MFN) principle, nor against the National Treatment principle, as it does not discriminate against any countries. One possibility is that the policy we suggest is considered part of special subsidies for agriculture, or part of a special, or preferential treatment rule. In any case, the fact that the effect on «OT» coffee and on tea is almost negligible could mean that it is unlikely that the policy will be challenged[5].

A Subsidy for FT Coffee Producers

The effect in producing countries of a subsidy for the production of fair trade coffee is illustrated in Figure 2. For this purpose, we represent the demand for «FT» coffee as D_{FT} –keep in mind that this demand comes from UK–, the demand for regular coffee as D_{OT}, and the demand for tea as D_T. Similarly, the corresponding supplies are S_{FT}, S_{OT} and S_T respectively.

When a subsidy is introduced in the producing communities, the supply of «FT» in the UK shifts to the right, from S^0_{FT} to S^1_{FT} . The quantity sold, thus, increases from Q^0_{FT} to Q^1_{FT}. But this is not the end of the story. As «FT» coffee after the subsidy is cheaper than what it was before, some regular coffee and tea consumers might switch towards fair trade consumption. This is represented in the figure as an inward shift of demands from D^0_{OT} to D^1_{FT} and from D^0_T to D^1_T, with a reduction in regular coffee sold of $Q^0_{OT} - Q^1_{OT}$, and a reduction in tea sales of $Q^0_T - Q^1_T$.

There is, as well, another effect not represented in the diagram, the income effect. This takes into account the effect of the relative increase in income due to the reduction in the «FT» coffee price.

The subsidy creates a welfare loss in the «FT» market represented by the area *abc*, and also a welfare loss in the regular coffee and tea markets of *def* and *ghi* respectively due to the decrease in demand.

A Tax on OT Coffee and Tea

The case of a tax on regular coffee in the UK is illustrated in Figure 3 –the case of a tax on tea is basically the same. The policy shifts the supply of the taxed good to the left, from S^0_{OT} to S^1_{OT}. This reduces the quantity sold from Q^0_{OT} to Q^1_{OT} and generates a dead weight loss of area *abc*. Again, some consumers will switch consumption to-

[4] All the WTO legal texts can be accessed at the following address: http://www.wto.org.

[5] After several communications with WTO staff we have not been able to determine whether the policy is against WTO rules. The general impression has been, however, that this is not likely.

FIGURE 2

The effect of a subsidy on fair trade coffee production (in the producing countries)

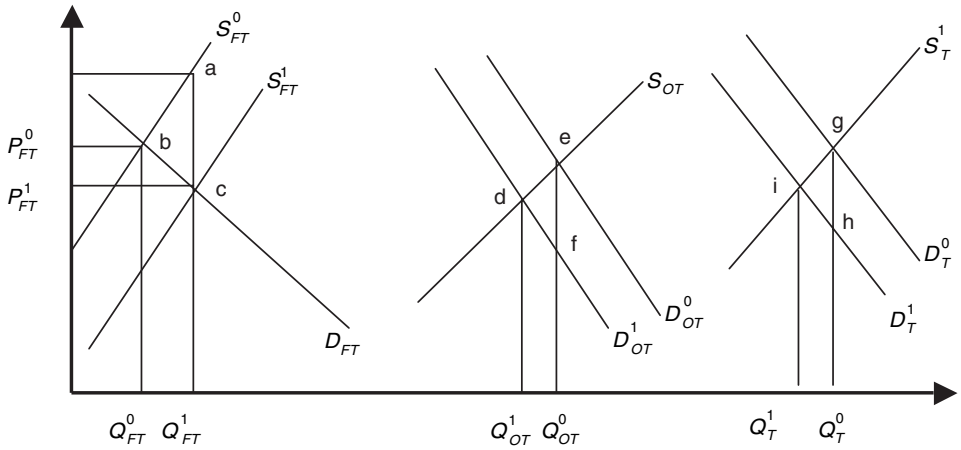
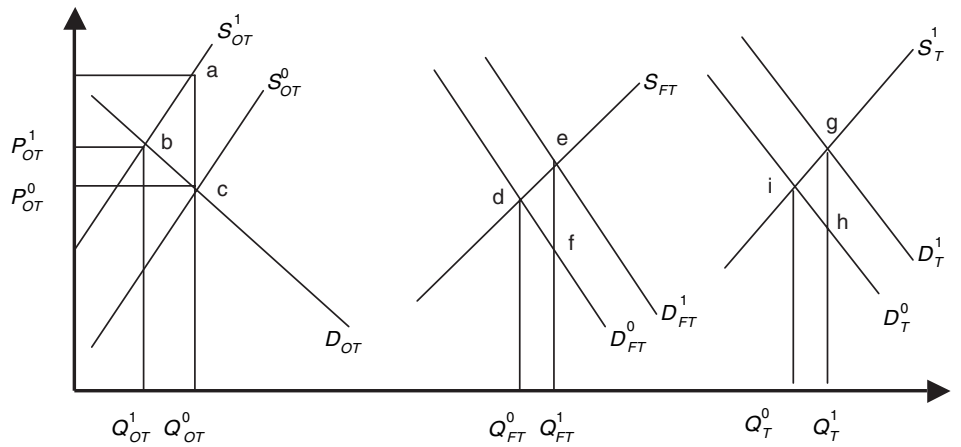


Figure 3

THE EFFECT OF A TAX ON REGULAR OT COFFEE



wards the relatively cheaper good; that is, towards tea and «FT» coffee. The latter is represented as a shift to the right in the tea and «FT» demands.

The effect of the tax is, therefore, a welfare loss in the regular coffee market and a welfare gain in the tea and «FT» markets.

Combining Taxes With the Subsidy

Once the need for a subsidy on «FT» coffee production to account for the environmental benefit has been justified, and we have also justified the idea that regular

coffee and tea drinkers should pay for it, it is reasonable to design the following scheme: a subsidy for fair trade producing communities and a tax on regular coffee and tea drinkers. The criteria used to do so is that «the closer the substitute the bigger the tax'. In other words, the tax on the regular coffee market should be greater than the one on the tea market. Of course, it could be argued that the criteria should be the greater the damage the greater the tax. We do not, however, have any information on the costs that «OT» coffee and tea generate.

5. Mathematical illustration

The following analysis aims to illustrate the overall effect when many close substitutes are included in the study. The work is based on the study by Morris and Kis (*op cit*.) of product charges in the Hungarian tyres. The method has been further developed in Galarraga (*op cit*.) to account for the income effects that the policies generate. A full application of the method can also be found in Galarraga and Markandya (2003). With this purpose, we define the following demand and supply equations. Demand functions –equation [1]– depend on the price of each good (P_i) and income (m), while the supply functions –equation [2]– depend on prices only.

$$x_{id} = h_i\,(P_1, P_2, ..., P_n, m)\ \forall\ i = 1, ..., n \qquad [1]$$

$$x_{is} = \nu_i\,(P_1, P_2, ..., P_n)\ \forall\ i = 1, ..., n \qquad [2]$$

Following the analysis by Morris and Kis (*op cit*.), these demand and supply function can be, now, approximated as constant elasticity functions. That is,

$$x_{id} = P_1^{e_{i1}}, P_2^{e_{i2}}, ..., P_n^{e_m}\, m^{e_i}\ \forall\ i = 1, ..., n \qquad [3]$$

$$x_{is} = P_1^{\varepsilon_{i1}}, P_2^{\varepsilon_{i2}}, ..., P_n^{\varepsilon_m}\ \forall\ i = 1, ..., n \qquad [4]$$

where e_{ii} is the own price demand elasticity for product i, e_{ij} is the cross price demand elasticity, ε_{ii} is the own price supply elasticity for good i, ε_{if} is the cross price supply elasticity, and e_i is the income elasticity of the i th good.

By differentiating equations [3] and [4], and using proportional notation we can obtain the following equations:

$$Ex_i = e_{ii}\, EP_i + \sum_{\substack{j=1 \\ j \neq i}}^{n} e_{ij}\, EP_j + e_i\, Em\ \forall\ i = 1, ..., n \qquad [5]$$

$$Ex_i = \varepsilon_{ii}\, EP_i + \sum_{\substack{j=1 \\ j \neq i}}^{n} \varepsilon_{ij}\, EP_j\ \ \forall\ i = 1, ..., n \qquad [6]$$

where the prefix E stands for the proportional change in the variable.

If we, now, represent the introduction of a tax (subsidy) as a proportional change in the supply of the product taxed ($E\tau_i$) (or subsidized, $E\zeta_i$), we have, by total differentiation of the supply function, the following function:

$$\frac{1}{\varepsilon_{ii}} Ex_i - EP_i - \sum_{\substack{j=1 \\ j \neq i}}^{n} \frac{\varepsilon_{ij}}{\varepsilon_{ii}} EP_j = E\tau_i \; \forall \; i = 1, ..., n \qquad [7]$$

where τ_i $(1 + t_i)$.

Note that the expressions derived can only be used when the relevant changes are small.

The expression for equation [7] comes from differentiating the following supply function and using the proportional notation[6],

$$x_i = [(1 + t_i) P_i]^{\varepsilon_{it}} \prod_{\substack{j=1 \\ j \neq i}}^{n} P_j^{\varepsilon_{ij}} \; \forall \; i = 1, ..., n$$

We can also approximate the change in income due to the tax (subsidy) as the quantity consumed of the good times the price change originating with the tax (subsidy)[7]. That is, $dm = -x_i \, dP_i$. Introducing the proportionate change we can easily obtain the following equation that includes the income effect in the analysis:

$$Em_i = -w_i \, EP_i \; \forall \; i = 1, ..., n \qquad [8]$$

where w_i stands for the expenditure share of good i.

Equations [5], [7] and [8] give a system of $3n$ equations that can be solved by inserting the values of the different elasticities and taxes (subsidies)[8].

The dead weight loss (DWL), including the welfare gains (losses) derived from the substitution effects, can be approximated in line with the analysis presented in Diamond & McFadden (1974) as,

$DWL = \sum_{i=1}^{n} DWL_i$, where DWL_i, is defined as follows[9]:

$$DWL_i = (X_i^1 - X_i^0) \, dP_i \, (0.5) - \sum_{\substack{j=1 \\ j \neq 1}}^{n} (X_j^1 - X_j^0) \, dP_j, \; \forall \; i = 1, ..., n \qquad [9]$$

where X_i^0 is the quantity of segment before the tax (subsidy) is introduced and X_i^1 is the quantity of segment i after the entire tax (subsidy) for that product has been introdu-

[6] For two goods, introducing a tax on good 1, the derivation gives the following equation, $\frac{dx_1}{x_1} = \varepsilon_{11} \frac{d\tau_1}{\tau_1} + \varepsilon_{11} \frac{dP_1}{P_1} + \varepsilon_{12} \frac{dP_2}{P_2}$, where $\tau_1 = (1 + t_1)$. Using the proportional notation this can be rewritten as $Ex_i = \varepsilon_{11} E\tau_1 + \varepsilon_{11} EP_1 + \varepsilon_{12} EP_2$. Finally, re-arranging terms we have, $\frac{1}{\varepsilon_{11}} Ex_1 - EP_1 - \frac{\varepsilon_{12}}{\varepsilon_{11}} EP_2 = E\tau_1$.

[7] For the case of the subsidy $s_i = -t_i$.

[8] $2n$ equations are derived from the demand and supply functions, while n equations can be derived to explain the income effects when implementing n tax (subsidies).

[9] It can be shown that this definition of the DWL is equivalent to the Stern (1987) equation presented in section 5.2. The equations are the same for the cases in which the income effect is not significant, and, thus, the uncompensated and compensated responses are equal. We apply this approximation of the dead weight loss for simplicity. See Albi *et al*. (2000) for further discussion on the issue.

ced. Note that the price differential in this equation refers to the price change derived directly from the tax, not to the change in the equilibrium price. This is the vertical distance $dP_i = (1 + t_i)\, P_i - P_i = t_i\, P_i$.

Procedure

The new equilibrium state and the DWL are calculated through nested interactions of an inner and an outer loop. The outer loop (first) iterating through the market segments, and the inner loop (second) through the shifts in supply, one at a time. The shifts have been decomposed into ten equal intervals. Thus, after every iteration of the inner loop, new equilibrium prices and quantities are calculated[10]. By decomposing the supply shifts, the error arising from making a linear extrapolation across a non-linear interval is reduced. Examining taxes (subsidies) one market at a time, on the other hand, allows us to isolate any exogenous change in price in the estimation of the DWL for each market segment. (Morris and Kis, *op cit*.). This is done solving the matrix system presented in appendix C for each different expenditure share (w_i), and introducing the supply shifts one at a time, taking into account the ten different intervals, as explained above.

Note that, in our study income effects are also included. This means that, with every new equilibrium price and quantity, new expenditure shares are calculated. We, then, insert these new values in equation [8] and obtain a new matrix, A.

6. Calculations and Values Used

There are three sets of values needed to carry out the calculations in this paper. These are:

1. Demand Elasticities

We use the estimates calculated with the QBDS model in Galarraga and Markandya (2004) for the own price elasticity for fair trade coffee, and the cross price elasticities between fair trade and other coffees in the U.K. The values presented in Galarraga and Markandya (2004) show a range of own price elasticities for regular coffee from –1 to –5. For simplicity, we only use the value for own price elasticity of regular coffee of –1. These values are presented in Table 4.

2. Supply Elasticities

Estimating the elasticities of supply is outside the scope of this paper. Instead, we use some «well-guessed» supply elasticity values in line with the information presen-

[10] This is done according to the formula $XP^1_e = (EV^0_e \times XP^0_e) + XP^0_e$, where XP^1_e stands for the vector of post-iteration prices and quantities, XP^0_e for the vector of pre-iteration prices and quantities, and EV^0_e for the vector of estimated proportional changes in prices and quantities. The post-iteration vector will become the new pre-iteration vector for the following iteration.

TABLE 4

QBDS elasticity estimates

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 –1 Income 0.5	0.02	–1.57	0.59	0.48	–1.10	0.0

ted in previous sections. These values are: an own price elasticity of supply for regular coffee of 0.5; an own price elasticity of supply for tea of 0.35; and an own price elasticity of supply for fair trade coffee of 0.25. The latter is within the range of the estimates presented in Lohr and Park (*op cit*.) for organic crops. In this case, we are assuming that fair trade/organic coffee supply is more inelastic than regular coffee and tea supply, since –unlike some organic vegetables that can be sold in regular and organic markets– the coffee grown to be sold to a fair trade organisation it is unlikely to be sold in the international market.

3. Initial Equilibrium Prices and Quantities

Using data from the Ministry of Agriculture, Fisheries and Food (MAFF) on coffee expenditure per capita in the UK, data from Max Haveelar on fair trade sales volumes in the UK, data on population, and data on exchange rates, we are able to estimate market quantities before the policy is applied. This information is shown in Table 5.

TABLE 5

The original quantities and prices of the three market segments

Product	Original Quantities (kg)	Original Prices (Euro)
Regular Coffee	37,038,403	25.81
Fair Trade Coffee	959,000	28.71
Tea	59,274,602	13.28

Applying the formulae presented in section 5 to the case of coffee allows us to derive the following set of equations:

$$Ex_{OT} = e_{OT/OT} EP_{OT} + e_{OT/FT} EP_{FT} + e_{OT/T} EP_T + e_{OT} Em \quad [10]$$

$$Ex_{FT} = e_{FT/FT} EP_{FT} + e_{FT/OT} EP_{OT} + e_{FT/T} EP_T + e_{FT} Em \quad [11]$$

$$Ex_T = e_{T/T} EP_T + e_{T/OT} EP_{OT} + e_{T/ft} EP_{FT} + e_T Em \quad [12]$$

$$\frac{1}{\varepsilon_{OT/OT}} Ex_{OT} - EP_{OT} - \frac{\varepsilon_{OT/FT}}{\varepsilon_{OT/OT}} EP_{FT} - \frac{\varepsilon_{OT/T}}{\varepsilon_{OT/OT}} EP_T = E\tau_{OT} \quad [13]$$

$$\frac{1}{\varepsilon_{FT/FT}} Ex_{FT} - EP_{FT} - \frac{\varepsilon_{FT/OT}}{\varepsilon_{FT/FT}} EP_{OT} - \frac{\varepsilon_{FT/T}}{\varepsilon_{FT/FT}} EP_{T} = E\varsigma_{FT} \quad [14]$$

$$\frac{1}{\varepsilon_{T/T}} Ex_{T} - EP_{T} - \frac{\varepsilon_{T/OT}}{\varepsilon_{T/T}} EP_{OT} - \frac{\varepsilon_{T/FT}}{\varepsilon_{T/T}} EP_{FT} = E\tau_{T} \quad [15]$$

where equations 10-12 represent «OT» coffee, «FT» coffee and tea demand functions respectively, and equations 13-15 the corresponding supply functions[11].

$$Em_1 = -w_{OT} EP_{OT} \quad [16]$$

$$Em_2 = -w_{FT} EP_{FT} \quad [17]$$

$$Em_3 = -w_T EP_T \quad [18]$$

The income effects that each policy creates are given by equations 16-18. That is, Em_1, Em_2 and Em_3 represent the income effect that the tax on regular coffee, the subsidy on fair trade coffee, and the tax on tea respectively create. These are used to solve the matrix system presented in the appendix for each different expenditure share (w_i), as explained in the previous section –three different A matrices are used in this case–, introducing the supply shifts one at a time, and taking into account the ten different intervals.

We have imposed subsidies of 0.5, 1 and 2 euro per kilogram of fair trade coffee produced, and included an administrative cost of 0.1 euro per kilogram for each subsidy. The idea is to design the tax rates to be able to finance the whole subsidy scheme. Of course, the taxes are set *a posteriori*; that is, once the effect of the subsidy on the fair trade, regular coffee and tea markets has been calculated; the tax rates being the product of many calculations. The tax rates have been set, therefore, to be able to cover the cost of each subsidy.

Results

Our calculations show that, for the three subsidy values analysed, the results are as follows:

a) 0.5 euro/kg subsidy

Introducing a 0.008 euro/kg tax on regular coffee consumption and a 0.005 euro/kg tax on tea, allows us to finance a subsidy of 0.5 euro/kg on fair trade production (plus 0.1 administrative cost). The results obtained with this policy are displayed in Table 6 and Table 7.

[11] Note that $\zeta_i = (1 + s_i)$.

TABLE 6

Results of the 0.5 euro/kg subsidy for «FT» coffee production

Market Segment	After Policy Quantities (kg)	After Policy Prices (euro)	Change in Quantities (%)	Change in Prices (%)
Regular Coffee	37,033,133.4	25.81	-0.01	0.002
Fair Trade Coffee	972,486.4	28.46	1.41	–0.89
Tea	59,267,113.2	13.28	-0.01	0.002

As a result of the policy, the quantity of regular coffee and tea consumed decrease by 0.01%, as prices increase by 0.002%, while fair trade coffee consumption increases by 1.4% as a consequence of the drop in price of 0.9%.

Once welfare gains and losses are considered —taking direct and cross effects into account—, the policy proposed generates a welfare loss of 12,531.8 euros. This loss is composed of a number of elements. Firstly, a gain of 14.6 euros generated by the tax on regular coffee, which is itself composed of a direct DWL loss in the consumption of regular coffee more than compensated by the beneficial cross effects on the tea and fair trade coffee markets. Secondly, a loss of 12,555.2 euros with the fair trade subsidy, which is due to a direct welfare loss in the fair trade market and losses on regular and tea market segments. And thirdly, a gain of 8.8 euros with the tea tax, which, again, seem to suggest that the DWL in tea market is offset by the welfare gain in the other two market segments. (See Table 7).

TABLE 7

Partial and total effects of the entire policy

Policy	Euro/kg	After Policy Quantities (kg)	Balance	Euro	Welfare Loss (Euros)
Tax on Regular Coffee Consumption	0.008	37,033,133.4	Collected with «ot» coffee tax	296,265.1	-14.6 (gain)
Subsidy on Fair Trade Coffee Production (for growers)	0.6 (0.5 + 0.1)	972,486.4	Cost of subsidy	583,491.9	12,555.2
Tax on Tea Consumption	0.005	59,267,113.2	Collected with tea tax	296,335.6	-8.8 (gain)
TOTAL				**9,108.8**	**12,531.8**

The calculations also show that, once the subsidy is fully paid, the policy generates a surplus of 9,108.8 euros that could be used for other complementary policies[12].

Therefore, assuming that the environmental/social costs of «OT» coffee and tea are similar, and around 0.45 euro/kg, the environmental/social benefit –generated by

[12] By increasing the tax on tea to 0.0055, one can obtain the result that the surplus is greater than the welfare loss generated by the policy. This could be used for other complementary policies.

the increase in «FT» coffee production and the decrease in «OT» coffee and tea production— compensates the DWL that the policy generates. This figure has been estimated as follows:

We know, on the one hand, that the welfare loss is 12,531.8 euros. Additionally, the increase in fair trade coffee generates a social and environmental benefit of 6,743.2 euros (the increase in «FT» quantity times the subsidy). Hence, the total loss that the policy generates is 5,788.6 euros, that is (12,531.8-6,743.2). The cost that «OT» and tea are required to generate so that the benefits exceed the total loss is, thus, 0.45 euro/kg. The latter comes from dividing the total loss by the sum of the increases in «OT» and tea production.

b) 1 euro/kg subsidy

In this case, a tax on «OT» coffee of 0.0145 and a tax on tea of 0.01 are enough to finance the 1 euro/kg subsidy on the production of fair trade coffee.

The results of the policy are an increase of 2.8% in fair trade coffee consumption motivated by a decrease of 1.8% in the fair trade coffee price, while the prices of «OT» and tea increase by 0.003% and 0.002% respectively, dropping the quantities consumed by 0.03%. (See Table 8 and 9).

TABLE 8

Results of the 1 euro/kg subsidy for FT coffee production

Market Segment	After Policy Quantities (kg)	After Policy Prices (Euro)	Change in Quantities (%)	Change in Prices (%)
Regular Coffee	37,028,538.2	25.81	–0.03	0.003
Fair Trade Coffee	986,067.2	28.20	2.82	–1.76
Tea	59,259,448.5	13.28	–0.03	0.002

The welfare loss that this policy generates amounts to 50,164.6 euros, while the surplus of taxes (once the subsidy and the administrative cost are fully paid) is around 44,834 euros[13].

The cost that «OT» and tea is required to generate —again assuming that they generate the same cost— so that benefits exceed the total loss is, now, 0.92 euro/kg.

Note that we are assuming that the amount of the subsidy is equal to the benefit that the FT coffee production generates.

c) 2 euro/kg subsidy

The outcome of this policy is sumarised in Tables 10 and 11. The 2 euro/kg subsidy can be easily financed by 0.03 euro/kg and 0.02 euro/kg taxes on the «OT» and

[13] An increase in «OT» coffee tax by 0.005 is enough to collect a surplus that exceeds the DWL with very similar results.

TABLE 9

Partial and total effects of the entire policy

Policy	Euro/kg	After Policy Quantities (kg)	Balance	Euro	Welfare Loss (Euros)
Tax on Regular Coffee Consumption	0.0145	37,028,538.2	Collected with «OT» coffee tax	536,913.8	–58.6 (gain)
Subsidy on Fair Trade Coffee Production (for growers)	1.1	986,067.2	Cost of subsidy	1,084,673.9	50257.1
Tax on Tea Consumption	0.01	59,259,448.5	Collected with tea tax	592,594.5	–33.9 (gain)
TOTAL				**44,834.4**	**50,164.6**

tea markets in the UK. The combination generates an increase in «FT» coffee consumption of 5.7% due to a decrease in price of 3.5%. Additionally, regular coffee consumption decreases by 0.05% due to an increase in its price of 0.007%, while an increase of 0.005% in the price of tea reduces its consumption by 0.05%.

TABLE 10

Results of the 2 Euro/kg subsidy for «FT» coffee production

Market Segment	After Policy Quantities (kg)	After Policy Prices (euro)	Change in Quantities (%)	Change in Prices (%)
Regular Coffee	37,018,248.9	25.81	-0.05	0.007
Fair Trade Coffee	1,013,746.3	27.70	5.71	–3.49
Tea	59,244,441.7	13.28	-0.05	0.005

The DWL that the policy generates is around 202,627.9 euros, while the surplus collected is around 166,569 euros[14]. Finally, the cost OT and tea are required to generate so that benefits exceed the total loss is 1.85 euro/kg.

TABLE 11

Partial and total effects of the entire policy

Policy	Euro/kg	After Policy Quantities (kg)	Balance	Euro	Welfare Loss (Euros)
Tax on Regular Coffee Consumption	0.030	37,018,248.9	Collected with «OT» coffee tax	1,110,547.5	–245.4 (gain)
Subsidy on Fair Trade Coffee Production (for growers)	2.1 (2 + 0.1)	1,013,746.3	Cost of subsidy	2,128,867.2	203,019.1
Tax on Tea Consumption	0.02	59,244,441.7	Collected with tea tax	1,184,888.8	-145.8 (gain)
TOTAL				**166,569.1**	**202,627.9**

[14] In this case an «OT» coffee tax of 0.031 euro/kg guarantees a surplus tax collection greater than the DWL.

Finally, it is important to note that the estimated costs that «OT» and tea are required to generate so that the benefits of the three policies (0.5, 1 and 2 euro/kg subsidies) exceed the costs are very similar to the subsidies introduced in each case. The latter makes sense since, from the cost-benefit analysis point of view, once the subsidy is fully financed, the policies are interesting as long as they generate a benefit greater than the cost. The benefit being, in this case, the increase in «FT» coffee production, and the decrease in «OT» and tea production, while the cost arises from the DWL that the policy generates. Note also that the welfare changes that these three policies generate are really small in absolute terms given that they apply to the whole coffee market in the UK.

6. Conclusion

The policy proposed here allows to subsidise fair trade coffee growers in producing countries re-distributing benefits between the UK and any fair trade coffee producing community. The idea is simple, that who causes the externality should pay for it while the one who does not cause it, and moreover, generates a positive effect, it should be compensated. Fair trade coffee is subsidised due to the positive externality it generates in terms of the protection of the environment and improvement of social conditions, while regular coffee and tea consumption are taxed due to the negative externalities they create. The model estimates the welfare loss from the policy suggested, taking account, of course, of revenues collected by the state through the taxes and the money spent on the subsidy.

Our results suggest that such policy is not only financially viable, but also recommendable, due to the small negative effect of the tax compared with the beneficial effect of the subsidy. Some supply elasticity values have been assumed in this study, and, therefore, the results should be carefully interpreted. But the data indicates that:

1. 0.008 euro/kg tax on regular coffee, and a 0.005 euro/kg tax on tea will be enough to finance a subsidy scheme for fair trade/organic coffee production in producing countries to the amount of 0.5 euro/kg.
2. 0.0145 euro/kg and 0.01 euro/kg taxes will finance a 1 euro/kg subsidy.
3. 0.03 euro/kg and 0.02 euro/kg taxes will finance a 2 euro/kg subsidy scheme for fair trade coffee production.

We have only calculated the dead weight loss for one out of the five values of own and cross elasticities for coffee presented in Galarraga and Markandya 2004. The important thing to note is, however, that the model proves to be a very useful and practical tool for policy analysis as well as for tax optimisation.

The figures for the tax and subsidies in this paper are mere examples to show how with the methodology presented in this paper it may be possible to design a Tax-Subsidy scheme to internalise the external cost of coffee. This cost is very big, and it includes a great social and environmental cost in coffee producing countries that we can not turn our eyes away from it. This externality has a face and here there is a policy that might help reducing it while promoting a trade that it is fair.

Finally, there are two additional concerns when suggesting such a policy: how do you distribute the subsidies in the (several) producing countries if the tax is collected in the UK?; and whether this policy is against WTO trade rules?

The answer to the first question is that the government could collect the tax on «OT» and «T» consumption in the UK (similar to the VAT). The British Government cannot, of course, transfer this money to fair trade/organic coffee producing communities in 16 different countries, but, instead, it could transfer this money to fair trade NGOs, which will ensure that producers are compensated.

The answer to the second question is far more complex[15]. The policy does not seem to go against the Most Favoured Nation (MFN) principle, nor against the National Treatment principle, as it does not discriminate against any countries. One possibility is that the policy we suggest is considered part of special subsidies for agriculture, or part of a special, or preferential treatment rule. In any case, the fact that the effect on «OT» coffee and on tea is almost negligible could mean that it is unlikely that the policy will be challenged[16].

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[15] All the WTO legal texts can be accessed at the following address: http://www.wto.org.

[16] After several communications with WTO staff we have not been able to determine whether the policy is against WTO rules. The general impression has been, however, that this is not likely.

Appendix A

The system in matrix form is, thus, $A \cdot B = C$. We use 3 matrixes A each one with the expenditure share in its corresponding column.

$$A = \begin{bmatrix} 1 & 0 & -\eta_i & -\mu_{ii} & -\mu_{ij} \\ 0 & 1 & -\eta_j & -\mu_{ji} & -\mu_{jj} \\ 1/-\varepsilon_{ii} & 0 & 0 & 1 & \varepsilon_{ij}/\varepsilon_{ii} \\ 0 & 1/-\varepsilon_{jj} & 0 & \varepsilon_{ji}/\varepsilon_{jj} & 1 \\ 0 & 0 & 1 & w_i & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} EX_i \\ EX_j \\ Em \\ EP_i \\ EP_j \end{bmatrix}$$

$$C = \begin{bmatrix} 0 \\ 0 \\ dP_i/P_i \\ dP_j/P_j \\ 0 \end{bmatrix}$$