Fair Trade and the World Markets for Coffee

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Abstract

We construct a theoretical model to study the impacts of Fair Trade coffee production and consumption on the global market for conventional coffee. We are especially interested in the impacts on the price elasticity of both demand for and supply of coffee. Also we study the impacts of changes in Fair Trade producer minimum price on the price of conventional coffee. We study these issues by calibrating the theoretical model using demand side parameters estimated from very rich retail shop level data from Finland and supply parameters estimated in relevant literature. We find that Fair Trade reduce both demand and supply price elasticities implying that it increases the volatility of conventional coffee price. Also increases in Fair Trade minimum price reduce the conventional coffee price.

VERY PRELIMINARY, NOT TO BE QUOTED!

1 Introduction

To fully evaluate the impacts of systems like Fair Trade on the welfare of the poorest people we have to understand not only their direct impacts on the direct beneficiaries of the system but also the indirect impacts on them and on other poor persons. This means that in case of Fair Trade for coffee it is of paramount importance to understand the impacts of the system on the workings of the global conventional coffee market. Fair Trade influences this market through several channels.

First, in the supply side, Fair Trade coffee producers are also active in the conventional coffee market because by way the Fair Trade system is organized. Fair Trade producers cannot sell all of their coffee as Fair Trade and supply the surplus (which on average larger than the sales as Fair Trade coffee) to conventional coffee market. Thus, to the extent Fair Trade is able to sustain producers who otherwise would not be producing, it directly increases supply

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of conventional coffee. This has a direct impact on the price of conventional coffee, tending to reduce, thereby deteriorating the welfare of conventional coffee producers.

Secondly, the Fair Trade system may affect supply by changing the way producers behave, and most importantly their incentives to change production when coffee prices change. At the individual producer level we argue that the Fair Trade producers supply to conventional coffee market is less responsive to conventional coffee price changes than the supply of other producers. But this does not necessarily hold for the aggregate supply as Fair Trade producers also react to changes in demand for Fair Trade coffee and the aggregate supply elasticity depends, surprisingly, through this channel on the elasticities of demand for Fair Trade coffee with respect to various prices. One of the important contributions we make here is to analyze how important this channel is quantitatively. The price elasticity of supply is important as it is one key variable in understanding the reasons for coffee price volatility. The lower the supply price elasticity is the more volatile the price is, ceteris paribus. If Fair Trade system increases the price volatility, the welfare of all coffee producers may fall as a consequence of Fair Trade system. Paradoxically, one of the perceived advantages of the Fair Trade system is to stabilize producers' incomes by the minimum price system.

Fair Trade affects also the demand side of the market. The key impact is not through switching demand from conventional coffee to Fair Trade, as simultaneously suppliers also shift from conventional coffee production to Fair Trade production. The key impact is on consumers’ reactions to price changes, the elasticity of coffee demand with respect to conventional coffee and Fair Trade prices. Theoretical considerations do not pin down the expectations of how the elasticities change. We do not have the possibility, in contrast to what is the case for supply, to exactly identify how Fair Trade affects the demand elasticities. Also, our empirical estimations give different answers. But since the share of Fair Trade coffee in total consumption of coffee is known we have ways of arguing that we can identify the effect.

Finally, since one of the key parameters Fair Trade sets is the minimum producer price and the social bonus the Fair Trade producers receive it is of some interest to study how changes (increase) in the minimum price affect the price of conventional coffee. Again, theoretically the effect can go any way, but our approach allows us to clarify also this issue.

There exist only few evaluations of the Fair Trade coffee system. The most thorough study is by Ruben and Fort (2012). They find that the Fair Trade coffee producers do not have higher incomes than conventional coffee producers (actually they find that FT producers incomes are smaller but the difference is not statistically significant). They also do not find any impact on coffee production (or they get mixed results). Barham et. al. (2010) in contrast find that Fair Trade increases production. Our theoretical model, when calibrated, can provide partial explanation to these findings. TO BE COMPLETED.

The model consists of supply side where we model the supply by Fair Trade producers utilizing a very simple model of cooperative production. The demand
side is based on a model where Fair Trade consumption is assumed to emanate from the warm glow motive (gift giving from Fair Trade gives personal utility above the utility from pure consumption of coffee). The model is calibrated using estimates for demand elasticities based on a very detailed Finnish data on the sales and prices of all brands of coffee sold in Finland. The data is obtained from a large Finnish retail chain and contains data from every shop for every day for one week in each month for 4 years 2007-2010. The supply elasticities are based on estimates available in literature.

2 Supply of Fair Trade coffee

The basic mode of organization of Fair Trade coffee is production by cooperatives acting as sales agents for the individual producers. In the following we first construct a model of supply of coffee by cooperatives. This is followed by a formulation of a global model of supply of conventional coffee to be followed by a model of global equilibrium in the global conventional coffee market.

To model the supply of coffee by Fair Trade coffee producers we have to tackle two issues. The first is how the revenue earned by the cooperative is divided between its members. The second is how to take into account the fact that at Fair Trade coffee prices the producers would like to supply more coffee than is demanded: by definition the price of Fair Trade coffee is above the price equilibrating the market for conventional coffee (though not always given that Fair Trade prices are not adjusted continuously)\(^1\). Since the qualities of the both types of coffee as coffees are close to each other (though the quality of Fair Trade coffee has been increasing) and the Fair Trade suppliers have the possibility to sell their coffees also as conventional coffee, their supplies of coffee as Fair Trade coffee must be rationed. E.g. in Nicaragua the Fair Trade cooperatives can typically sell 30 per cent of their production as Fair Trade coffee (Nygren and Valkila 2009).

We assume that the cooperative revenue from Fair Trade coffee sales is divided between members in proportion to their overall production. The revenue from sales of conventional coffee is then allocated on the basis of sales by individual producers. The rationing is taken into account by assuming that the cooperative faces an upper bound for its sales of Fair Trade coffee. This is in tradition of the models of rationing popular in macroeconomics in 1970’s and 1980’s (e.g. Malinvaud 1976). Thus, let \(Q\) = maximum sales of Fair Trade coffee by the cooperative. Let \(Q = total\) production of coffee by the cooperative and \(Q_i = production\) of coffee by the member \(i\) of the cooperative. The net income

\(^1\)Also, the real price of Fair Trade coffee can change inducing either entry to or exit from Fair Trade coffee production altogether.
earned by $i$ is now

$$
p^{FT} \frac{Q_i}{Q} + p^O \left( Q_i - \frac{Q_i}{Q} \right) - c_i(Q_i) =

(p^{FT} - p^O) \frac{Q_i}{Q} + p^O Q_i - c_i(Q_i)

$$

Here $p^{FT} =$ price of Fair Trade coffee (per relevant unit, ton or kilo), $p^O =$ price of conventional coffee, and $c_i(Q_i) =$ costs of producing $Q_i$. We assume costs to be increasing at increasing rate with increases in production, $c'_i, c''_i > 0$.

To get ahead, we have to make assumptions on how decisions on production within the cooperative are made. A theoretical possibility is that they are made to maximize the aggregate net income of the cooperative, with distribution of the income then determined by some process of negotiation or some other mechanism. This would imply that each individual producer would produce up to the point where the price of conventional coffee is equated to the marginal cost

$$
p^O = c'_i(Q_i)

$$

In this case the production decisions of the FT producers would not differ at all from the decisions by the conventional coffee except for possible differences in marginal costs of production e.g. due productivity differentials or possible higher wages paid to farm workers (Nygren and Valkila 2009 have shown that in Nicaragua there are no wage cost differentials). But as the revenue at least in Nicaraguan Fair Trade is divided on the basis of production shares and the cooperative does not coordinate production (Valkila 2009) it seems natural (in other cases the individual members would have an incentive to exceed the production quota assigned to them) to assume that individual producers maximize their net income given in (1). We take this as our starting hypothesis. But we have to make additional assumptions. First, we assume that neither the cooperative or its individual members can affect

$$
\frac{Q}{Q}

$$

Secondly, we assume, for simplicity only, that individual producers take the aggregate cooperative production as being independent of their own decision. This assumption may be especially relevant for cooperatives with large number of members. The assumption amounts of looking at the production Nash-equilibrium within the cooperative.

With all this, the optimal decision for an individual member is characterized by the first order condition

$$
(p^{FT} - p^O) \frac{Q}{Q} + p^O = c'_i(Q_i)

$$

(2) holds as long as the Fair Trade premium is positive,

$$
p^{FT} - p^O > 0

$$

2In this case Fair Trade would result to a lump sum subsidy to Fair Trade producers.

3At the level of an individual cooperative naturally it is possible to try to get the FT coffee buyers to become interested in their production but at the aggregate there is rationing.
Otherwise the producer would not produce at all or would produce just for the other benefits being a Fair Trade producer brings, net of costs for getting and preserving the Fair Trade producer certificate.

Let us now study the behavior of a producer for whom (2) holds. The equation implies that

\[ Q_i = c_i^{-1} \left( (p^{FT} - p^O) \frac{Q}{Q} + p^O \right) \]  

(3)

Then the aggregate production by the cooperative is implicitly determined by the equation

\[ Q = \sum_i Q_i = \sum_i c_i^{-1} \left( (p^{FT} - p^O) \frac{Q}{Q} + p^O \right) \]  

(4)

This gives the aggregate production as a function of the Fair Trade premium, the price of conventional coffee, and the quota for Fair Trade sales (plus variables affecting the marginal cost of production, to be analyzed below). (4) leads to

\[ \frac{dQ}{Q} = \alpha \left[ \eta \left( \frac{dQ}{Q} - \frac{dQ}{Q} \right) + \frac{d\pi^{FT}}{\pi^{FT}} + (1 - \eta) \frac{dp^O}{p^O} \right] \]

giving

\[ \frac{dQ}{Q} = \frac{\alpha \eta}{1 + \alpha \eta} \left( \frac{dQ}{Q} + \frac{d\pi^{FT}}{\pi^{FT}} \right) + \frac{\alpha (1 - \eta)}{1 + \alpha \eta} \frac{dp^O}{p^O} \]  

(5)

where

\[ \alpha \equiv \left( \sum_i c_i^{-1} \right) \left( (p^{FT} - p^O) \frac{Q}{Q} + p^O \right) \]

\[ \eta \equiv \frac{(p^{FT} - p^O) \frac{Q}{Q}}{(p^{FT} - p^O) \frac{Q}{Q} + p^O} \]

\[ \pi^{FT} \equiv p^{FT} - p^O \]  

(5) tells that the presence of Fair Trade reduces the cooperative level elasticity of aggregate supply with respect to conventional coffee price on two counts. First, the direct effect is reduced as the conventional price is only one component of the marginal price received by the producer, this is the term \( \frac{\alpha (1 - \eta)}{1 + \alpha \eta} \). Secondly, since aggregate production responds positively to an increase in Fair Trade premium, \( p^{FT} - p^O \), an increase in the price of conventional coffee by reducing the premium reduces the aggregate supply. These results imply that the elasticity of Fair Trade cooperative supply of conventional coffee with respect to the conventional coffee price is lower than the elasticity of producers producing only conventional coffee as the supply by the Fair Trade cooperative is

\[ Q - \bar{Q} \]
and the cooperative takes $\overline{Q}$ as given. But it must be emphasized that this is just a partial equilibrium result, in the coffee market equilibrium also $\overline{Q}$ is determined.

In (5) the elasticity of coffee supply without Fair Trade is obtained when $\eta = 0$, i.e. the price elasticity of conventional coffee supply is $\alpha$ with $\overline{Q} = 0$. To see the factors that affect the supply elasticity let us assume that the coffee production function of an individual farm is

$$B_i A_i^\beta \left(L_i + L_i^f \right)^{1-\beta}, 0 < \beta < 1$$

where $B_i =$ productivity of the farm, $A_i =$ acreage of the farm, $L_i =$ labor hired to work in the farm, $L_i^f =$ family labor used in the farm. Assuming, for simplicity, that producers use the family labor only in the own farm, the hired labor needed to produce a given production $Q_i$ is

$$L_i = \left( \frac{Q_i}{B_i A_i^\beta} \right)^\frac{1}{1-\beta} - L_i^f$$

giving the cost function

$$c_i = w \left( \frac{Q_i}{B_i A_i^\beta} \right)^\frac{1}{1-\beta} - w L_i^f$$

(7)

Thus the optimality condition for the producer, equation (2), now becomes

$$\frac{1}{1-\beta} w \left( \frac{Q_i^\beta}{B_i A_i^\beta} \right)^\frac{1}{1-\beta} = \left( p^{FT} - p^O \right) \frac{\overline{Q}}{Q} + p^O \equiv \pi$$

leading to

$$Q_i = B_i^\beta \left[ \left( \frac{1 - \beta}{\pi} \right) \frac{1}{w} \right]^{\frac{1-\beta}{\beta}} A_i$$

This gives the price elasticity of production as

$$\alpha = \frac{1 - \beta}{\beta}$$

The available estimates (see Varangis et. al. 2007) give estimates of $\alpha$ around 0.1 – 0.2. This leads to figures for $\beta$ in the range [0.83, 0.91]. The expressions in (5) can now be obtained by setting $\alpha$ to the values close to the estimated values and then trying different values for $\eta \equiv \frac{\left( p^{FT} - p^O \right) \overline{Q} \overline{Q}}{\left( p^{FT} - p^O \right) \overline{Q} + p^O}$
In the Nicaraguan case \( \frac{\sigma}{\sigma} = 0.30 \). In addition one can find reasonable values for the Fair Trade premium \( p^{FT} - p^O \) and the the price received by producers of conventional coffee.

Note that the above result on the supply elasticity of coffee is a partial equilibrium result. In market equilibrium also the amount of Fair Trade coffee demanded is endogenous and, since it depends on prices, will have an effect on the equilibrium supply elasticity.

3 Demand for conventional and Fair Trade coffee

To model the consumer demand for both conventional and Fair Trade coffee in a framework suitable for a partial equilibrium analysis let us assume that a representative consumer has the following quasi-linear preferences including the "warm-glow"-motive (e.g. Andreoni 1990) for consuming Fair Trade coffee (see also Niemi-Haaparanta-Valkila 2010b for details) and gift-giving more generally:

\[
u(x_O + x_F, \phi (f(\pi^{FT}) x_F, m)) + h\]

where \( u(x_O + x_F, \phi (f(\pi^{FT}) x_F, m)) \) is a strictly concave function of consumption of coffee and gift giving \( g = \phi (f(\pi^{FT}) x_F, m) \) with positive marginal utilities, \( x_O \) = consumption of conventional coffee, \( x_F \) = consumption of Fair Trade coffee, \( h \) = consumption of all other goods, \( \pi^{FT} = p_F - p_O \), with \( p_O \) = consumer price of conventional coffee, \( p_F \) = consumer price of Fair Trade coffee, and \( f(\pi^{FT}) \) = the estimate by consumers of how much of the retail price premium actually is delivered to the Fair Trade producers. This estimate can be a non-linear function of the observed premium in the retail market. The gift giving to poor countries through Fair Trade may be a complement or substitute to \( m \) = private charitable non-Fair Trade donations to developing countries.

One crucial assumption we have adopted is that as pure consumption goods conventional and Fair Trade coffee are perfect substitutes. This can be rationalized by the fact referred to above that most of the Fair Trade produced is actually sold as conventional coffee. Naturally, the assumption need not hold\(^4\), but for us it has been an identifying assumption.

Utility maximization reduces to the following first order conditions (note that the coffee prices are relative to the prices of goods other than coffee):

\[
\begin{align*}
    u_x [x, g] & = p^O \\
    u_x [x, g] + u_g [x, g] \phi_{f(\pi^{FT}) x_F} f(\pi^{FT}) & = p_F \\
    u_g [x, g] \phi_m & = 1
\end{align*}
\]

\(^4\)One of the largest Finnish gas station chains decided some years ago to serve only Fair Trade coffee in its cafeterias. This led to vocal protests from its customers claiming that Fair Trade coffee tastes bad. They were not complaining about the higher prices but about the quality. From the point of view of the chain the customers naturally were right and the decision was reversed soon.
where \( x = \text{total demand for coffee} \equiv x_O + x_F \). Use the first and the last equations in the middle equation (the FOC for Fair Trade coffee) to get

\[
\frac{\phi_{f(x^{FT})x_F} f'(\pi^{FT})}{\phi_m} = 1
\]

This implies that

\[
m = m(x_F, \pi^{FT})
\]

which can then be used in the first and the last FOC to see that

\[
x = x(p^O, \pi^{FT})
\]

\[
x_F = x_F(p^O, \pi^{FT})
\]

implying that

\[
x^O = x(p^O, \pi^{FT}) - x_F(p^O, \pi^{FT}) \equiv x^O(p^O, \pi^{FT})
\]

and altogether

\[
x^O = x^O(p^O, \pi^{FT})
\]

\[
x_F = x_F(p^O, \pi^{FT})
\]

Retail demands for both types of coffee are functions of the retail price of conventional coffee and the retail premium of Fair Trade coffee.

We have estimated the demand functions using Finnish retail prices for coffee (see Niemi–Haaparanta-Valkila 2010 for details). We obtained shop level data on prices charged and quantities sold of all different coffee brands for four years 2006-2009 from a large Finnish retail chain and some additional data from another large retail chain. The data covers all the shops and contains the daily observations for two middle weeks of each month. In addition, we have data on the type of shop (local grocery store, supermarket etc.), the location of the shop and its distance from the central warehouse of the chain serving all the shops in Finland, the size of the shop and local commercial rents for largest cities. The instrumental variable estimations, using the world market price of coffee as an instrument for shop level prices, give the following demand elasticities when data for all of Finland is used:

\[
\begin{align*}
\varepsilon^{OD}_{p^O} &= 0.91, \varepsilon^{OD}_{\pi} = -0.18, \varepsilon^{FTD}_{p^O} = -0.84 \\
\varepsilon^{FTD}_{\pi} &= -0.04
\end{align*}
\]

where \( \varepsilon^{OD}_{p^O} = 0.91 \) the absolute value of price elasticity of demand for conventional coffee, the other elasticities are standard numbers. We use these estimates as our starting point in evaluating the world market impacts of Fair Trade coffee production. The ordinary least squares estimates of the elasticities are much larger in absolute value but the qualitative differences are the same: demand for conventional coffee is more price elastic than the demand for Fair Trade coffee.
We have checked the robustness of our results also by using the OLS estimates. INCOMPLETE: STRUCTURAL ESTIMATION WILL BE TRIED.

The price elasticities of demand we have estimated exceed those available in the literature. E.g. for USA the price elasticity of demand for coffee is around 0., \( \varepsilon^{OD}_{pO} = 0.1 \), (Varangis et. al.). This is an estimate for total consumption of coffee but given that the shares of coffee other than conventional coffee are low this could be expected to be very close to the elasticity of demand for conventional coffee. But it is natural to expect the elasticities obtained from disaggregated consumption to be higher as now the within aggregate substitution is possible. Thus, we stick to our results and assume that \( \varepsilon^{OD}_{pO} = 0.91 \).

There is one important caveat, however, in our calculations below: We assume that our estimate of the price elasticity for conventional coffee with respect to its own price, \( \varepsilon^{OD}_{pO} = 0.91 \), would also prevail without the existence of Fair Trade coffee. It is straightforward to show that if the utility function is separable in aggregate coffee consumption and "warm glow" then Fair Trade reduces the price elasticity of conventional coffee demand. Fair Trade can increase the price elasticity if the coffee consumption and "warm glow" are strong direct complements. Our assumption thus amounts to assuming that coffee consumption and "warm glow" are modest complements, which may be a natural assumption. A complete analysis would require structural estimates.

As a short cut to getting some idea of structural parameters we have specified the utility function to be

\[
 u = x^\alpha \left[ a \left( f \left( \pi^{FT} \right) x_F \right)^\theta + (1-a) m^\beta \right]^\frac{\pi}{\beta}, \quad 0 < \alpha, \beta < 1, \alpha + \beta < 1, 0 \leq a < 1, \theta \leq 1
\]

(9)

giving

\[
x^O = \frac{\alpha \Phi \left( \pi^{FT} \right) m^\beta}{\beta p^O} - \left( \frac{a}{1-a} \frac{\Phi \left( \pi^{FT} \right)}{\pi^{FT}} \right)^\frac{1}{\pi^\eta}, \quad \beta m^{\theta (1-\alpha) + \beta} \left( \frac{\alpha}{\beta p^O} \right)^\alpha \Phi \left( \pi^{FT} \right)^{\frac{\pi}{\pi^\eta}} = 1
\]

(10)

where

\[
\Phi \left( \pi^{FT} \right) = a f \left( \pi^{FT} \right) \theta \left( \frac{a}{1-a} \frac{f \left( \pi^{FT} \right)}{\pi^{FT}} \right)^\frac{\theta}{\pi^\eta} + (1-a)
\]

Obviously the demand functions for both types of coffee can then be solved explicitly. Finally, by setting e.g.

\[
f \left( \pi^{FT} \right) = \frac{\left( \pi^{FT} \right)^{1-\eta} - 1}{1-\eta}
\]

or simply

\[
f \left( \pi^{FT} \right) = \left( \pi^{FT} \right)^\eta
\]
one finally gets the explicit solutions to the demand equations from which the theoretical elasticities can be calculated and equated to the estimated elasticities and solved for the underlying parameters. From these one can calculate that the price elasticity of conventional coffee with respect to its own price is

$$\frac{\theta - \beta}{\theta (\alpha - 1) + \beta}$$

while without Fair Trade coffee (set $a = 0$ implying $x_F = 0$) the elasticity is

$$\frac{1 - \beta}{\alpha + \beta - 1}$$

In this case our procedure of using the estimated own price elasticity of demand for conventional coffee when Fair Trade coffee is also consumed would underestimate the true elasticity with the absence of Fair Trade coffee and our result in the next section would be stronger. The robustness of this result should be checked with a utility function allowing different degrees of substitutability between coffee consumption and donations. TO BE COMPLETED (HOPEFULLY BY THE CONFERENCE PRESENTATION).

4 The equilibrium for conventional coffee market

The Fair Trade coffee price is administratively set. Thus, the only relevant equilibrium condition is the equilibrium condition for the conventional coffee. This equilibrium condition is

$$\sum_j D_j (p_j^{Oc}, p_j^{FTc} - p_j^{Oc}) = \sum_i Q_i^O (p_i^O) + \sum_i (Q_i (\pi_i) - \overline{Q}_i)$$

Here $j$ refers to countries in which coffee is consumed, the superscript $c$ refers to consumers, the function $D_j (p_j^{Oc}, p_j^{FTc} - p_j^{Oc})$ is the demand function for conventional coffee (see Niemi 2010 for derivation using a quasilinear utility function), and the function $Q_i^O (p_i^O)$ is the production in country $i$ by producers of conventional coffee. Since, by definition, the aggregate quota facing the Fair Trade producers equals the demand for Fair Trade coffee, the equilibrium condition can be rewritten as

$$\sum_j D_j (p_j^{Oc}, p_j^{FTc} - p_j^{Oc}) + \sum_j D_j^{FT} (p_j^{Oc}, p_j^{FTc} - p_j^{Oc}) = \sum_i Q_i^O (p_i^O) + \sum_i Q_i (\pi^{FT}, p^{O}, \overline{Q}_i)$$

We have estimated just static equations, current consumption depends on current prices and premia. We have thus ignored e.g. the fact that current consumption of coffee depends also from past consumption of coffee due to habit formation or addiction. In future we take this also into account.
which equates total demand for coffee with the total supply of coffee. Note that in this expression the demand for coffee is the derived demand for coffee beans assuming that one unit of coffee used by the final consumers implies a demand for a fixed amount of raw coffee. What this coefficient of proportionality is does not matter for our calculations below.

In general we can set

\[ p_{j}^{OC} = (1 + m_{j})p^{O}, \quad p_{j}^{FTc} = (1 + m_{j}^{FT})p^{FT} \]

\[ p_{i}^{O} = (1 + l_{i})p^{O} \]

where \( p^{O} \) is the world market price of coffee and the \( m \)'s are various mark-ups that can vary across countries. We assume that the demand functions are the same in all countries, i.e.

\[ D_{j} \left( p_{j}^{OC}, p_{j}^{FTc} - p_{j}^{OC} \right) = D \left( p_{j}^{OC}, p_{j}^{FTc} - p_{j}^{OC} \right) \]

\[ D^{FT} \left( p_{j}^{OC}, p_{j}^{FTc} - p_{j}^{OC} \right) = D^{FT} \left( p_{j}^{OC}, p_{j}^{FTc} - p_{j}^{OC} \right) \]

as we have detailed data only on Finland with which we can estimate the various demand elasticities. Similarly we will be using aggregate supply elasticities implying that we assume the supply functions to be identical across producers. We assume that the world market for conventional coffee is competitive (with both individual producers and consumers taking the world market coffee price as given) implying that \( p^{O} \) adjusts to preserve (11).

As the final piece for the analysis we must understand is that the entry of producers into Fair Trade system is endogenous: producers shift between the systems depending on the different coffee prices and production costs. First note that Fair Trade imposes various types of restrictions on the production mode. Some of them relate to production technology in the form of environmental regulations. Also Fair Trade prohibits the use of child labor in the Fair Trade cooperatives. This implies higher costs both in terms increasing need for outside workers (by reducing \( L_{i}^{f} \) in (7), by prohibiting the use of producers’ own children). The other regulations increase the productions costs which in our model can be regarded as reducing productivity \( B_{i} \). To compensate for these (and for the costs of acquiring the Fair Trade certificate) the Fair Trade system must offer high enough price. This gives the margin at which producers enter Fair Trade production.

\[ (p^{FT} - p^{O}) \frac{Q_{i}}{Q} + p^{O}Q_{i} - c_{i}(Q_{i}) \geq 0 \]

\[ p^{O}Q_{i} - c^{O}_{i}(Q_{i}) \geq 0 \]

But there is also the other margin, the decision whether to give up production or produce. Fair Trade affects this if

\[ (p^{FT} - p^{O}) \frac{Q_{i}}{Q} + p^{O}Q_{i} - c_{i}(Q_{i}) \geq 0 > p^{O}Q_{i} - c^{O}_{i}(Q_{i}) \]
This means that the supply of coffee can become more inelastic through the entry process: reductions in the price of conventional coffee will induce entry to Fair Trade production. The first margin implies that producers supply elasticities will fall while the latter margin means that producers do not exit the market. It is hard to get estimates for these elasticities, and for most what we do we assume the elasticity to equal 0.

Assuming that the shares of individual FT cooperatives in overall sales of FT coffee are given (11) can be rewritten as

\[
\sum_j D_j \left( p_j^{Oc}, p_j^{FTc} - p_j^{Oc} \right) + \sum_j D_j^{FT} \left( p_j^{Oc}, p_j^{FTc} - p_j^{Oc} \right) = \sum_i Q_i^{O} (p_i^{O}) + \sum_i Q_i \left( \pi^{FT}, p_i^{O}, s_i, \bar{Q} \right) =
\]

\[
\sum_i Q_i^{O} (p_i^{O}) + \sum_i Q_i \left( \pi^{FT}, p_i^{O}, s_i \sum_j D_j^{FT} \left( p_j^{Oc}, p_j^{FTc} - p_j^{Oc} \right) \right)
\]

where \(s_i\) = share of country i FT producers in the total demand for FT coffee. (12) implies the following for the equilibrium percentage changes in prices (assuming all elasticities are the same across countries/suppliers):

\[
s^O \left[ -\varepsilon_{pO}^{OD} \bar{p}^O + \varepsilon_{pFT}^{OD} \left( r^c \bar{p}^{FT} - (r^c - 1) \bar{p}^O \right) \right] + (1 - s^O) \left[ \varepsilon_{pO}^{FTD} \bar{p}^O + \varepsilon_{pFT}^{FTD} \left( r^c \bar{p}^{FT} - (r^c - 1) \bar{p}^O \right) \right] =
\]

\[
s^O \varepsilon_{pO}^{OS} \bar{p}^O + (1 - s^O) \left[ \varepsilon_{pO}^{FTS} \bar{p}^O + \varepsilon_{pFT}^{FTS} \left( r \bar{p}^{FT} - (r - 1) \bar{p}^O \right) + \varepsilon_{pFT}^{FTS} \left( p^c \bar{p}^{FT} - (p^c - 1) \bar{p}^O \right) \right]
\]

where \(r^c = \frac{(1+m_{FT})p^{FT}}{(1+m_{FT})p^{FT}-(1+m_j)p^{O}}\), \(r = \frac{p^{FT}}{p^{FT}-(1+m_j)p^{O}}\), \(s^O = \) share of conventional coffee production in total coffee production, \(\varepsilon_{pO}^{OD} = \) elasticity of demand (D) for conventional coffee (O) with respect to \(p^O\), other elasticities are defined in a similar manner (S refers to supply). The point of interest is that the rationing of FT producers implies that demand for FT coffee directly affects the aggregate supply of coffee.

5 Calibration of the Model and Simulation Results

This section relies heavily on data from Valkila-Haaparanta-Niemi (2010, Journal of Business Ethics) in calibrating the mark-ups and price differentials. To get an idea on the numerical values of elasticities we start with the supply elasticities. We take the largest estimate for the supply of coffee from Varangis

\[
\varepsilon_{pO}^{OS} \equiv \alpha = 0.2
\]

To get an estimate of \(\eta\) we use the Nicaraguan value for \(\frac{\bar{p}}{\bar{Q}} = 0.3\). The average market price per pound of coffee over the last ten years is 0.98311 USD and
our estimate for the average Fair Trade premium over that period is 0.332 USD (though during the last years it has been significantly lower), DETAILS TO BE ADDED. Thus, we get

\[ \eta = \frac{(p_{FT} - p^O) Q}{(p_{FT} - p^O) Q + p^O} = 0.1327 \]

Using this in (5) we get

\[ \varepsilon_{p^O}^{FTS} = \frac{\alpha (1 - \eta)}{1 + \alpha \eta} = 0.1690 \]

Similarly we get

\[ \varepsilon_{Q_i}^{FTS} = \frac{\alpha \eta}{1 + \alpha \eta} = 0.0258 \]

To get the supply elasticity we need to know elasticity of demand for Fair Trade coffee with respect to the price differential between the consumer price of Fair trade coffee and ordinary coffee. We use the results obtained from Finnish data presented above

\[ \varepsilon_{p^O}^{FTD} = -0.04 \]

Finally, for the producer side we need an estimate of \( r \). Using the same average values as above for the coffee world market price and Fair Trade coffee premium for the producers we get

\[ r - 1 = \frac{p^O}{p_{FT}^O - p^O} = 2.9611 \]

Similarly we need an estimate for the consumer side equivalent of this, \( r^c \). In Finland, in our data (see Valkila–Haaparanta-Niemi 2010)

\[ (1 + m_j^{FT}) p_{FT} = 1.5 (1 + m_j) p^O \]

giving

\[ r^c - 1 = 2 \]

With these, the price elasticity of aggregate supply of coffee

\[ \varepsilon_s = s^O \varepsilon_{p^O}^{OS} + (1 - s^O) \left[ -\varepsilon_{Q_i}^{FTS} (r - 1) - \varepsilon_{Q_i}^{FTS} \varepsilon_{p^O}^{FTD} (r^c - 1) \right] \]

is, using

\[ s^O = 0.99 \]

as our estimate for the conventional coffee supply in total coffee supply, we get

\[ \varepsilon_s = 0.1975 \]

which is lower than the elasticity of supply without Fair Trade coffee. The difference is small due to smaller share of Fair Trade coffee in the total supply. But remarkably

\[ \left[ -\varepsilon_{Q_i}^{FTS} (r - 1) - \varepsilon_{Q_i}^{FTS} \varepsilon_{p^O}^{FTD} (r^c - 1) \right] = -0.0486 \]
which gives the supply of coffee by Fair Trade producers to be backward bending in price of conventional coffee. This implies, ceteris paribus, that if the share of Fair Trade coffee on total coffee supply increases, the supply elasticity will decrease.

Using the demand elasticities from (8) the price elasticity of aggregate demand for coffee

\[ \epsilon^D \equiv s^O \left[-\epsilon_{pO}^{OD} - \epsilon_{\pi PT}^{OD} (\pi - 1) \right] + (1 - s^O) \left[\epsilon_{pO}^{FTD} - \epsilon_{\pi PT}^{FTD} (\pi - 1) \right] \]

is

\[ \epsilon^D = 0.5521 \]

which is smaller than \( \epsilon_{pO}^{OD} = 0.91 \). With the caveats given above Fair Trade reduces also the price sensitivity of coffee demand. TO BE COMPLETED WITH "ESTIMATES" OF THE STRUCTURAL PARAMETERS.

We can also use these numbers to study how an one per cent increase in the price of Fair Trade coffee received by the farmers affects the price of conventional coffee. The percentage change of supply is given by

\[ (1 - s^O) \left[\epsilon_{pFPT}^{FTS} + \epsilon_{\pi PT}^{FTS} \pi \right] = 0.00079 \]

per cent using the demand elasticities from Helsinki area. Similarly, the impact on demand is

\[ s^O \epsilon_{pO}^{OD} + (1 - s^O) \epsilon_{\pi PT}^{FTD} \pi \]

Thus, an increase in the Fair Trade coffee price increases excess supply in conventional coffee market both by increasing supply and reducing demand. Thus, with these numbers an increase in the Fair Trade producer price would reduce the price of conventional coffee. Theoretically increases in Fair Trade coffee production can increase the conventional coffee price. This has been argued e.g. by Konečný and Mysliveček (2008) and is also a possibility also within the theoretical model developed here (in case "warm glow" and coffee consumption are strong substitutes). But, with the basic calibration the reverse holds.

The basic conclusions reached with the basic calibration are

- Fair Trade coffee production and consumption reduce price elasticities of both demand for and supply of conventional coffee. This implies that Fair Trade increases the volatility of the price of conventional coffee.

- Fair Trade reduces the price of the conventional coffee, with increases in Fair Trade coffee prices reducing the conventional coffee price further.

These results imply that Fair Trade makes the conventional coffee producers worse off and may also make Fair Trade producers worse off (at least those who are able to produce without Fair Trade). Given these strong conclusions we have conducted several sensitivity tests to check the robustness of the conclusions.

First, we have used the following OLS demand elasticities from Niemi-Haaparanta-Valkila (2010):

\[ \epsilon_{pO}^{OD} = 4.85, \epsilon_{\pi PT}^{OD} = -0.4, \epsilon_{pO}^{FTD} = -1.15, \epsilon_{\pi PT}^{FTD} = -0.08 \]
These numbers are substantially larger in absolute value than the IV-estimates used above. It is straightforward to calculate that the results above are strengthened.

Secondly, the estimate of the retail Fair Trade premium (the Fair Trade coffee price minus the conventional coffee price) may be higher in Finland than elsewhere. In Finland the retail Fair Trade price is 1.5 times the retail conventional coffee price. We have checked what happens to both the demand and supply elasticities when the mark-up is reduced all the way to 1.1. With the remaining parameters staying the same as in the baseline calibration the price elasticity of demand becomes even smaller when the retail Fair Trade premium becomes smaller. The reverse happens to the supply elasticity: supply becomes more elastic, but the effect is very small, the impact on the demand elasticity is much larger than on the supply elasticity. Thus, smaller retail Fair Trade premiums reinforce the conclusions we reached in the basic case.

The only parameter that seems to matter for the conclusions is $\varepsilon_{OD}^{FT}$, the elasticity of demand for conventional coffee with respect to the Fair Trade price. If it is positive and "fairly" large, Fair Trade can increase the price elasticity of demand for coffee. Since this elasticity does not matter for the aggregate supply elasticity, Fair Trade could then reduce the volatility of the price of conventional coffee. At the same time it would make it more likely that increases in Fair Trade premium would increase also conventional coffee price. The mechanism is clear: higher Fair Trade coffee prices would make consumers to switch their consumption swiftly to conventional coffee. A consequence of this switch naturally is that the share of Fair Trade production that can be sold as Fair Trade coffee declines. In this case the Fair Trade producers would gain from increased sales at higher prices to conventional coffee market.

6 Conclusions

We have reached the following main conclusions:

Fair Trade in coffee reduces responsiveness of both the supply of and demand for the conventional coffee. This implies that Fair Trade increases the volatility of conventional coffee price. As a consequence, the position of conventional coffee producers is made worse by Fair Trade. But perhaps more importantly, also the Fair Trade producers are hurt by the increased volatility as they sell a large share of their production as conventional coffee. This again is a consequence of the minimum price guarantee which is supposed to insure the producers against market shocks.

Secondly, we have shown that attempts to improve the producers' lot by increasing the Fair Trade minimum price may hurt (with the data we have will hurt) the producers of conventional coffee. At the same time also Fair Trade producers can be hurt as they earn less on their sales to conventional coffee markets accounting for the bulk of their sales.

These results should be taken with some caution, however. Especially the estimates of the impacts of Fair Trade on demand elasticity are very uncertain
as it is hard in a world where Fair Trade already exists to estimate what the
demand elasticity without Fair Trade would be. There is thus more work to b
done on th demand side. We are more confident with our supply side estimates.

Our results of the adverse impacts of Fair Trade may also be underestimates.
In the supply side we have not taken into account the impact of Fair Trade on
the entry and exit of producers when prices change. Fair Trade is claimed to
increase the resilience of producers against adverse changes in market conditions
(ADD REFERENCE). If this is true then Fair Trade may make the supply even
less responsive to price changes as we have estimated above.

Another weakness in our study is that one would need detailed data on con-
tracts between coffee farmers, both conventional and Fair Trade farmers. There
is not e.g. any single price for Fair Trade coffee but contracts between buyers
and sellers specifying in addition to price also the conditions for transportation
(who pays it etc.)

7 References

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