ISSN 0111-1760

University of Otago
Economics Discussion Papers
No. 0709

July 2007

Fair Trade

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[1]This research was supported, in part, by an ANU CBE CIGS Grant. We are grateful to Rodrigo Taborda for research assistance and to Peter Neary and participants at the 2nd Otago Workshop in Trade, at the 2007 APTS Shanghai meetings and at seminars at McGill University and ANU for discussion and comments. Any remaining errors are, of course, our own.

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Abstract

This paper deals with the behavior of fair trade organizations in an oligopolistic setting in which the vertically integrated fair trade firm produces a commodity which is a weak substitute for another commodity. Profit-maximizing oligopolists are vertically disintegrated and produce for both markets and the fair trade firm can charge a premium to consumers due to a "warm glow effect" that depends on the wage paid to fair trade producers. We show that trade integration will unambiguously increase the size of the fair trade firm. However, the relative size compared to oligopolists shrinks with integration. The effect of a change in substitutability between the two commodities on markets shares depends on the relative market potential. Furthermore, we show that the warm glow effect does not support an expansion of the volume of fair trade.
JEL-Classification: F12.

Keywords: Fair trade, integration, imperfect competition.

1 Introduction

In recent years many countries have seen a sharp increase in the prevalence of so-called Fair Trade (FT) products. Worldwide sales of FT coffee, cocoa, tea, rice, sugar, honey, fruit, textiles and other handicrafts grew at over 3% annually in the 1990s and demand for FT coffee in particular has grown much more rapidly than demand for coffee overall.[1] The FT movement has been most successful in Europe, where Fairtrade Labeling Organizations International (FLO) claim that Fair Trade products are sold in over 55,000 supermarkets. In Switzerland, for example, Fair Trade products account for over 45% of the banana market, over 25% of the flower market and nearly 10% of all sugar sold.[2]

Commencing in the Netherlands in 1973 (although the Fair Trade label had its origins in 1988), these FT organisations essentially offer a certification to producers that meet certain standards. Howley (2006) describes the operation of TransFair USA, the US operation of the 1989 Dutch company, as certifying Fair Trade products and auditing the production chain from grower to final retailer. The certification of farms is undertaken by FLO, a collective organization which specifies criteria that farms must satisfy to receive the stamp of approval. The carrot offered to members is that the FLO guarantees a minimum floor price for certified members that not only provides stability in an extremely volatile market but ensures a premium on the market price.[3] It is important to note that obtaining FT certifica-

[1]The growth rate of FT sales comes from Ronchi (2006, p1), who also notes that FT coffee accounted for only about 0.5% of the 2004 market in the US, the world's largest market, but around 6% in Switzerland in 2005 and 20% in the U.K. Further, she reports that the average growth rate of sales of FT coffee since its introduction in North America in 1998 has been 65% and 47% for the Canadian and US markets respectively. Wilkinson (2006) suggests that the FT coffee share of the specialty coffee market grew from 0.6% to 4.3% from 2000 to 2006 (and 0.2% to 2.2% of total coffee sales, the specialty market going from a third of the overall market to over half of the US$22b total US coffee market in 2006.)

[2]These figures on supermarket numbers come from Krier (2005 p.9) and those on Switzerland are from Krier (2005 p.65).

[3]For Arabica coffee, for example, it pays $1.26 if the New York price is less than $1.21, otherwise it pays the New York price plus five cents. Since 2000 there have only been two brief periods during which the latter price was the relevant one. In the Robusta coffee

tion requires more of a farm than simply being willing to receive a higher price; significantly, a farm must be strictly a family concern (employing no long-term hired labor) and must be a member of a large cooperative:[4] the FLO does not deal with individual farms but with collectives of small farms. Once producers comply with the eligibility criteria, they receive approval to contact licensed importers. These importers are expected to supply credit to growers but pay no fee. Roasters and distributors pay a license fee for the right to use the fair trade logo.

This collective structure is an important feature of FT production and is central to our analysis. Milford (2004) finds "clear evidence" that co-ops use "membership regulations actively in order to obtain a specific level of membership and a corresponding volume of coffee" (p.52). That is, while, in principle, these FT cooperatives are meant to be open to all new members willing to produce by the FT guidelines, *de facto* they do constrain output. She also examines the efficiency of co-op operations and finds evidence of "free-rider" problems in the management and control of co-ops. This is a key feature of the model of this paper.

The driving force behind the FT movement in the coffee market has been a process of dramatic change in the return to growers: the real price of coffee beans has fallen precipitously – to approximately 25% of its 1960 level in 2001[5] – as world production has increased,[6] with the consequence that returns to growers have declined precipitously. Many developing countries are highly dependent on coffee exports in their export portfolios (according to the World Bank, in 2000 coffee exports provided 79% of total export revenue in Burundi, 54% in Ethiopia and 43% in Uganda (Gresser and Tickell, 2002

market the relevant market price has not reached the Fairtrade floor price in over ten years.

[4]Other requirements imposed on cooperatives include restrictions on their political structure and independence and requirements regarding openness to new members: see Rice (2001) and Milford (2004). We discuss the international coffee market more fully in Appendix A.1 of this paper.

[5]Figure 4 of Gresser and Tickell (2002) looks at US December basis spot prices per pound in US cents and shows a decline from 126.8 in 1980 to 46.2 in 2001.

[6]Figure 5 of Gresser and Tickell (2002) indicates that world production of coffee beans has risen from around 80m bags (a bag being 60kgs) in 1979/80 to 115m bags in 2001/2.

p.8)); consequently, a number of very poor countries – particularly in Africa and Central America – have encountered serious financial difficulties as a result of these market changes.

Fair trade has not been universally applauded, however (see *The Economist* 2006 and Lindsey, 2003.) One criticism is that, by increasing and guaranteeing the price received by farmers, it insulates farmers from the market signals provided by falling prices, reducing incentives for diversification and inducing excessive supply that keeps market prices low. Another criticism is that it reduces incentives for quality improvement by individual farmers, due to the collective structure of growers' cooperatives (see Booth and Whetstone, 2007). Finally, as a means of delivering assistance to poor farmers, the efficiency of FT has been questioned: Harford (2006) suggests that the price premium paid to farmers should translate into less than a penny a cup of coffee to consumers and yet the premium charged is more typically ten times this amount.[7]

This retail premium for FT products suggests that they are perceived as imperfect substitutes for non-FT goods and yet the product differentiation is, effectively, in the production process and not in the final consumer product. This is a feature of a number of other 'ethical' goods such as dolphin-friendly tuna, goods produced without child labor, even organic food and so-called low air-miles food, and this dimension of our model can apply to the analysis of markets for these goods, too.

The overall success of the FT movement raises a number of interesting questions. If it pays FT firms to adopt this production technology, then why do not all firms do it? What has led to the increase in prominence of FT firms? At the same time that FT has become such a phenomenon, we have also observed a bifurcation in coffee consumption along quality lines, with FT firms operating exclusively in the 'gourmet' sector of the roast and ground market, the high quality segment of the coffee market (the low quality segment being the market for instant coffee). How does this affect the viability of FT firms? Given that FT firms are effectively vertically integrated, from

[7]Harford (2006, p.33) argues that the price difference charged by retailers may simply be an instrument of price discrimination.

the farm to the consumer, how can they survive against non-integrated lower-cost multinational competitors? How does the collective structure of FT firms affect incentives of growers? What is the importance of the so-called 'ethical consumer' – the consumer willing to pay a premium for FT products?

In this paper we develop a model of a market in which a vertically integrated FT firm competes against a number of oligopolistic competitors, in order to address these – and other – questions. There are two quality-differentiated markets, the products in them being imperfect substitutes in demand and the FT firm competes in one only (the high quality market) with or without oligopolistic rivals (depending on parameter values.) The FT firm contracts with an endogenously chosen number of farmers but the cost of transforming their inputs into high-quality output depends (negatively) on the quality of the inputs and this, in turn, depends on unobservable farmer effort. This yields a moral hazard problem facing the FT firm that is not faced by its rivals who deal with growers on a spot market where inputs are provided at minimum quality but require added processing to be transformed into high quality outputs. The moral hazard problem endogenously limits the optimal size of the FT collective. The FT firm also returns all surplus from its operations to its growers in the form of a wage premium over the wages paid by rivals and, in turn, induces a higher willingness-to-pay from consumers who derive a "warm glow" effect from the knowledge that they are delivering more to growers. Finally, all firms incur trade costs in shipping the growers' outputs to their processing plants in the final country of consumption.

In this setting we first derive the equilibrium outputs, prices and surplus to FT growers. We then consider a number of comparative statics exercises to determine, *inter alia*, the consequences of trade cost reductions, the impacts of changes in market size and the effects of a decrease in the degree of perceived substitutability between qualities of the final good. We also address some welfare issues.

We are unaware of any existing analytic models of FT markets, other than Becchetti and Adriani (2002, discussed below) as what existing literature there is on this topic is largely non-analytical. A number of authors (Maseland and de Vaal, 2002, Milford, 2004, Hayes, 2006) have observed that a FT

organization can offset monopsonistic behaviour in an input market. Leclair (2002) documents the increasing significance of FT generally while Milford (2004) provides a discussion more focused on coffee in particular. She also provides some graphical analysis and discussion of input markets with a monopsonist in competition with a non-profit co-operative, the latter either being open to all prospective members or closed. The analysis is all partial equilibrium, however, and considers only the input market. Becchetti and Adriani (2002) have an analytical model of FT that considers the role of consumers willing to pay a premium for FT products. In their model, the FT firm hires those workers with the lowest outside options, thereby forcing the monopsonist to pay more than it otherwise would. However, in contrast to the present paper, Becchetti and Adriani do not model the cooperative nature of FT production and nor is there any responsiveness of consumer welfare to the level of Southern wages: the good is simply considered to be fairly produced or not.[8]

The remainder of the paper is organised as follows. In the next section we present our model and Section 3 discusses the equilibrium while Section 4 undertakes a number of comparative statics and policy exercises of interest. Section 5 concludes. For expositional convenience, we have relegated the main bulk of our proofs to the appendices, along with a discussion of the structure of the world coffee market, which motivates some of our modeling choices.

2 The Model

There are two countries, home and foreign, with all initial production in the foreign country but all consumption at home. There are also two qualities of the good for sale and they are perceived by consumers as imperfect substitutes. We distinguish two types of firms: a fair trade firm (henceforth

[8]Their analysis is similar to that of papers that consider the impact of eco-labeling on trade (see *e.g.* Graeker, 2006, and Mälkönen, 2005 and, for models incorporating green consumers, Conrad, 2005, and Eriksson, 2004). Fair trade is more concerned about factor rewards than about the production process, although, as noted above, FT certifying organizations do impose a significant number of restrictions on their members in terms of the organization of production. See footnote 4 and the references therein.

labeled as FT) and other firms which we will label oligopolists. The FT firm serves the high quality market only and its supply is equal to z, whereas all oligopolists produce, in aggregate, $X(Y)$ for the low (high) quality market. Demand behavior can be determined by considering the optimal consumption plan of a representative consumer. The utility function of the consumer is quasi-linear and given by

$$\begin{aligned} \tilde{U} &= U(X,Y,z)+Q, \qquad (1)\\ U(X,Y,z) &= AX+\alpha(Y+z)-\frac{1}{2}(X^2+2\gamma X(Y+z)+(Y+z)^2)\\ &\quad +\delta wz,\\ &\quad \gamma\in[0,1], A,\alpha,\delta>0, \end{aligned}$$

where X denotes consumption of the low quality commodity, $Y(z)$ denotes consumption of the high quality commodity which is produced by oligopolists (by the FT firm), and Q is the consumption of a commodity which is produced under perfect competition. Q is the numeraire in our model. The term δwz is the "warm glow" effect which is explained below in detail.

We assume that one unit of labor is required to produce one unit of commodity Q, and that the total labor endowment is fixed at L. Accordingly, the representative consumer maximizes expression (1) subject to the budget constraint

$$pX+qY+rz+Q=L, \qquad (2)$$

where p,q and r denote the respective prices for X,Y and z. Maximization leads to the inverse demand functions

$$\begin{aligned} p &= A-X-\gamma(Y+z), \qquad (3)\\ q &= \alpha-(Y+z)-\gamma X,\\ r &= \alpha-(Y+z)-\gamma X+\delta w. \end{aligned}$$

Utility maximization of the representative agent gives rise to the existence of two markets, a low quality market and a high quality market, because the

price for the high quality commodity received by the FT firm differs from the price received by the oligopolists only by a wage premium. Hence, we will use

$$p = A - X - \gamma(Y + z), q = \alpha - (Y + z) - \gamma X \tag{4}$$

only and add a wage premium for the FT firm. High and low quality commodities are (weak) substitutes and the parameter γ measures the degree of substitutability.

We assume that the number of firms is fixed such that there is only one FT firm but n oligopolists. As for the oligopolists, we adopt the standard assumption that they are profit-maximizing firms. They are able to serve both the high and the low quality market. On the production side, oligopolists are vertically disintegrated and acquire inputs on the international spot market. Without loss of generality, we assume that each oligopolist requires one unit of input to produce one unit of output. The marginal cost for producing the low quality final commodity is normalized to zero, but the high quality commodity warrants a marginal cost of size c with $c > 0$.[9]

The market for intermediate inputs is competitive from the supply side as there is a large number of producers. These producers are located in the foreign country, and each producer can produce one unit of the intermediate input. If the producer is not offered a contract with the FT firm, it has to decide whether to produce one unit of the intermediate input, which will be sold on the international market, or to pick an outside option whose payoff we have normalized to zero. Accordingly, the price of the intermediate input on the international market will be zero irrespective of the demand by oligopolists.[10]

This practice and, in particular, the market power of oligopolists, is not felt to be fair, even by consumers of the final commodity, and this discomfort gives rise to the establishment of a different type of firm – the FT firm –

[9]While we have normalized the oligopolists' costs of producing the low quality good to zero, our focus is on the cost premium of producing high quality goods (those that compete with the FT firm) and this is captured in c.

[10]If producers had market power, double marginalization would occur and would make vertical integration profitable.

which has a different objective. It produces high quality commodities only[11] and guarantees credibly that all proceeds net of production costs are given back to individual producers. The FT firm is vertically integrated with producers as it produces the final output exclusively with the input of producers with which it has signed an exclusive contract. Hence, the FT firm does not use the international market, and producers signing a contract with the FT firm (henceforth labeled as FT producers) will exclusively produce the intermediate input for the FT firm.

As the oligopolists use the spot market for buying the intermediate input whereas the FT firm uses contracts with producers, it is natural that the FT firm can commit to its output before oligopolists decide on their input decisions. Furthermore, as profit maximizing oligopolists are vertically disintegrated, vertical integration comes with an additional cost. The contract between the FT firm and the FT producer is assumed to be incomplete as it specifies the delivery of one unit of the intermediate input, but not the effort of each producer to reduce the overall production cost of the final (high quality) commodity. This effort is not observable and thus FT production suffers from a moral hazard problem due to vertical integration. Table 1 gives the sequence of decisions of the game, which we will solve in the usual backward induction fashion.

Table 1: Game structure

Stage I: FT firm decides on the number of FT producers.
Stage II: Each FT producer decides on efforts to reduce production costs.
Stage III: Oligopolists decide simultaneously on their production levels in both markets.

[11] As discussed by Sutton (1991), production of instant coffee involves substantial fixed costs in comparison to production of roast coffee beans, either whole or ground, so, in the coffee market at least, this explains the fact that FT firms operate only in the latter, high-quality, sub-sector.

The other notable difference between FT production and production by oligopolists is the warm glow effect of FT production. Since the FT firm can credibly guarantee that it gives all profits back to the producers, it is able to earn a wage premium on top of the high quality price q. This wage premium is the "make me feel good" effect consumers experience when they contribute to the success of a business which is felt to be based on fair trade rules. The FT good can be regarded as bundling a service and a private good. The service is similar to a private charity contribution and allows consumers to make a donation in order to increase FT producers' income.[12] We assume that consumers are willing to pay δw more per unit of the high quality commodity for this service offered by the FT firm, where w denotes the wage premium paid to each FT producer (and thus, given that the wage of oligopolists is normalized to zero, the wage itself) and $\delta \in [0, 1]$.[13]

In order to determine each producer's payoff, let c_0 denote the production cost of the FT firm, and let t denote the per unit trade cost of the intermediate input.[14] Since each producer produces one unit, its wage is determined by the price in the high quality market, complemented by the wage premium and corrected for costs:

$$\alpha - z - Y - \gamma X + \delta w - c_0 - t = w \Leftrightarrow w = \frac{\alpha - z - Y - \gamma X - c_0 - t}{1 - \delta}.$$

As for the production cost, we assume that each FT producer can make a contribution by individual efforts e_j such that

$$c_0 = \theta - \frac{\lambda \sum e_j}{z}$$

[12]In this sense, bundling successfully prevents fraudulent use of donations as the FT firm guaratees that all proceeds are returned to FT producers.

[13]We assume that the consumer perceives the two high-quality goods to be perfect substitutes in all respects other than the preference for 'fair' production techniques. An alternative way of modeling the effect of FT labelling would be to suppose that an FT product is perceived as an imperfect substitute for its oligopoly rival products. We are grateful to Peter Neary for this observation.

[14]Note that our analysis does not warrant that the FT firm's marginal cost is higher that the marginal cost c. However, $c_0 > c$ might be the result of vertical disintegration being the most efficient production method, but an FT firm can claim to be fair only if it is vertically integrated.

with $\theta, \lambda > 0$. We are now ready to determine the behavior of each FT producer. It correctly anticipates the number of all fellow FT producers and maximizes its payoff

$$v_j \equiv w - \frac{\mu e_j^2}{2},$$

where the quadratic term gives the individual cost of the unobservable efforts. Maximizing over individual effort leads to

$$e_j^* = \frac{\lambda}{\mu z(1-\delta)}, v_j^* = \frac{\alpha - z - Y - \gamma X - \theta - t}{1-\delta} + \frac{2z-1}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^2} \equiv v^*. \quad (5)$$

The asterisks denote optimal levels, and v^* uses symmetry among FT producers. Expression (5) shows that the FT producer's surplus consists of two parts, the price-cost margin and the reduction in production cost due to producers' effort. The price-cost margin declines with the number of FT producers and the aggregate output of oligopolists, while the production cost reduction also gets smaller with z, as the moral hazard problem becomes more severe with an increase in FT producers.

The FT firm correctly anticipates the behavior of each FT producer and chooses their number to maximize the sum of payoffs of all FT producers, which is equal to

$$S(z) \equiv zv^* = z\left(\frac{\alpha - z - Y(z) - \gamma X(z) - \theta - t}{1-\delta} + \frac{2z-1}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^2}\right). \quad (6)$$

Expression (6) takes into account that the FT firm is well aware that it precommits to its high quality output z before the oligopolists become active. This is the reason why both X and Y depend on z. Given that each FT producer is relatively small, we will ignore the integer constraint in the remainder of the paper. However, it takes at least one FT producer to establish a vertically integrated FT firm so that $z \geq 1$.

3 Fair Trade Equilibrium

In this section, we discuss the behavior of the FT firm and the oligopolists. The oligopolists move last in this game and they know, or they correctly anticipate, how many FT producers have been hired by the FT firm. In order to make the problem interesting, we assume that the oligopolists will be active at least in one market. Let z^* denote the optimal number of FT producers. We require:

Assumption 1 $z^* < \dfrac{A-t}{\gamma}$.

Assumption 1 guarantees that the oligopolists are at least active in the low quality market. We now solve the game by backward induction. In stage 3, each oligopolist maximizes its profits $\Pi_i \equiv (p-t)x_i + (q-c-t)y_i$ which leads to the Kuhn-Tucker conditions

$$\begin{aligned} p - t + p_X x_i + q_X y_i &= 0, \\ q - c - t + q_Y y_i + p_Y x_i &\leq 0, y_i \geq 0, \\ y_i(q - c - t + q_Y y_i + p_Y x_i) &= 0, \end{aligned} \tag{7}$$

where the subscripts denote the partial derivatives of the inverse demand function w.r.t. respective aggregate output levels.[15] Note that oligopolists have to take a cannibalization effect into account: an increase in output in one market will decrease the price in the other market, and this effect is stronger with a larger γ. Based on condition (7), we now have to distinguish two cases. If $y_i = 0$, oligopolists do not serve the high quality market, and the firm output levels are equal to

$$x_i^* = \frac{A - t - \gamma z}{n+1}, y_i^* = 0. \tag{8}$$

[15]It can easily be shown that the second order conditions $\Pi_{xx}, \Pi_{yy} < 0, \Pi_{xx}\Pi_{yy} > \Pi_{xy}^2$ are fulfilled.

If $y_i > 0$, oligopolists serve both markets and their output levels (denoted by a double star) are equal to

$$x_i^{**} = \frac{A - (1-\gamma)t - \gamma(\alpha - c)}{(n+1)(1-\gamma^2)}, \tag{9}$$
$$y_i^{**} = \frac{\alpha - \gamma A - (1-\gamma)t - c - (1-\gamma^2)z}{(n+1)(1-\gamma^2)}.$$

Note that z affects y_i^{**} only but not x_i^{**}. In particular, an increase or decrease in z will not change x_i^{**}. The reason is that an increase in z has two effects on firm behavior in the low quality market, a direct and an indirect effect. First, the low quality market becomes less attractive as more imperfect substitutes are on the market (despite the decline in y_i^{**}), and this direct effect would make x_i^{**} decrease. However, y_i^{**} and x_i^{**} are strategic substitutes, and since y_i^{**} decreases, the cannibalization effect has been reduced and x_i^{**} should increase. In our model with an identical γ across quality types and linear demand, both effects cancel each other.

From (9), we can infer the critical level of z which makes the FT firm monopolize the high quality market. Monopolization will (not) occur if z is larger (smaller) than

$$\widehat{z} \equiv \frac{\alpha - c - (1-\gamma)t - \gamma A}{1-\gamma^2}. \tag{10}$$

The FT firm will maximize its surplus (6), correctly anticipating the oligopolistic output levels. In general, the marginal surplus is given by

$$\frac{dS}{dz} = v^* - \frac{z}{1-\delta}\left(1 + \frac{dY}{dz} + \gamma\frac{dX}{dz} - \frac{z-1}{z^3}\frac{\lambda^2}{\mu(1-\delta)}\right). \tag{11}$$

More precisely, we have to distingush between the two cases of rivalry or no rivalry in the high quality market, and we find that the marginal surplus is equal to

$$\frac{dS}{dz} = \begin{cases} v^* - \frac{z}{1-\delta}\left(\frac{1+n(1-\gamma)}{n+1} + \frac{z-1}{z^3}\frac{\lambda^2}{\mu(1-\delta)}\right) & \text{if} \quad z < \widehat{z} \\ v^* - \frac{z}{1-\delta}\left(\frac{1}{n+1} + \frac{z-1}{z^3}\frac{\lambda^2}{\mu(1-\delta)}\right) & \text{if} \quad z > \widehat{z} \end{cases} \tag{12}$$

From expression (12), we find that the surplus function is continuous and differentiable except for $z = \hat{z}$:

$$\lim_{z \to \hat{z}^-} \frac{dS}{dz} > \lim_{z \to \hat{z}^+} \frac{dS}{dz}. \tag{13}$$

At $z = \hat{z}$, the surplus function has a kink. If – coincidentally – the optimal number of FT producers were equal to $\hat{z}$, the FT firm's reaction to changes in parameters and oligopolistic output would be subject to inertia until the marginal surplus is changed more than marginally. We will not consider this case, but it is noteworthy that an FT firm may not respond to changes, and this is due to the kink in the surplus function. Except for $\hat{z}$, the optimal behavior of an active FT firm can be determined by $dS/dz = 0$ because the next lemma demonstrates that the sufficient condition is fulfilled.

Lemma 1 *$S(z)$ is a strictly concave function.*

Proof: see Appendices A.2 and A.3.
The first-order condition $dS/dz = 0$ gives the behavior of the FT firm only if this firm is viable. Lemma 2 shows that at least one FT producer who is better off compared to producing for the spot market is required to establish an FT firm.

Lemma 2 *A fair trade firm will not be established if $v^*(1) < 0$.*

Proof: According to (12), $dS/dz < v^*$, and if $v^*(1) < 0$ surplus will be negative for all $z > 1$. □
From Lemma 2, we may derive conditions under which an FT firm will (not) be established:

Corollary 1 *A fair trade firm will not be established if trade costs are too high and/or the warm glow effect is too small.*

Proof: This follows from eq. (6) for $S(1) < 0$. In case of no competition in the high quality market, $S(1) < 0$ for output levels according to (8) implies

$$\alpha - 1 - \frac{\gamma n(A - \gamma)}{n + 1} - \theta - t\frac{n(1 - \gamma) + 1}{n + 1} + \frac{\lambda^2}{\mu(1 - \delta)} < 0.$$

If oligopolists serve the high quality market, $S(1) < 0$ for output levels according to (9) warrants

$$\frac{\alpha - 1}{n+1} + \frac{nc}{n+1} - \theta - \frac{t}{n+1} + \frac{\lambda^2}{\mu(1-\delta)} < 0. \square$$

We may already conclude from Corollary 1 that some combination of economic integration and the warm glow effect is an essential prerequisite for the existence of an FT firm. Of course, even with $\delta = 0$ we can still sustain an FT firm, but this requires a sufficiently low t. In the remainder of the paper, we will assume that parameters are such that the FT firm will be viable.[16]

4 Integration, Substitutability and Fair Trade

In this section, we consider how changes in parameter values will affect the fair trade equilibrium. We consider only small parameter changes that do not lead to a regime switch such that the FT firm switches from rivalry in the high-quality market to non-rivalry or vice versa. We are in particular interested in how economic integration, measured by a decline in trade cost t, will affect the fair trade equilibrium. Our next result extends Corollary 1 such that integration is crucial for the success of an FT firm.

Proposition 1 *A decrease in trade cost increases the number of FT producers.*

Proof: see Appendices A.2 and A.3.

Proposition 1 shows that the FT firm becomes larger with integration. This holds true in both cases. While this result supports our finding that integration is crucial for the establishment of an FT firm, we would also like to enquire how the market share of an FT firm changes with integration.

[16]We have assumed that the FT firm incurs only variable costs of operation but one might also model the establishment of an integrated FT network as a fixed cost. Doing so will obviously lower the threshold level of trade costs above which and/or increase the threshold level of δ below which a FT firm cannot operate, but it would not obviously add anything further to the analysis of this paper.

Obviously, the market share will be unity if the FT firm monopolizes the high-quality market. Proposition 2 demonstrates that the absolute increase in size with integration does not imply an increase in relative size.

Proposition 2 *Given that both the FT firm and the oligopolists are active in the high quality market, a decrease in trade cost increases the market share of oligopolists and decreases the market share of the FT firm.*

Proof: The details of the computations can be found in Appendix A.3. The change in the number of FT producers is equal to

$$\frac{dz^*}{dt} = -\frac{(1-\delta)\mu z^{*3}}{2(1-\delta)\mu z^{*3} + \lambda^2(n+1)} = -\frac{1}{2 + \frac{\lambda^2(n+1)}{(1-\delta)\mu z^{*3}}} > -\frac{1}{2},$$

and the change in oligopolistic production in the high quality market can be derived as

$$\frac{dy_i^{**}}{dt} = \frac{\partial y_i^{**}}{\partial t} + \frac{\partial y_i^{**}}{\partial z}\frac{dz^*}{dt} = -\frac{1}{(n+1)(1+\gamma)} - \frac{1}{(n+1)^2(1+\gamma)}\frac{dz^*}{dt}$$
$$= -\frac{1}{(n+1)(1+\gamma)}\left(1 + \frac{1}{n+1}\frac{dz^*}{dt}\right) < -\frac{1}{(n+1)(1+\gamma)}\left(1 - \frac{1}{2(n+1)}\right)$$

which leads to

$$\frac{dy_i^{**}}{dt} < -\frac{2n+1}{2(n+1)^2(1+\gamma)} < -\frac{1}{2}.$$

If $dt < 0, dz^* < -dt/2, dy_i^{**} > -dt/2$. Hence, each oligopolist becomes relatively larger, whereas the FT firm becomes relatively smaller. □

The intuition for this result is that a FT firm suffers from the moral hazard problem. An expansion of FT producers necessarily implies that the marginal cost of production goes up, whereas oligopolists continue to produce with the same marginal cost. Note carefully that this will not drive the FT firm out of the market but integration will benefit oligopolists overproportionally and the FT firm underproportionally. All firms, including the FT firm, will produce more which will result in a rise in oligopolistic profits and the FT firm's surplus (distributed back to producers).

It is unlikely that it is integration alone which has contributed to the establishment of FT firms in recent years and the boom in the 'boutique'

coffee market, so we also consider the impact of a perceived lessening of the degree of substitutability, by consumers, between the two qualities of good being produced. That is, we conduct comparative statics on γ. For the case of no rivalry in the high quality market, the effect of a change in γ on FT production is ambiguous.

Proposition 3 *If only the FT firm is active in the high quality market, FT production increases (decreases) with γ if*

$$z^* > (<)\frac{A-t}{4\gamma}.$$

Proof: See Appendix A.2.

Note that Proposition 3 is neither in conflict with Assumption 1 nor with condition (10). It shows that the response of the FT firm depends on the level of aggregate FT output. An increase in γ makes oligopolists and the FT firm closer rivals. If the moral hazard problem of FT production is not severe, the FT firm's marginal costs increase only moderately, and thus the FT firm will be large in size. An increase in γ will make the FT firm increase output (and vice versa) because it is now more capable of stealing business from the low quality market. A low size of the FT firm, however, indicates a substantial moral hazard problem and strongly increasing marginal costs, and the FT firm would like to reduce FT output in order to compensate for the price decline in the high quality market. This decline is caused by relatively efficient oligopolists stealing business in the FT market. Hence, if γ declines, we expect an increase (decrease) in the size of the FT firm if its size has been small (large).

In the case of rivalry in the high-quality market, we find, perhaps surprisingly, that the substitutability parameter γ does not appear in the FT firm's first-order condition (see (A.6) in Appendix A.3). Hence, any change in γ will not affect the optimal number of FT producers. This result warrants an explanation. In our linear setting, we find that the impact of the aggregate output of the rival oligopolists due to a change in γ will just neutralize each other. In fact, define $\Omega \equiv n(\gamma X + Y)$, and we find that $d\Omega/d\gamma = n(X+\gamma dX/d\gamma+dY/d\gamma) = 0$ (see (A.9) in Appendix A.3). Thus, any

change in market shares is driven by changes in output levels of oligopolists. Proposition 4 shows that the effect depends on the relative market potential of the high-quality market, defined as

$$\frac{\alpha - c - t}{A - t}.$$

Proposition 4 *Given that both the FT firm and the oligopolists are active in the high quality market, an increase in* γ

1. *will not change the number of FT producers,*

2. *will decrease (increase) the oligopolistic output in the low- (high-)quality market if*
$$\frac{\alpha - c - t}{A - t} < \frac{1 - \gamma^2}{2\gamma},$$

3. *will increase the oligopolistic output in both markets if*
$$\frac{\alpha - c - t}{A - t} \in \left[\frac{1 - \gamma^2}{2\gamma}, \frac{1 + \gamma^2}{2\gamma}\right]$$

4. *will increase (decrease) the oligopolistic output in the low- (high-)quality market if*
$$\frac{\alpha - c - t}{A - t} > \frac{1 + \gamma^2}{2\gamma}.$$

Proof: See Appendix A.3.

Proposition 4 demonstrates that a decrease in substitutability has a non-monotonic impact on market shares. If the relative potential of the high quality market is large, a decrease in γ will make the oligopolistic output in the high quality market larger. Since the number of fair trade producers stays constant, the market share of the FT firm will decline and the market share of oligopolists will rise. On the other hand, if the relative market potential of the high-quality market is small, y_i^{**} will decline, so that the FT firm's market share will rise and the oligopolistic market share will decline. Hence, we may expect a decline in the FT firm's market share if the relative potential of the high-quality market is large or has become larger over time, when these two commodities have become less substitutable at the same time.

Next, we consider the effects of changes in consumers' willingness to pay a premium for FT products: an increase in the "warm glow" effect. Not surprisingly, this will lead to an expansion of the FT firm and the number of FT producers and a decline in the operations of the oligopolistic firms.

Proposition 5 *Given that both the FT firm and the oligopolists are active in the high quality market, an increase in* δ

1. *will increase the number of FT producers and*

2. *will decrease the oligopolistic output in the high quality market.*

Proof: See Appendix A.4.

Finally, given that integration increases FT production and enhances consumers' warm glow, we consider whether a small increase in FT at the margin – perhaps through a quota on non-FT trade or a small subsidy to FT production – could raise welfare.[17] This analysis draws upon trade policy papers which determine under which conditions imports of a foreign firm should be supported (or discouraged).[18] The increase in consumer surplus must be balanced against the decline in aggregate profits, and the outcome is unclear in general. Without any warm glow effect, the effect of an increase in z is similar because an FT firm gives all net revenues back to producers.[19] Let us label the incentive or disincentive to increase z marginally without any warm glow effect the *marginal import effect*. We would now like to explore how this incentive is changed when fair trade is considered, and thus we call the second effect the *marginal warm glow effect*.

We do this exercise for the case of competition in the high quality market by considering a marginal expansion of FT production which has been set equal to the optimal number of FT producers by the FT firm. Hence, the marginal FT surplus will be equal to zero and any marginal change will have

[17]We do not model the dynamic consequences of FT firms, particularly the danger of encouraging producers to overly postpone exit from a declining industry. Accordingly, our welfare analysis, while looking at global welfare, is static in nature only.

[18]For an overview, see Feenstra (2004), Chapter 7.

[19]A further complication of our model is that the FT firm is a Stackelberg leader and an increase in z affects both markets.

only second-order effects on the FT firm's surplus. Using (7), we may write the maximixed profits of an oligopolist as $\Pi_i^{**} = x_i^2 + y_i^2 + 2\gamma x_i y_i$, and since x_i does not change with z, the change in profit is equal to

$$\frac{d\Pi_i^{**}}{dz} = -\frac{2y_i}{n+1} < 0, \frac{d\Pi^{**}}{dz} = -\frac{2Y}{n+1} < 0,$$

where Π^{**} denotes the aggregate profits on the industry level. As expected, aggregate profits will decrease with FT production (*i.e.*, $dz > 0$). As for consumer surplus, we find that

$$\frac{dU}{dz} = -p_Y \left(\frac{dY}{dz} + 1\right) X - q_Y \left(\frac{dY}{dz} + 1\right)(Y + z) + \delta \left(w^* + z\frac{dw^*}{dz}\right),$$

where dw^*/dz gives the marginal change of the equilibrium wage with FT output. Defining social welfare as $W \equiv \Pi^{**} + U + S(z)$, and since $dY/dz = -n/(n+1), dY/dz + 1 = 1/(n+1)$ and $dS(z = z^*)/dz = 0$, we arrive at

$$\frac{dW}{dz} = \underbrace{\frac{\gamma X - (Y - z)}{n+1}}_{\text{(I)}} + \underbrace{\delta \left(w^* + z\frac{dw^*}{dz}\right)}_{\text{(II)}}. \tag{14}$$

Term (I) is the marginal import effect, the sign of which is ambiguous without further assumptions, and term (II) is the marginal warm glow effect, which we are able to sign in order to prove Proposition 6.

Proposition 6 *The marginal warm glow effect is negative.*

Proof: Appendix A.5 shows that

$$w^* + z\frac{dw^*}{dz} = -\frac{\lambda^2}{2\mu z^2(1-\delta)^2} < 0. \ \square \tag{15}$$

Proposition 6 demonstrates that *ceteris paribus* the warm glow effect does not warrant an increase in FT production. Hence, if the marginal import effect is negative, the overall effect is negative irrespective of the size of δ. Furthermore, a positive but moderate marginal import effect may be over-compensated by the negative warm glow effect.

Why does the warm glow effect make promotion of FT products less attractive? The reason is the increasing marginal cost which the FT firm

faces due the moral hazard problem. We may rewrite the marginal warm glow effect in terms of the elasticity of wages w.r.t. FT production:

$$\delta\left(w^* + z\frac{dw^*}{dz}\right) = \delta w^*\left(1 + \frac{dw^*/w^*}{dz/z}\right).$$

Eq. (15) demonstrates that this elasticity is less than -1. Hence, a relative output increase implies an overproportionally large relative decrease in the wage rate. A marginal increase in FT output leads to less efforts by each FT producer and thus an increase in marginal cost.[20] In conclusion, the moral hazard effect of FT production works against any favorable treatment of FT products.

5 Concluding Remarks

This paper has developed a model of the behavior of fair trade organizations, taking into account the apparent fact[21] that consumers are willing to pay more for a fair trade product since consumption of fair trade products gives rise to a warm glow effect. However, fair trade production comes with an additional cost, as any fair trade organization must be vertically integrated. This vertical integration limits the size of the fair trade organization compared to its rivals in international markets. In particular, while economic integration will make the fair trade organization absolutely larger in size, its size shrinks relative to that of its rivals. Hence, while we conclude that economic integration will support the establishment and the increase in size of fair trade organizations, our analysis suggests that there is a limit to the size that a fair trade firm can attain - at least, under the ownership structures that current fair trade firms impose – which constrains its ability to expand in competition with non-vertically integrated rivals.

Furthermore, our analysis lends only partial support to the contention that,"[t]he ethical consumer and the fair trade premium are not the core of

[20]In fact, the marginal warm glow effect would disappear if the marginal cost of FT production were constant, contrary to our assumptions. In this case, $\lambda = 0$ and $(dw^*/w^*)/(dz/z) = -1$ according to eq. (15).

[21]See Hiscox and Smyth (2005) for semi-experimental evidence on this. We are grateful to Steve Matusz for this reference.

fair trade" (Hayes, 2006 p.466.) It is true that one of fair trade's central impacts is on the input market. However, a sufficiently large warm glow effect is necessary for the establishment of the fair trade firm if trade costs are insufficiently low (particularly if we assume that the fair trade firm also has to carry some fixed start-up costs). Hence, either economic integration and/or the warm glow effect must be sufficiently strong in order to make fair trade production worthwhile. However, where the warm glow effect is present, it does not necessarily imply that fair trade production warrants any favorable treatment by the importing country. If fair trade production were supported, the wage paid to fair trade producers would decrease overproportionally because each fair trade producer will reduce its efforts and marginal costs will increase.

Our model has been set up such that it matches the stylized facts of fair trade production which are (i) that fair trade products aim at the high end of markets and face competition in these markets or markets of close substitutes, (ii) that the number of fair trade producers forming the fair trade organization is *de facto* restricted, and (iii) that fair trade organizations must be vertically integrated in order to be credible, and that this vertical integration gives rise to a moral hazard problem. Fair trade coffee production has been shown to be the pioneering fair trade brand. Since vertical integration limits the scale of fair trade production, it is hard to predict whether its increase in market share will continue and whether a lot of other commodities will follow to be offered also as a fair trade product.

In terms of future work, fair trade production has become more and more visible and therefore deserves further academic attention. In particular, we did not take into account that fair trade production may make fair trade producers less sensitive to market signals. We have also assumed that fair trade producers have identical abilities. If they differ in terms of productivity, should the fair trade firm sign contracts with the most efficient producers, as to maximize the aggregate surplus, or does that undermine the spirit of the fair trade movement? Furthermore, we assumed only one fair trade firm. If fair trade production will continue to boom, will more fair trade firms be established or is competition undermining the warm glow effect? Indeed,

Nicholls and Opal (2004, p.246 ff.) note that the fair trade 'movement' already faces threats both from within (competing fair trade certification bodies) and without (from self-certification by farmers or low-cost independent certification.) The long-run entry dynamics of this sort of market are an important and promising area for future research.

Appendix

A.1 The international coffee market

In order to motivate some of the modeling assumptions we have made in the paper, we here present a brief overview of the world coffee market. There are broadly four stages in the production of a cup of coffee for a consumer: the growing of green beans by farmers, the purchase of those beans and production of roasted or ground beans or soluble coffee by processors (roasters), the wholesale of that processed output to retailers and the final sale to consumers. The current structure of the international coffee market (low prices for farmers, a few major roasters and international traders and thousands of small, unorganized coffee growers) has been interpreted as the outcome of a transition from an institutionalized market, heavily controlled for 30 years, to one with little stability and excess supply. From 1962 to 1989 the world coffee market was controlled by the International Coffee Agreement (ICA) through quotas and supply controls signed by producer and consumer countries, members of the International Coffee Organization (ICO). The sole purpose of such agreements was the stabilization of the market to prevent fluctuating prices.

The demise of the agreement saw prices drop and they have remained at historic lows for the last 15 years, which has led to various proposals and mechanisms designed to 'protect' small coffee farmers. Figure 1 shows the price per pound in international markets for Arabica and Robusta types from 1957 to 2005. The close co-movement suggests considerable substitutability between the two types of bean.

Insert Figure 1 about here.

The guarantee of stable prices under the ICA created opportunities for countries to develop strong coffee sectors; furthermore, the price hikes in 1977, 1979 and 1986 (caused by Brazilian frosts) encouraged increased plantations globally. Underlying this process are low short-run supply and demand price elasticities. The elasticity of supply is low in the short run since it takes at least two years for a new tree to be productive, so short run changes

in prices affect other variable factors of production, particularly labour and hence farmers' incomes. In the longer run, supply elasticities are higher and historically growers have responded enthusiastically to sporadic high prices. Since demand elasticities are argued to be low in the short run also, output fluctuations can lead to highly volatile prices in periods of high prices consumption does not decrease, and neither increases in periods of low prices where production is typically high. The demise of the ICA in 1989 has been attributed to various factors:

- the retirement of United States from the ICA after a change in consumption patterns towards ground (mostly Arabica) rather than soluble (mostly Robusta) coffee and its effects on big roasters,
- the failure of the agreement to constrain country members to quotas,
- the political struggle by producing members to get larger exporting shares,
- the effort of new producers to enter,
- production 'leakages' going (coming) to (from) non-member countries.

While there were benefits of the ICA for coffee growers in terms of income stability (see Akiyama and Varangis, 1990) it has also been argued that it created artificially high prices, encouraging over-plantation and a subsequent excess supply. Interestingly, in light of the fondness expressed by many FT apologists for the quota-controlled days of the ICA, recent evidence (see Krivonos, 2004) suggests that post-ICA market-oriented reforms have tended to increase the share of producers in the world price of coffee.

But the ICA's demise is not the only cause of the current reduction in prices. The excess supply of coffee from growing plantations in Brazil and Vietnam (currently the second largest producer, passing from 73,000 bags in 1980 to 14 million in 2004), a lower growth rate in consumption (Fig. 2) and, finally, technological progress in production (increased mechanization in Brazilian plantations, more resilient coffee plants in Colombia and higher quality extraction from Robusta coffee by roasters), have all been identified as sources of the steady reduction in prices since 1986. Figure 2 shows the four biggest coffee producers of the world in 2005. The spectacular growth of Vietnam since the beginning of the 90s and the peak in production of Brazil between 1995 and 2002 partially explain the increased supply of the same period in the world market, as seen in Figure 3.

Insert Figures 2 and 3 about here.

With the end of the ICA, the 'balance of power' in the world coffee market changed from producers and consumers associated under one roof – the ICA-ICO – toward a liberalized market with thousands of coffee growers (organized, or not, in local associations) and a few large international traders and roasters. In 1993 a number of producer countries formed the Association of Coffee Producer Countries (ACPC) in an attempt to control supply through export retention schemes, but these attempts failed in 1998-99 and 2000-01. Many argue that the current structure of the world coffee market has tilted in favor of roasters *vis-à-vis* other actors (international traders and growers). As discussed in Ponte (2002), "International traders argue that roasters have gained increasing control of the marketing chain in recent years because of oversupply, increased flexibility in blending and the implementation of 'supplier-managed inventory' (SMI)" (p. 1108). SMI allows roasters to shift inventory holding costs to trading houses; at the same time traders have strengthened ties with local exporters (upstream market integration).

The five major roasters (Kraft, Nestlé, Procter & Gamble, Sara Lee and Tchibo) take almost half of the world supply of green coffee. The biggest importer countries in 2005 (with 55% of the market) are the United States, Germany, Japan, Italy, France and Spain (figure 4). Aside from these big roasters, other important players in the market are big supermarket chains, especially in soluble coffee.

Insert Figure 4 about here.

Interestingly, for what used to be a highly regulated market, coffee faces very low import tariffs and non-tariff measures (NTM) in major consumer countries. In 2005, the European Union, the United States, Japan, Canada and Switzerland, accounted for 90% of the world imports of green coffee and none had tariffs or NTM (only Canada in 2000 and Switzerland in 1996 report any NTM against coffee). In roasted coffee, where the United States, Canada, European Union, Japan and Australia take almost 70% of world imports, the EU has a 7.5% tariff and Japan 12%, but the rest have almost no trade restrictions (Canada, Australia and Switzerland do report some NTMs in 2000 and 1996).

For trade in processed coffee, however, there are some trade restrictions. For instant coffee imports, the EU, with almost 20% of imports in 2005, applies a 9% tariff, and Japan an average tariff of 15%, and the US and Russia report incidence of NTM on 100% of imports.[22] Table 1 summarizes this information.

[22]For goods that use coffee as a base input, the Russian Federation and Saudi Arabia apply 15% and 5% tariffs, respectively. Finally, the countries in the world with the highest tariffs against green coffee are India, Seychelles and Bhutan, at 100%, 50% and 50%, respectively, but insignificant shares in world trade. For roasted coffee Dominica, India

Insert Table 1 about here.

Alongside the reshaping of the international coffee market there has been a change in coffee consumption trends. Specialty coffees or "conscious consumption",[23] single origin coffees, coffee chains and speciality shops have emerged as alternatives to the homogenized brands traditionally sold in supermarkets. The success and growth of coffee bars such as Starbucks, or Tchibo in Germany, has increased public awareness (especially amongst younger consumers) of the structure of the international coffee market, branding coffee consumption as an "experience" with a cafe atmosphere, new coffee flavours,[24] FT branded coffee, single origin and gourmet coffees (see *The Economist*, 2007). In the face of falling prices the question of how to support the income of small coffee growers has been a pressing one. Attempts at cartelization through growers associations have failed, in a world of market integration and de-regulation in trade, as noted in the failure of the ACPC to constrain supply in the early 1990s. One option suggested by some has been to try to induce coffee producer countries to shift up 'the value chain'. But this faces several obstacles:

- economies of scale in existing processing factories in United States and Europe are high and difficult to overcome. Sutton (1991) notes very high fixed costs associated with production of instant coffee, in particular, that constitute a significant barrier to small entrants;
- brand space crowding by existing leading coffee brands (ground and soluble) means the creation and commercialization of new brands may not be a viable solution for small coffee growers;
- shelving and transportation of ground and soluble coffee is more expensive than green coffee storage. For efficient transportation, processed coffee must be agglomerated and re-packed, which affects the initial quality reached in blending; also transportation of packed coffee is more expensive as it is heavier;
- packing, advertising and branding from producer countries may be more expensive than in consumer countries, given strict regulation in the latter.

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and Mexico set the highest tariffs, at 135%, 100% and 72%, respectively. In this segment, the United States, Switzerland, Canada, Brazil, Colombia and Mexico are the largest exporters and all except the US impose NTM on 100% of imports.

[23]Defined in Ponte (2002) as consumption of fair trade, organic, shade-grown and bird-friendly coffees.

[24]New coffee recipes beyond black water coffee, such: iced coffee, cappuccino, frapuccino, mocha (chocolate blended coffees), caramel coffee, etc.

It is under these circumstances that the FT initiative has promoted its labelling campaign from coffee growers to final retailers, guaranteeing a 'decent' income for farmers and informing consumers of the good deed they are doing in buying FT branded coffee. The growth of FT has been impressive, especially in recent years. In Europe it has experienced almost 25% growth in sales outlets since 1999. In the US, the market share increased from 0.60% to 4.30% in the specialty sector; and from 0.20% to 2.20% of total coffee sales between 2000 and 2005 (Wilkinson, 2006).

In light of this discussion, in the model of the paper we assume that the processing and marketing of coffee is dominated by a few large firms buying green coffee on a world spot market with no cartelization of producers; that there are quality-differentiated varieties of final-good coffee which are substitutes in demand and the oligopolists sell to both markets; that a FT firm is effectively vertically integrated over the growing and marketing stages of high-quality green beans which are then sold on to processors; that the FT firm returns all surplus to its farmers; that consumers of high quality coffee are willing to pay a premium increasing in the wage paid to farmers; and that all production of beans occurs in a country different to that in which coffee is consumed so that all middlemen firms incur trade costs. Furthermore, in our model there are two ways of producing high-quality final coffee: one is due to higher farmer effort in growing the input beans and the other is through higher cost processing of input beans.

A.2 No rivalry in the high quality market

The first-order condition for the FT firm reads

$$\begin{aligned}\frac{\alpha - z^* - \gamma n\frac{A-t-\gamma z^*}{n+1} - \theta - t}{1-\delta} + \frac{2z^*-1}{2z^{*2}}\frac{\lambda^2}{\mu(1-\delta)^2} \\ -z^*\left(\frac{1+n-n\gamma^2}{(n+1)(1-\delta)} + \frac{2z^*-1}{z^{*3}}\frac{\lambda^2}{\mu(1-\delta)^2}\right) = 0.\end{aligned} \tag{A.1}$$

The second derivative is

$$-\frac{\frac{4(1+n(1-\gamma^2))(1-\delta)}{n+1} + \frac{2\lambda^2}{\mu z^3}}{2(1-\delta)^2} < 0, \tag{A.2}$$

and is clearly negative. Hence, surplus is strictly concave in z if $z > \hat{z}$. Differentiating (A.1) w.r.t. t yields

$$-\frac{n(1-\gamma)+1}{(n+1)(1-\delta)} < 0, \tag{A.3}$$

so that

$$\frac{dz^*}{dt} < 0.$$

Differentiating (A.1) w.r.t. γ yields

$$\frac{4\gamma z^* - (A-t)}{(n+1)(1-\delta)}$$

so that

$$\frac{dz^*}{d\gamma} > (<)0 \text{ if } z^* > (<)\frac{A-t}{4\gamma}.$$

A.3 Rivalry in the high quality market

Using (9), we may rewrite the high-quality price as a function of z:

$$q(z) = \alpha - n(\gamma x_i(z) + y_i(z)) - z = \frac{\alpha + n(c+t) - z}{n+1}. \tag{A.4}$$

Given the FT producer behavior, the surplus can be rewritten as

$$z\left(\frac{\frac{\alpha+n(c+t)-z}{n+1} - \theta - t}{1-\delta} + \frac{2z-1}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^2}\right). \tag{A.5}$$

The first-order condition for the FT firm is

$$\begin{aligned} &\frac{\frac{\alpha+n(c+t)-z^*}{n+1} - \theta - t}{1-\delta} + \frac{2z^*-1}{2z^{*2}}\frac{\lambda^2}{\mu(1-\delta)^2} \\ -z^*&\left(\frac{1}{(n+1)(1-\delta)} + \frac{(z^*-1)}{z^{*3}}\frac{\lambda^2}{\mu(1-\delta)^2}\right) = 0. \end{aligned} \tag{A.6}$$

Note carefully that (A.6) does not depend on γ; hence any change in γ will not change the number of FT producers (see Proposition 4) unless it leads to a regime switch such that z^* hits $\hat{z}$. The second derivative is

$$-\frac{\frac{2(1-\delta)}{n+1} + \frac{\lambda^2}{\mu z^3}}{(1-\delta)^2} < 0, \tag{A.7}$$

and is clearly negative. Hence, surplus is strictly concave in z if $z < \hat{z}$. Differentiating (A.6) w.r.t. t yields

$$-\frac{1}{(n+1)(1-\delta)} < 0, \tag{A.8}$$

so that

$$\frac{dz^*}{dt} < 0.$$

The size of dz^*/dt can be determined by using the implicit function theorem and (A.7) and (A.8). This leads to dz^*/dt as used in Proposition 2. As for the changes of x_i^{**} and y_i^{**} with γ, note that we may compute them by using (9) directly as z will not change with γ. We find that

$$\begin{aligned} \frac{dx_i^{**}}{d\gamma} &= \frac{(1-\gamma^2)(\alpha-c-t)-2\gamma(A-t)}{(1-\gamma^2)(n+1)}, \\ \frac{dy_i^{**}}{d\gamma} &= \frac{(1+\gamma^2)(A-t)-2\gamma(\alpha-c-t)}{(1-\gamma^2)(n+1)}, \end{aligned} \tag{A.9}$$

which completes the proof of Proposition 4. Furthermore, (A.9) proves that

$$n(X + \frac{\gamma dX}{d\gamma} + \frac{dY}{d\gamma}) = 0$$

since

$$X = n\frac{A-(1-\gamma)t-\gamma(\alpha-c)}{(n+1)(1-\gamma^2)}.$$

A.4 Proof of Proposition 5

Totally differenting (11) w.r.t. z and δ – taking into account that dX/dz and dY/dz do not depend on δ – shows that $dz^*/d\delta$ and $\partial^2 S/\partial z\partial\delta$ have the same sign because $d^2S/dz^2 < 0$. Furthermore,

$$\begin{aligned} \frac{\partial^2 S}{\partial z\partial\delta} &= \frac{\partial v^*}{\partial\delta} - \frac{z}{(1-\delta)^2}\left(1 + \frac{dY}{dz} + \gamma\frac{dX}{dz} - \frac{z-1}{z^3}\frac{\lambda^2}{\mu(1-\delta)}\right) \\ &\quad + \frac{z}{1-\delta}\frac{z-1}{z^3}\frac{\lambda^2}{\mu(1-\delta)^2} \\ &= \frac{\partial v^*}{\partial\delta} - \frac{v^*}{1-\delta} + \frac{z-1}{z^2}\frac{\lambda^2}{\mu(1-\delta)^3}, \end{aligned} \tag{A.10}$$

where $dS/dz = 0$ (see eq. (11)) has been used. We also find that

$$\frac{\partial v^*}{\partial\delta} = \frac{\alpha - z - Y - \gamma X - \theta - t}{(1-\delta)^2} + \frac{2z-1}{2z^2}\frac{2\lambda^2}{\mu(1-\delta)^3} = \frac{v^*}{1-\delta} + \frac{2z-1}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^3}, \tag{A.11}$$

where the definition of v^* (see (5)) has been used. Hence,

$$\frac{\partial^2 S}{\partial z\partial\delta} = \frac{2z-1}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^3} + \frac{z-1}{z^2}\frac{\lambda^2}{\mu(1-\delta)^3} = \frac{4z-3}{2z^2}\frac{\lambda^2}{\mu(1-\delta)^3} > 0, \tag{A.12}$$

which proves that an increase in the warm glow effect increases the number of FT producers. Furthermore, the oligopolistic output levels decrease with an increase in z^* (see (8) and (9)). □

A.5 Proof of Proposition 6

We may rewrite the FT firm's objective funtion (6) such that the surplus is given by

$$S(z) = z(w - f(e)), f(e) = \frac{1}{2}\mu e^2.$$

In equilibrium, optimal efforts are equal to $e^* = \lambda/(\mu z(1-\delta))$, so that

$$f(e^*) = \frac{\lambda^2}{2\mu z^2(1-\delta)^2}, \frac{df(e^*)}{dz} = -\frac{\lambda^2}{\mu z^3(1-\delta)^2}.$$

The FT firm maximizes surplus so that

$$\frac{dS}{dz} = w + z\frac{dw}{dz} - f - z\frac{df(e^*)}{dz} = 0$$

holds which implies

$$w + z\frac{dw}{dz} = f + z\frac{df(e^*)}{dz} = -\frac{\lambda^2}{2\mu z^2(1-\delta)^2}. \square$$

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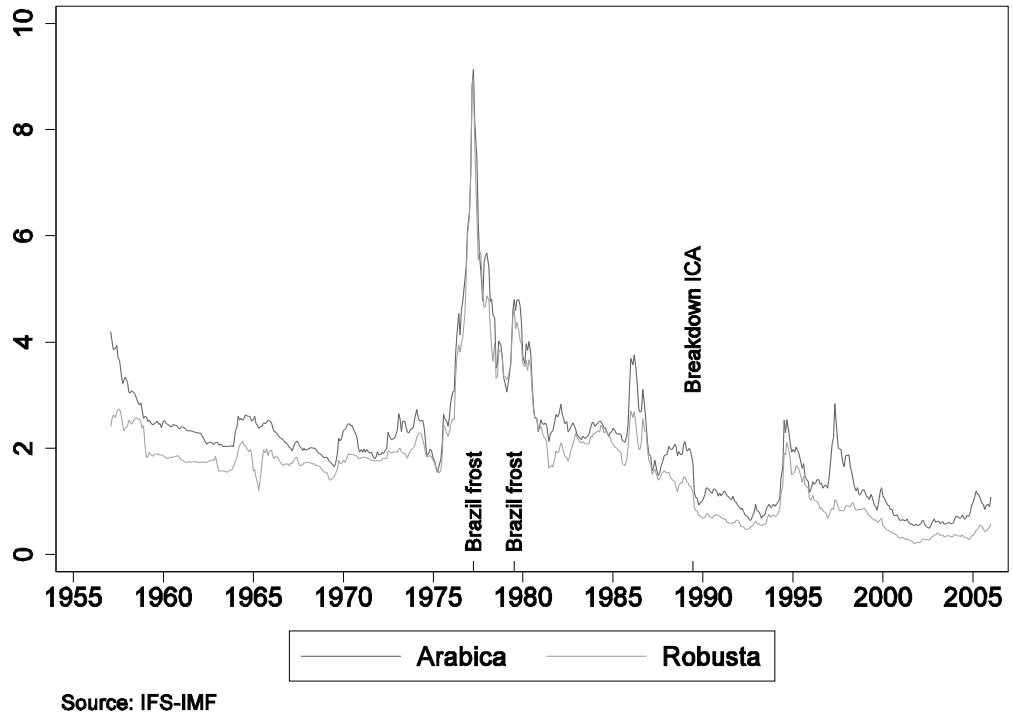

Figure 1. Arabica and Robusta coffee prices. Constant 2000 US$/lb, deflated by US CPI.

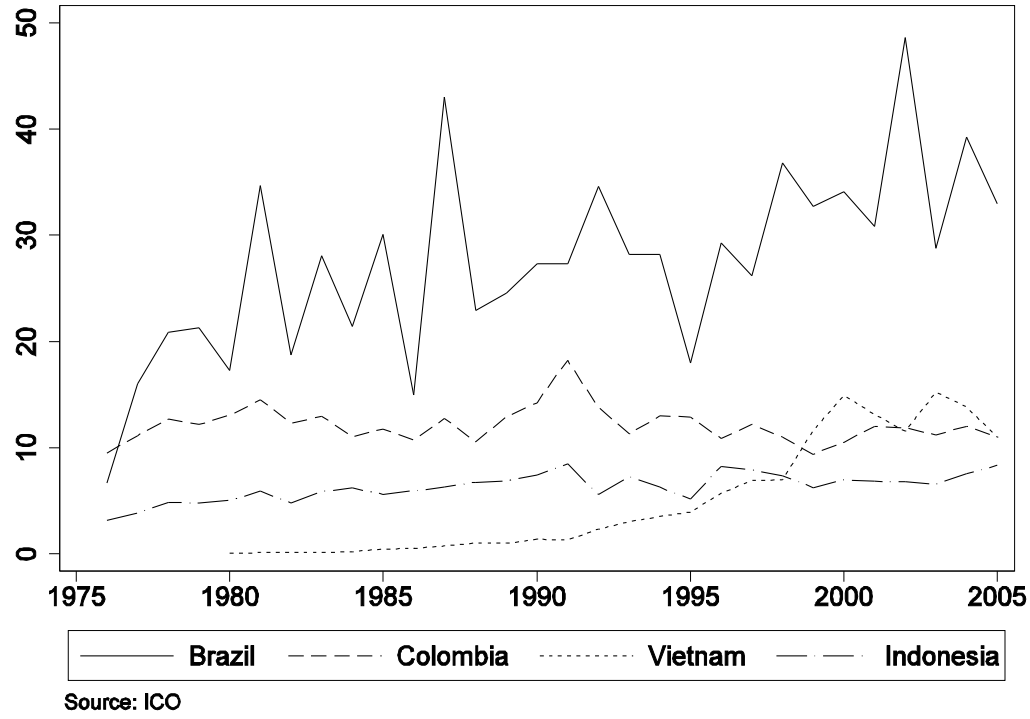

Figure 2. Largest coffee producers. Top 4 coffee producers in 2005. Millions of 60k bags.

Figure 3. ICO members' production and world imports. Millions of 60k bags.

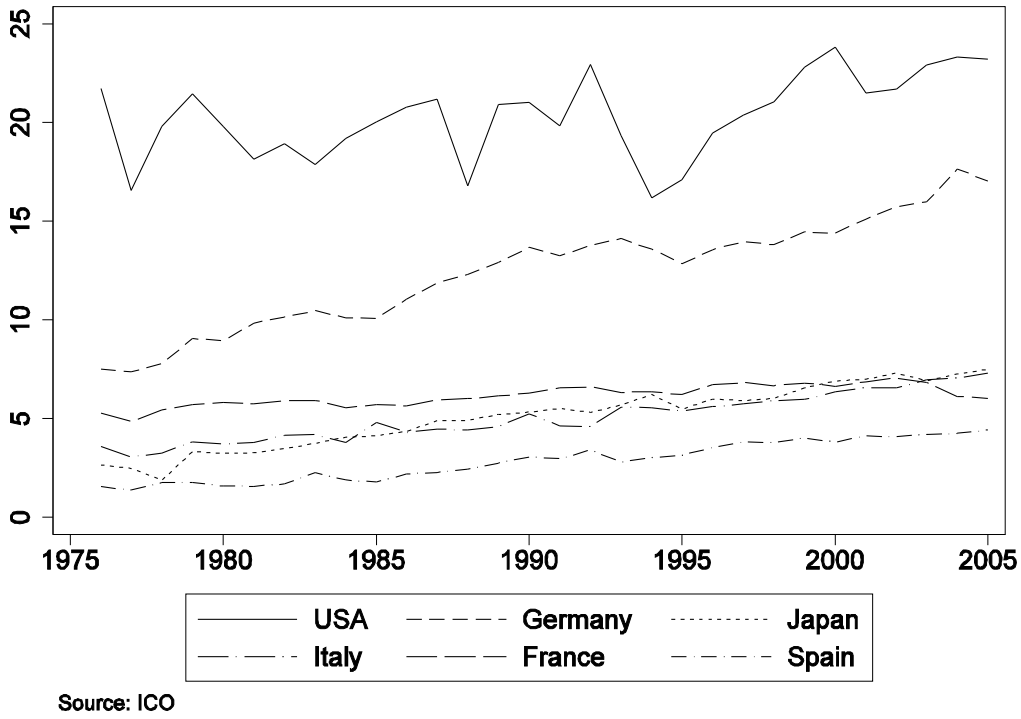

Figure 4. Largest coffee importers. Top 6 coffee importers in 2005. Millions of 60k bags.

Green coffee /a

Country	World imports share	MFN Mean (%)	NTM Incidence (%)
European Union	0.491	0	0
United States	0.258	0	0
Japan	0.101	0	0
Canada	0.032	0	100
Switzerland	0.021	0	100

Country	World exports share	MFN Mean (%)	NTM Incidence (%)
Brazil	0.300	10	100
Colombia	0.152	15	100
Vietnam	0.090	20	100
Indonesia	0.056	2.5	100
Guatemala	0.053	13.8	100
Honduras	0.041	13.8	0

Roasted coffee /b

Country	World imports share	MFN Mean (%)	NTM Incidence (%)
United States	0.251	0	0
Canada	0.247	0	100
European Union	0.125	7.5	0
Japan	0.044	12	0
Australia	0.036	0	100
Switzerland	0.031	N.A.	100

country	World exports share	MFN Mean (%)	NTM Incidence (%)
United States	0.369	0	0
Switzerland	0.286	N.A.	100
Canada	0.133	0	100
Brazil	0.055	10	100
Colombia	0.029	17.5	100
Mexico	0.025	72	100

Instant coffee packaged for retail /c

Country	World imports share	MFN Mean (%)	NTM Incidence (%)
European Union	0.189	9	0
United States	0.161	0	100
Russian Federation	0.157	N.A.	100
Japan	0.081	15.9	0

Preparations with coffee extracts /d

Country	World imports share	MFN Mean (%)	NTM Incidence (%)
Russian Federation	0.138	15	100
Saudi Arabia	0.079	5	0
China (Taiwan)	0.067	2	100
Canada	0.066	0	0

Notes: a. Non roasted, non decaffeinated coffee (beans) Harmonized Trade System (HTS) No. 090111. b. Roasted, non decaffeinated coffee (beans) HTS No. 090121. c. Instant coffee, not flavor non decaffeinated packaged for retail sale HTS No. 210111. d. Preparations with a base of coffee extracts for retail sale HTS No. 210112. MFN: Most favore nation. NTM: Non Tariff Measure

Source: UNCTAD - TRAINS. www.unctad.org

Table 1. Coffee trade tariffs. Largest importers and exporters. Where imports are shown, the table refers to tariffs imposed by the biggest importer of the good. Where exports are shown the table refers to tariffs on imports imposed by the biggest exporter.