NiCE Working Paper 12-106
September 2012

The effects of Fair Trade when productivity differences matter

Maarten Breimer
Albert de Vaal

Nijmegen Center for Economics (NiCE)
Institute for Management Research
Radboud University Nijmegen

P.O. Box 9108, 6500 HK Nijmegen, The Netherlands
http://www.ru.nl/nice/workingpapers

The effects of Fair Trade when productivity differences matter

Maarten Breimer and Albert de Vaal*
Radboud University Nijmegen

September 2012

Abstract

This paper uses a heterogeneous firms model to scrutinize Fair Trade's aim to help the most disadvantaged producers in developing countries. Incorporating important aspects of Fair Trade in a two-good heterogeneous firm model we show that only the most productive firms will join Fair Trade arrangements. Higher required production standards and entry costs make Fair Trade not viable for low-productivity firms, despite its advantage of offering direct and secure distribution channels to international consumer markets. To overcome this selection effect, Fair Trade organizations may want to reconsider their selection criteria, focussing on a firm's productivity rather than its capacity to adhere to Fair Trade standards.

1 Introduction

Fair Trade can be best described as a movement that applies fairness principles in the supply chain from poor local smallholders in developing countries to consumers in rich developed countries. The concept is put to practice by Fair Trade Organizations (FTOs), replacing middlemen in the supply chain and offering long-term trading relationships. Fair Trade has known a continuous world-wide growth over the past decades, both in sales and volume (e.g. Raynolds and Long, 2007). Sales of certified products reached US$ 4.3 billion in 2010, showing an average growth of more than 30% annually since 2005 (FLO, 2011a). In less than two decades, fair trade "has grown from an obscure niche market to a globally recognized phenomenon" (Murray and Raynolds, 2007: 5).

*Corresponding author: P.O. Box 9108, 6500 HK Nijmegen, The Netherlands. Tel: +31 24 3615888; Fax: +31 24 3612379; Email: a.devaal@fm.ru.nl

The aim of Fair Trade is "to offer the most disadvantaged producers in developing countries the opportunity to move out of extreme poverty through creating market access under beneficial rather than exploitative terms" (Nicholls and Opal, 2005: 6). This is accomplished by paying local producers a stable, guaranteed minimum price for decent coverage of production and living costs, as well as by providing them with a development premium for local projects to improve social, economic and environmental infrastructure. FTOs charge higher prices for comparable products in rich consumer markets to facilitate these above market payments.

Economic analyses of the impact of Fair Trade have concentrated on the claims FTOs make, primarily regarding the alleged effects on income levels of the targeted group and the efficiency by which this is reached. Theoretical contributions include analyses of the distorting effects of using price floors as a mechanism to increase local producers' incomes (Lindsey, 2004; LeClair, 2002), the efficiency of fair trade as a vehicle of transferring income to the poor (Yanchus and De Vanssay, 2003), the effect of privileged market access for fair trade producers on other producers, locally or abroad (Maseland and de Vaal, 2008), and the verdict that fair trade outperforms free trade in alleviating poverty in developing countries (Maseland and de Vaal, 2002). Fair trade has also been assessed on its potential to eradicate monopsony powers and other market imperfections in supply chains (Hayes, 2006). De Janvry et al. (2010) point out that the floor prices offered by Fair Trade are bound to lead to overcertification, eroding the net benefit producers receive from the price premium consumers pay for Fair Trade goods. Finally, a first comprehensive empirical study of the effects of fair trade on local incomes is given in Ruben (2008).

This paper uses a heterogeneous firms model to scrutinize the alleged aim of Fair Trade to help the most disadvantaged producers in developing countries. We incorporate important characteristics of Fair Trade in a two-good heterogeneous firm model à la Bernard et al. (2003), finding that unless specific measures will be taken, Fair Trade will not succeed in reaching society's poorest producers. In our model, producers decide whether to produce a Plain Good (PG) or a Fair Trade (FT) good. PG production is the default mode of entry for any firm entering the market, but after entry producers may switch to FT production. The special traits of the Fair Trade movement we incorporate are as follows.[1] First, FT products are produced by adhering to better, yet also more costly production standards. On the other hand, FT producers receive higher prices for their goods, which consumers of these products in rich countries are willing to pay. Second, we assume that the decision to start producing FT goods is clouded with some

[1]Milford (2004) gives an extensive overview of Fair Trade rules for coffee cooperatives, indeed featuring issues like payment of a fair trade premium, access to consumer markets and adhering to minimum (environmental) standards. See also the Fairtrade International website (www.fairtrade.net).

ambivalence on part of local producers. After all, entering a FT arrangement will imply abandoning familiar production methods and producing for different markets. We model these transition costs as an additional entry cost to the one that must be incurred by any firm that wants to produce. Finally, since Fair Trade also provides a sustainable trading relationship, it makes it less likely that FT firms are hit by an unexpected negative shock. Accordingly, we assume that the stochastic survival rate of FT firms is higher than for PG firms.

Our analysis shows that Fair Trade leads to a selection effect and that it will be the most productive firms that will join Fair Trade arrangements. The reason is that the higher production costs will only make FT production a more profitable option than PG production if a firm's productivity level exceeds some threshold level. As is standard in heterogeneous firms models, these firms will then also receive the highest profits. Since the least advantaged will be those producers with the lowest productivity, this implies that Fair Trade cannot fulfil its goal to help the most disadvantaged. Furthermore, the additional entry costs poses a barrier to Fair Trade that matters most for the least productive producers. The ambiguities involved with adapting to the different standards of Fair Trade will increase the selection effect, moving Fair Trade even further away from its goal. The practice of Fair Trade thus results in a paradox: When Fair Trade succeeds in its inherent workings – better standards, secure trade channels, and so on – the consequence is that it will help the better off, not the least advantaged.

We also show how FTOs could improve on their goal of reaching the poorest farmers. A comparative statics analysis on the key parameters of Fair Trade reveals that the threshold level of productivity to become a fair trade firm decreases when FTOs would be (better) able to reduce the ambiguities surrounding becoming a fair trade firm. Furthermore, to get the less productive firms into Fair Trade arrangements would be helped by a higher societal preference for Fair Trade goods and by higher standards in non-fair-trade good production. Nevertheless, as long as Fair Trade is more costly than plain good production, a selection effect remains and other measures may be required for FTOs to reach the poor.

Finally, we show that it is important that potential firms are aware of the possibility to engage in Fair Trade before they make their decision to become active as a firm or not. As we show, if the possibilities of Fair Trade are not known to producers in advance, firms already producing benefit disproportionately in the form of pure profits. In a setting of poor developing countries with few and dispersed Fair Trade operations, this is not an unlikely scenario.[2] The information effect arises because firms form false expectations regarding future profits. Weighing the initial entry cost against the net present value

[2] FLO International (2011b) reports that by the end of 2010 there were 905 Fairtrade certified producer organizations in 63 countries. The 938 000 farmers these organizations involve world wide compare to the total number of farm holders in countries like Guatamala and Burkina Faso (FAO, 2011).

of future profits, new firms are unaware that these could be higher due to fair trade production. Fewer firms will enter the market, leading to unemployment or a decline in real wages. Such adverse effects can be prevented by raising awareness about Fair Trade amongst potential entrants.

The structure of the paper is as follows. Section 2 incorporates the key aspects of fair trade into the demand and supply relations of a heterogeneous firms model. Section 3 elaborates on the entry and exit decisions of firms in view of fair trade possibilities and Section 4 discusses equilibrium. Section 5 applies comparative statics analysis to verify what it would take for FTOs to attract low-productivity firms as well. Section 6 focusses on the importance of having prior information on fair trade for the outcomes. Section 7 concludes.

2 Modelling Fair Trade and heterogeneous firms

Key to the success of Fair Trade is that some consumers have a preference for a category of products produced by a higher standard, willing to pay higher prices for it. Other consumers care less or are indifferent with respect to such fairness characteristics, seeing fair trade goods as any other good. We therefore assume that there are two categories of goods in society, fair trade goods and plain goods, which each yield different utility to different types of consumers. It is convenient to divide consumers in two broad categories. There is a group of ethical consumers who prefer fair trade goods, while a group of ordinary consumers would prefer plain goods. These preferences are fixed, but not absolute. Ethical consumers have a relative preference for fair trade goods, but not at every cost. By the same token, ordinary consumers may also buy fair trade goods.

We stylize this by assuming a representative consumer that values consumption of both plain goods and fair trade goods as follows:

$$U = \left[aC_{pg}^{v} + (1-a)C_{ft}^{v}\right]^{1/\nu}, \tag{1}$$

where $C_i, i \in \{pg, ft\}$, is a consumption index of different varieties from either the plain good category or the fair trade goods category and where v is a CES substitution parameter. This way of modeling is similar to the utility function of Bernard et al. (2003)[3]. The parameter $0 < a < 1$ is a demand shift parameter, which can here be interpreted as the

[3]It is also similar to the utility function in Bernard et al. (2010) where consumers have a preference for varieties of many different product categories. For our purposes it suffices to only model preferences for two types of products though. Furthermore, the focus of Bernard et al. (2010) is on productivity and demand related reasons for multi-product firms to switch products, for which reason they also include stochastic demand and idiosyncratic demand shocks.

relative importance the representative consumer gives to plain goods.[4] The importance of fair trade in utility is given by $1-a$. In our typology of different types of consumers, a would represent the share of ordinary consumers in society and $1-a$ the share of ethical consumers. The elasticity of substitution between categories is $\psi = 1/(1-\upsilon) > 1$. It is important since even though consumers have clear ideas on which category of goods they prefer, their actual consumption will also depend on the relative prices of goods from either product category.

Each product category consists of a multitude of varieties, indicated by the consumption index C:

$$C_i = \left[\int_{\omega \epsilon \Omega_i} c_i(\omega)^{\rho} d\omega \right]^{1/\rho},$$

where $c_i(\omega)$ is consumption of specific variety ω within the full set Ω_i of varieties of category $i \in \{pg, ft\}$ produced. Varieties within a category are imperfect substitutes, with elasticity $\sigma = 1/(1-\rho) > 1$. To focus on the difference between categories, preferences within a category are assumed to be constant and equal for both categories. In other words, the attractiveness of alternative varieties within a product category is constant and the same for ethical and ordinary consumers. Furthermore, we will make the standard assumption that the substitution elasticity within a category is larger than the substitution elasticity across categories: $\sigma - \psi > 0$.

We denote the price a consumer pays for a product variety by $p_i(\omega)$, The price index of a particular category of goods becomes:

$$P_i = \left[\int_{\omega \epsilon \Omega_i} p_i(\omega)^{1-\sigma} d\omega \right]^{1/1-\sigma}. \tag{2}$$

Consumers of either category maximize their utility by spending

$$r_i(\omega) = R_i \left[\frac{p_i(\omega)}{P_i} \right]^{1-\sigma} \tag{3}$$

on each variety ω. In this expression, $R_i = C_i \cdot P_i$ denotes overall spending on a particular category. Using $R = R_{pg} + R_{ft}$ to denote total expenditures in society, utility maximization also implies:

[4]The assumption that a is between 0 and 1 is necessary for having both categories produced.

$$\frac{R_{ft}}{R} = \frac{\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{1-\psi}}{1+\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{1-\psi}} = \frac{K}{1+K} \tag{4}$$

with K defined as $\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{1-\psi}$. The expenditure share of plain good products is then $1/(1+K)$. The importance of the demand shift parameter a in determining societal expenditure on fair trade goods is clear since $dR_{ft}/da < 0$: the expenditure share of fair trade goods increases when fair trade products are valued more (lower a). Furthermore, (4) reflects that the preference for the fair trade good and the willingness to pay more for it are clearly related. In order to keep fair trade's expenditure share constant, a higher price index for fair trade goods must go together with a higher preference for fair trade goods in society $(da < 0)$:

$$dR_{ft} = 0 \Longleftrightarrow (1-a)\,\frac{da}{a} = \frac{(1-\psi)}{\psi}\frac{dP_{ft}}{P_{ft}}.$$

We now turn to the implications of Fair Trade for the supply side. To begin with, the desire of Fair Trade to offer better trading conditions does imply some extra constraints on local producers. Requiring certain standards of production is just one of these constraints. Other constraints involve becoming part of a cooperative in order to be able to benefit from the fair trade arrangement, implying additional organization and information costs (Nicholls and Opal, 2005). Essentially then, becoming part of the Fair Trade production chain will be costly to firms, affecting variable and fixed costs of production. For instance, the dealings within the cooperative will increase the fixed costs of operations, while having to comply with Fair Trade environmental and labor standards directly translate into higher variable production costs. On the other hand, Fair Trade also involves clear benefits to participating firms. For instance, being part of a democratically organized cooperative yields counterweight to monopsonic middlemen in the distribution chain of products (Hayes, 2006). Furthermore, Fair Trade provides a direct and secure channel for producers to rich Western consumer markets. These benefits, however, seem to relate more to the decision to enter the fair trade arrangement, rather than affecting production decisions directly (see the next section). We therefore model fair trade as being more costly to produce than plain goods, using a parameter s to mark the difference (mnemonic for standard).

Accordingly, the production function for firms producing fair trade varieties and plain good varieties is given by:

$$l_i(\varphi, s) = \left(f + \frac{q_i(\varphi)}{\varphi}\right) s_i \tag{5}$$

for $i \in \{pg, ft\}$ and where we assume $s_{ft} > s_{pg} > 0$.[5] The production function gives the total amount of labour l that is required to produce output q of the variety the firm produces. There are increasing returns to scale at the firm level due to a fixed cost of production f. The variable costs of production are normalized to one, but depend on the productivity of the particular firm, denoted by $\varphi > 0$. Since $s_{ft} > s_{pg}$, a firm in fair trade requires higher labour input than an equally productive firm in plain good production.

We will assume that once firms have decided for which category they will produce their products, they cannot switch to the other category (see next section). Mixed-firm strategies are therefore ruled out. This makes sense in view of the fact that fair trade production requires different standards and a different organizational arrangement than plain good production, so that switching to a different mode of production would require new fixed costs. We will also assume that firms that produce fair trade products cannot sell these products without the Fair Trade label. That is, should demand for fair trade goods be insufficient, we deny them the possibility to 'dump' their fair trade products on plain goods markets. For our analysis this is not restrictive, since we only consider situations where demand for fair trade goods equals its supply. We note however that in view of the limited size of the Fair Trade market, in practice it is quite common for producers in Fair Trade programs to also sell part of their products on plain good markets.[6]

We also assume that wages are equalized across both sectors, assuming a perfectly working labour market. Furthermore, the wage rate will serve as numéraire in our model, that is: $w = 1$ henceforth. This is consistent with the idea that the very nature of the work remains the same (e.g. working on the land), despite the fact that working practices will be different in fair trade production from those in plain good production. Furthermore, equal wages across sectors is consistent with the idea that the presence of Fair Trade arrangements will bring labor markets closer to that of an ideal economy, where wages reflect productivity and not the exploitative powers of monopsonic middlemen in the supply chain of agricultural produce (Hayes, 2006). Finally, having equal nominal wages in both sectors is also consistent with the aspect of Fair Trade that it pays (more) decent wages: ceteris paribus a firm's production and productivity level, the higher labor standards of fair trade production imply fair trade labour receives wages that lie above their marginal productivity.

Firm profits are then given by

$$\pi_i = r_i - \left(f + \frac{q_i(\varphi)}{\varphi}\right) s_i$$

[5] At a later stage we will show that assuming that the difference in standards is the same for both fixed and variable costs of production does not qualitatively affect our results.

[6] This is at the heart of the analysis by de Janvry et al. (2010). There producers certify for Fair Trade, yet sell most of their production volumes outside Fair Trade markets.

and, using (3), profit maximization leads to the familiar outcome that price is a fixed mark-up over marginal cost:

$$p_i(\varphi) = \frac{1}{\rho}\frac{s_i}{\varphi}. \tag{6}$$

Ceteris paribus, the price for fair trade products is higher than for plain good products, while within each product category, more productive producers charge lower prices. Consequently, there is no need to introduce a guaranteed minimum price for fair trade producers in the analysis.[7] Furthermore, we assume that these prices are c.i.f. prices for reaching foreign markets – because that is eventually the relevant comparison for local producers. Any difference in costs of reaching far away markets between fair trade and plain good producers could be easily incorporated, but we ignore it because it would serve a similar function as the difference in s_i.

Given the pricing rule, firm profits and firm revenue can be written as:

$$\pi_i = \frac{r_i(\varphi)}{\sigma} - f s_i \qquad \text{and} \qquad r_i(\varphi) = R_i \left[\frac{s_i}{\rho\varphi P_i}\right]^{1-\sigma}. \tag{7}$$

As standard in the heterogeneous firm literature, firm revenues and profits are increasing in productivity levels:

$$\frac{r_i(\varphi')}{r_i(\varphi)} = \left(\frac{\varphi'}{\varphi}\right)^{\sigma-1} > 1, \forall \varphi' < \varphi. \tag{8}$$

As such, it is immediate that the least well-off among producers (in either category) would be the least productive firms. Whether a firm of (low) productivity is better off under fair trade than under plain good production is not clear:

$$\frac{r_{ft}(\varphi')}{r_{pg}(\varphi)} = K \cdot \left[\frac{\varphi'}{\varphi} \cdot \frac{s_{pg}}{s_{ft}} \cdot \frac{P_{ft}}{P_{pg}}\right]^{\sigma-1}. \tag{9}$$

However, for equal mass of fair trade firms and plain good firms, revenue and profits would be lower for fair trade producers unless a large enough share of consumers has a preference for fair trade goods:

$$\frac{r_{ft}(\varphi')}{r_{pg}(\varphi)} = \left[\left(\frac{1-a}{a}\right)^{\psi} \left(\frac{M_{pg}}{M_{ft}}\right)^{\frac{\sigma-\psi}{\sigma-1}} \left(\frac{s_{ft}}{s_{pg}}\frac{\varphi}{\varphi'}\right)^{1-\psi}\right] \tag{10}$$

for $\varphi = \varphi'$ and where we used (2) and firms' optimal pricing rule (6).

[7] The price fair trade producers receive is higher than what plain good producers get. The fixed mark-up rule ensures that firms will always be able to cover their labour costs of production.

3 Productivity and the decision to enter Fair Trade

The essence of entry and exit of firms is as in standard heterogeneous firm models. That is, firms learn about their productivity once they have entered the market and then decide to produce or not, depending on whether or not their productivity yields positive profits. This basic mechanism is the same for all firms, irrespective of whether they will end up producing plain goods or fair trade goods. Even though fair trade production has an ethical concern, its main aspect is still profitability (Nicholls and Opal, 2005; Moore, 2004). We assume that this also applies to the decision of firms within which category of goods they will to produce: a firm will choose the category that yields the highest profits. In our set-up this will involve a comparison of future profits of both product categories. This is different from Bernard et al. (2003), where the decision for which category to produce depends on single period profits. The reason is, as we will argue, that fair trade production is characterized by a higher probability of survival, while it also involves additional entry costs. This creates a gap between the outcomes of a comparison based on single period profits and a comparison based on expected future profits.[8]

It is a standard feature of the heterogeneous firms literature that firms can be hit by an exogenous shock leading to bankruptcy. The possibility of such a shock is modeled into a probability of exit (i.e. chance of death) for firms (Melitz, 2003; Bernard et al., 2003). We argue that the chance of firms facing a bad shock is smaller within the fair trade category than within the plain good category. This makes sense in view of Fair Trade's aim to engage in long-term relationships with local producers, but also because fair trade arrangements guarantee minimum prices and are likely to provide better access to financial markets. Hence, letting $0 < \theta < 1$ denote the chance of death for a plain good firm, we assume:

$$\theta_{ft} = X_d \theta$$

with $0 < X_d < 1$ denoting fair trade's relative chance of death.[9]

Becoming a fair trade firm also involves several transition costs. These costs can be material, for instance the costs of learning a new production method. But also immaterial costs are involved, like ambiguity regarding an unfamiliar arrangement. For instance, joining a Fair Trade cooperative implies a change towards a different organization of the

[8] For the same reasons, it sets our analysis apart from the framework offered by Bustos (2011). To investigate the effect of regional trade agreements on technology upgrading, she assumes that firms can reduce their marginal costs of production by paying a higher fixed cost. There are however no additional entry costs, while the technology upgrade also does not affect the exogenous market survival rate.

[9] When presenting this paper, people objected that one might as well assume $X_d > 1$, for reason that Fair Trade mainly relies on demand in low-growth, high-income markets, making its producers more vulnerable to adverse demand shocks. This is a valid point, but we nevertheless believe that *overall* the likelihood of being hit by a negative exogenous shock will be less for a fair trade firm than for a plain good firm.

supply chain. Farmers will leave the classical buyer system, where a monopsonic buyer would visit the farmer once a year to settle prices and production quantities. Despite its drawbacks, this system at least provided certainty to the farmer, something the new system still has to show. Especially for farmers who are at the margin of survival such ambiguity may be too much to bear, by lack of suitable fall-back options (Nicholls and Opal, 2005). Furthermore, joining the Fair Trade cooperative implies farmers will have to adjust their production method, for instance towards more sustainable ways of production. This also gives rise to ambiguity, especially when it would imply "switching from growing a crop that your grandfather grew to a higher-priced crop that no one in your village has ever grown before" (ibid: 19).

We model these transition costs as an additional entry costs e_{ft} that must be faced by each farmer that decides to become a fair trade producer. These entry costs are fixed and do not change over time. Adjusting to what it takes to become a Fair Trade farmer is a process any farmer has to go through, no matter the experiences of other farmers with Fair Trade.[10] The fair trade entry costs should be seen separately from the general market entry costs e, also time wise. However, both entry costs have in common that they become sunk once incurred.

Our assumptions imply that the decision to enter the market and which type of goods to produce can be seen as a three-step procedure. First, each potential entrant calculates an expected value of future earnings, which is a probability-weighted average of the potential earnings of becoming a plain good firm and a fair trade firm. The firm enters if this value exceeds the entry costs e it must pay to become a firm. Second, the firm learns about its productivity level and calculates whether its productivity level could sustain profitable production. If this is not the case, the firm will exit. Third, and related, the firm determines which type of good to produce. It bases this decision on a comparison of profits of plain good and fair trade production, taking into account the former's lower probability of survival and the latter's additional entry costs e_{ft}.[11]

The first calculation firms make is to list under what conditions production will be profitable. Irrespective of the category a firm will choose, firms must earn non-negative profits. This defines a production indifference value of productivity φ^* for either category

[10] Not modelling a learning effect is consistent with the absence of a learning effect for plain good entry. Furthermore, the inclusion of a learning effect would complicate the analysis considerably, since it could imply firms would want to postpone their entry. Assuming e_{ft} is fixed over time rules out such potential time inconsistency problems: for any firm with $\varphi > \varphi^{**}$ there is no point to stall their entry as a Fair Trade firm.

[11] We therefore see entrant firms as rational entities that are able to make all sorts of what-if calculations, basing their decision what to produce on a comparison between their actual productivity level (which they find out about once they have incurred the entry costs) and the what-if schemes they constructed. Though this may seem too far-fetched, especially in a developing country setting, it aligns the analysis to standard practice in the heterogeneous firms literature.

below which firms would not produce:

$$\frac{r_i(\varphi_i^*)}{\sigma} \geq fs_i \tag{11}$$

for $i \in \{pg, ft\}$. This is the standard outcome that operational profits should at least be equal to a firm's fixed cost of production. A priori it is not clear which category has the lowest value of φ^*. We know that for sufficiently low levels of productivity $\pi_{ft}(\varphi) < \pi_{pg}(\varphi)$ holds: $\pi_{ft}(0) = -fs_{ft} < \pi_{pg}(0) = -fs_{pg}$, as $s_{ft} > s_{pg}$. However, it will depend on the elasticity of π with respect to φ which category shows positive profits first when φ increases. However, as we will explain below, $\varphi_{ft}^* \geq \varphi_{pg}^*$.[12]

The second calculation is to derive conditions that determine which type of good to produce. Once a firm knows its productivity, and provided condition (11) for profitable production holds, this decision depends on whether the expected difference in future profits between fair trade and plain good production is equal or higher to the additional entry costs of fair trade. Expected future profits are obtained by taking the net present value of all future profits, correcting for the chance of death:[13]

$$\pi_{pg}^F(\varphi \geq \varphi_{pg}^*) = \frac{1}{\theta}\pi_{pg}(\varphi) \qquad \text{and} \qquad \pi_{ft}^F(\varphi \geq \varphi_{ft}^*) = \frac{1}{\theta_{ft}}\pi_{ft}(\varphi). \tag{12}$$

Let φ^{**} represent the productivity value where the difference between future profits of a fair trade firm and that of a plain good firm is just equal to the cost of entering the fair trade market. This marks the point of indifference for a firm between production methods, yielding a category indifference productivity value:

$$\pi_{ft}(\varphi^{**}) = X_d \pi_{pg}(\varphi^{**}) + \theta_{ft} e_{ft}. \tag{13}$$

We will assume that in the case of equal profitability, the firm will become a fair trade firm. The difference in chance of death lowers the required difference in profits for being indifferent between production methods ($X_d < 1$), the higher entry costs raise it. The nondeductible character of the additional entry cost means that it is not part of the single period profit function, for which reason e_{ft} is presented as a separate term in the comparison between future profits. A lower chance of death for a fair trade firm has a similar effect as a higher productivity level in the sense that it makes it easier to pay the entry cost for fair trade production.

Given that there are preferences for ordinary goods and for fair trade goods in society, equilibrium requires that both product categories must be produced. This puts constraints

[12] It is theoretically possible to have $\varphi_{ft}^* = \varphi_{pg}^*$.

[13] In line with Melitz' original model, time discounting of future profits is not implemented as the chance of death has qualitatively a similar effect (Melitz, 2003: 1702).

on the cut-off points identified in (11) and (13). First, it implies that $\varphi^*_{ft} \geq \varphi^*_{pg}$. Suppose, for argument's sake, that the ordering is reversed. This is possible when fair trade's profit elasticity to φ exceeds that of plain goods profits by a large enough margin. By (12), also the elasticity of *future* fair trade profits will be higher than that of plain goods profits. This implies that not only firms with $\varphi^*_{ft} \leq \varphi < \varphi^*_{pg}$ would want to become a fair trade firm, but also firms with $\varphi > \varphi^*_{pg}$. In such a situation, no firm would decide to become a plain good firm, rendering equilibrium impossible.[14]

Second, $\varphi^*_{ft} \geq \varphi^*_{pg}$ does not guarantee that producing fair trade goods is the preferred option for some values of φ. A sufficient condition for the existence of φ^{**} is that the elasticity of fair trade future profits to φ exceeds that of plain good production. This requires:

$$d\pi^F_{ft}/d\varphi > d\pi^F_{pg}/d\varphi \Longleftrightarrow dr_{ft}/d\varphi > \frac{\theta_{ft}}{\theta} dr_{pg}/d\varphi$$

which, using (7) and (4), is equivalent to:

$$\frac{\theta}{\theta_{ft}} \left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi} \left(\frac{s_{pg}}{s_{ft}}\right)^{\sigma-1} > \left(\frac{a}{1-a}\right)^{\psi}. \tag{14}$$

To have fair trade production requires a preference for fair trade products and that the cost of producing fair trade must not be too high. The lower chance of death works to increase the likelihood of fair trade production, as expected. The condition is also consistent with the formal requirement for $\varphi^*_{ft} \geq \varphi^*_{pg}$, see the appendix. Note also that if φ^{**} exists, it must be that: $\varphi^{**} > \varphi^*_{pg}$.

Proposition 1 *To have both plain goods and fair trade goods produced in equilibrium requires: i) that the zero-profit cutoff productivity of plain good production φ^*_{pg} is lower than the zero-profit cutoff productivity of fair trade production φ^*_{ft}, and ii) that condition (14) holds.*

If condition (14) holds, there will be a value $\varphi = \varphi^{**}$ beyond which firms prefer to produce fair trade goods.[15] This implies that high-productivity firms self-select in becoming fair trade firms, whereas low productivity firms produce plain goods. Defining $\varphi^* \equiv \varphi^*_{pg}$ then gives:

[14] Unless the additional entry cost of fair trade would be extremely high, as can be verified from our graphical representation below.

[15] To see this formally, we evaluate relative future profits in this point. Let $\varphi' > \varphi^{**}$. Then for the category indifference condition (13) to be true, $\pi^F_{ft}(\varphi') > \pi^F_{pg}(\varphi')$:

$$\frac{1}{\theta_{ft}} \frac{r_{ft}(\varphi')}{\sigma} - \frac{1}{\theta} \frac{r_{pg}(\varphi')}{\sigma} > \frac{1}{\theta_{ft}} f s_{ft} - \frac{1}{\theta} f s_{pg} + e_{ft}.$$

Assuming (13) holds and using (7) to get $r_c(\varphi')/r_c(\varphi^{**}) = (\varphi'/\varphi^{**})^{\sigma-1}$, it follows that

Proposition 2 *When both types of goods are produced, firms with productivity $\varphi^* < \varphi < \varphi^{**}$ will produce plain goods and firms with productivity $\varphi \geq \varphi^{**}$ will produce fair trade goods.*

The situation that arises is depicted in Figure 1 below. The horizontal axis lays out productivity levels, the vertical axis represents single period profits or future profits, depending on the curve portrayed. These are the what-if schemes each potential entrant calculates prior to learning its productivity. Figure 1 is drawn such that the single period profit lines of the two categories converge, which is however not required for the analysis to hold. To have both categories produced, expected future profit lines must converge though. They always start at $\pi_i(\varphi) = 0$ $(i = pg, ft)$, as firms with negative profits in a single period go out of business. The difference in slopes between future profit lines and single period profit lines is due to the ratio of death. Given the difference in survival rates, the slope of the future fair trade profits curves diverges more from the single period profit line than is the case for plain good production. Entry costs for fair trade can be introduced by means of a shadow line below $\pi_{ft}^F(\varphi)$, as if they were a one-time-for-all additional fixed costs. The indifference productivity level φ^{**} is then at the intersection of this shadow line with $\pi_{pg}^F(\varphi)$. This point lies to the right of ϕ_{pg}^*, and is for positive profits. Note however that actual profits earned are not represented by the shadow line, since e_{ft} becomes sunk once it has been incurred.

We also note that, as depicted, the productivity level that sustains fair trade production yields higher single period profits for plain good producing firms: $\pi_{pg}(\varphi^{**}) > \pi_{ft}(\varphi^{**})$. Though this could be different, it is consistent with the inclusion of other elements in the decision on which type of product to produce than just differences in production standards. The required jump in future profits at φ^{**} highlights the trade-off between facing lower prices but certainty with plain goods production, versus the ambiguity of switching to Fair Trade, despite the outlook of a better price. The difference in single period profits at φ^{**} could be interpreted in a similar way: to be on the safe side, firms are willing to face lower profits today.

(Insert Figure 1 about here)

$$\left(\frac{\varphi'}{\varphi^{**}}\right)^{\sigma-1}\left[\frac{1}{\theta_{ft}}\frac{r_{ft}(\varphi^{**})}{\sigma}-\frac{1}{\theta}\frac{r_{pg}(\varphi^{**})}{\sigma}\right]>\frac{1}{\theta_{ft}}\frac{r_{ft}(\varphi^{**})}{\sigma}-\frac{1}{\theta}\frac{r_{pg}(\varphi^{**})}{\sigma}.$$

should hold, which is the case since $\varphi' > \varphi^{**}$.

4 Equilibrium

Given that entrants know what would be optimal to do once knowing their productivity, they may calculate expected lifetime earnings and confront these with the entry cost for starting up a firm, including the possibility of additional entry cost for fair trade production. To make this assessment, firms need information on the probability of the alternative options upon entry (direct exit, plain good production, fair trade production). In this section we deal with this in the standard fashion of the heterogeneous firm literature, as in Melitz (2003). In a later section we verify the consequences of having incomplete information, for instance regarding the possibility of engaging in fair trade prior to entry.

We assume an ex ante probability density function of productivities $g(\varphi)$ and associated cumulative distribution function $G(\varphi)$. It follows that the ex-ante probabilities of successful entry, plain good production and fair trade production are, respectively, $1 - G(\varphi^*)$, $G(\varphi^{**}) - G(\varphi^*)$, and $1 - G(\varphi^{**})$. Taking into account that the distribution changes due to the exit of firms, the ex post probability distribution of productivities in either category become:

$$\mu(\varphi_{pg}) = \frac{g(\varphi)}{G(\varphi^{**}) - G(\varphi^*)} \text{ and } \mu(\varphi_{ft}) = \frac{g(\varphi)}{1 - G(\varphi^{**})}. \tag{15}$$

This determines average productivity levels in each market, which can be used to calculate aggregate variables. Average productivity only depends on the productivity distribution $g(\varphi)$ and the cut-off points (Bernard et al. (2003):

$$\tilde{\varphi}_{pg}(\varphi^*, \varphi^{**}) = \left[\frac{1}{G(\varphi^{**}) - G(\varphi^*)} \int_{\varphi^*}^{\varphi^{**}} \varphi^{\sigma-1} g(\varphi) d\varphi\right]^{1/\sigma-1} \tag{16}$$

$$\tilde{\varphi}_{ft}(\varphi^{**}) = \left[\frac{1}{1 - G(\varphi^{**})} \int_{\varphi^{**}}^{\infty} \varphi^{\sigma-1} g(\varphi) d\varphi\right]^{1/\sigma-1} \tag{17}$$

where a tilde above a variable denotes an average value. Since fair trade firms are firms with $\varphi \geq \varphi^{**}$ it follows that average productivity in fair trade is higher than in plain good production: $\tilde{\varphi}_{ft} > \tilde{\varphi}_{pg}$.

With full information about all options available, prior to entry the expected value of the firm is the probability weighted average of $\tilde{\pi}_{pg} = \pi_{pg}(\tilde{\varphi}_{pg})$ and $\tilde{\pi}_{ft} = \pi_{ft}(\tilde{\varphi}_{ft})$, taking into account the respective rates of survival. Entry stops when this value is equal to the expected entry costs:[16]

[16]By using (12) we could also have written the equation in terms of average future profits $\tilde{\pi}^F$.

$$\nu_e = \frac{G(\varphi^{**}) - G(\varphi^*)}{\theta}\tilde{\pi}_{pg} + \frac{1 - G(\varphi^{**})}{X_d\theta}\tilde{\pi}_{ft} = e + [1 - G(\varphi^{**})]e_{ft}. \tag{18}$$

Since this model deals with two types of firms, the costs of entry are separated between the general entry cost of becoming a firm, and the additional entry cost of becoming a fair trade firm. The latter carries a probability since only firms with productivity higher or equal than φ^{**} will decide to become fair trade firms, which is not clear ex ante.

As customary we will assume steady state equilibrium of entry and exit. This means that for every type of firm that exits a similar kind of firm enters. Let M_{pg} and M_{ft} be the mass of firms of plain good firms and fair trade firms respectively, denoting entrants to the market with M_e. Steady-state equilibrium then implies

$$\theta M_{pg} = [G(\varphi^{**}) - G(\varphi^*)]M_e \qquad \text{and} \qquad X_d\theta M_{ft} = [1 - G(\varphi^{**})]M_e. \tag{19}$$

The probabilities in (19) reiterate that firms decide on which type of firm to become after they have entered. Ceteris paribus, the relative incidence of fair trade firms increases if X_d goes down, if the threshold for profitable production φ^* goes up and if φ^{**} goes down.

The model is closed by assuming that the labor market clears. Labor is the sole input in our model and all revenue earned must be paid to labor. Since the wage rate was set to one (numéraire), this implies $L = L_e + L_p = R$, where L_e and L_p denote labor used for entry and labor used in production, respectively. Total profits earned are $\Pi = M_{pg}\tilde{\pi}_{pg} + M_{ft}\tilde{\pi}_{ft}$, which in equilibrium should match the costs of entry – else more firms would desire to enter. Thus:

$$L_p = R - \Pi \qquad \text{and} \qquad L_e = \Pi.$$

L_e includes the additional entry costs for those firms that decide to become a fair trade firm:

$$L_e = M_e e + [1 - G(\varphi^{**})]M_e e_{ft}$$

and labour market equilibrium implies:

$$M_{pg}\tilde{\pi}_{pg} + M_{ft}\tilde{\pi}_{ft} = M_e e + M_e[1 - G(\varphi^{**})]e_{ft}. \tag{20}$$

The model can be reduced to a system of four equations that can be solved for the endogenous variables φ^*, φ^{**}, P_{pg} and P_{ft}. To solve the model, we follow Bernard et al. (2003) in terms of procedure. First, we combine the expression for relative firm revenue (9) with the category indifference condition (13). Then, using $r_{pg}(\varphi^{**}) = (\varphi^{**}/\varphi^*)^{\sigma-1}r_{pg}(\varphi^*)$ from (8) and applying the zero-profit cut-off condition (11), we get:

$$\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\sigma-1}=\frac{\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{fs_{pg}}-X_d}{\left(\dfrac{1-a}{a}\right)^{\psi}\left(\dfrac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}\cdot\left(\dfrac{s_{pg}}{s_{ft}}\right)^{\sigma-1}-X_d} \tag{21}$$

which is larger than one since $\varphi^{**}>\varphi^{*}$. By (14) the denominator is positive. It is clear that disadvantageous cost and price developments for fair trade - for instance s_{ft} up or P_{ft}/P_{pg} down – will increase the minimum productivity requirement for becoming a fair trade firm relative to what it takes to profitably enter the market. By the same token, this also holds for a decrease in the relative expenditures of fair trade R_{ft}/R_{pg}.[17] A decrease in the relative advantage fair trade producers have regarding the exogenous chance of exiting – an increase in X_d – is likely to increase φ^{**}/φ^{*}, but this cannot be settled definitely. We will come back to these and other issues in the next section, but intuitively this can be explained by means of Figure 1, where a change in X_d would not only rotate the curves depicted, but also shift them.

The relative price index ratio can be expressed as:

$$\frac{P_{ft}}{P_{pg}}=\left(\frac{M_{ft}}{M_{pg}}\right)^{1/1-\sigma}\frac{s_{ft}}{s_{pg}}\frac{\tilde{\varphi}_{pg}}{\tilde{\varphi}_{ft}}=\left[\frac{\int_{\varphi^{**}}^{\infty}\varphi^{\sigma-1}g(\varphi)d\varphi}{\int_{\varphi^{*}}^{\varphi^{**}}\varphi^{\sigma-1}g(\varphi)d\varphi}\right]^{\frac{1}{1-\sigma}}\frac{s_{ft}}{s_{pg}}\left(\frac{1}{X_d}\right)^{\frac{1}{1-\sigma}} \tag{22}$$

where we applied (19) and the expressions for average productivity (16)-(17). Logically, the price index ratio is increasing in fair trade's relative labour standard by the fixed mark-up pricing rule. Likewise, a higher average productivity for fair trade products decreases its relative price ratio. When fair trade's relative chance of death X_d lowers, its price ratio will decline because fewer firms will exit, ceteris paribus entry. We note that with $\varphi^{**}>\varphi^{*}$ and $X_d<1$ it is not clear whether fair trade goods carry higher prices, despite $s_{ft}>s_{pg}$. Though one of the central tenets of the fair trade movement is that consumers pay higher prices for goods that are produced under fair circumstances, the self-selection of high-productivity firms in fair trade arrangements makes that this is neither necessary, nor required.

The next step is to express (18) in relative prices and cut-off points. Using (10), (8),

[17] Using (4), the denominator can be rewritten to $\dfrac{R_{ft}}{R_{pg}}\left(\dfrac{P_{ft}}{P_{pg}}\right)^{\sigma-1}\cdot\left(\dfrac{s_{pg}}{s_{ft}}\right)^{\sigma-1}-X_d$.

and (11), while applying the expressions for average productivity (16)-(17), we get:

$$\begin{aligned}\tilde{\pi}_{pg} &= \left[\left(\frac{\tilde{\varphi}_{pg}}{\varphi^*}\right)^{\sigma-1} - 1\right] f s_{pg} \\ \tilde{\pi}_{ft} &= \left[\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}\left(\frac{s_{pg}}{s_{ft}}\cdot\frac{\tilde{\varphi}_{ft}}{\varphi^*}\right)^{\sigma-1} - \frac{s_{ft}}{s_{pg}}\right] f s_{pg}.\end{aligned}$$

Upon substitution, the free entry condition (18) becomes:

$$\begin{aligned}&\frac{f s_{pg}}{\theta}\left[\int_{\varphi^*}^{\varphi^{**}}\left[\left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1} - 1\right] g(\varphi)d\varphi\right] \\ &+\frac{f s_{pg}}{X_d\theta}\int_{\varphi^{**}}^{\infty}\left[\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}\left(\frac{s_{pg}}{s_{ft}}\right)^{\sigma-1}\left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1} - \frac{s_{ft}}{s_{pg}}\right] g(\varphi)d\varphi \qquad (23) \\ = \;& e + e_{ft}\int_{\varphi^{**}}^{\infty} g(\varphi)d\varphi.\end{aligned}$$

Equilibrium conditions (21) and (22) combined determine a unique value of relative goods prices and the relative cut-off point.[18] Together with equation (23) and (20), they solve for φ^*, φ^{**}, P_{pg}, and P_{ft}.

5 What does it take to reach the poorest farmers?

By Proposition 2 we have seen that Fair Trade arrangements are bound to attract the more productive firms in society. This begs the question: what would it take for Fair Trade Organizations (FTOs) to come closer to their goal of reaching the poorest farmers in developing countries? To investigate this we perform a comparative statics exercise on the parameters in the model over which FTOs can be expected to have some control. These are the additional entry cost e_{ft} associated with the entry of fair trade firms and the reduced chance of post-entry failure of fair trade firms compared to their plain good producing counterparts: $X_d = \theta_{ft}/\theta < 1$. Furthermore, the relative production cost disadvantage of fair trade production (due to higher standards, $s_{ft}/s_{pg} > 1$) and society's relative preference for fair trade goods $(1-a)/a$ are important parameters in determining the potential success of Fair Trade. The issue of completeness of information will be taken

[18] From equation (21) it follows that P_{ft}/P_{pg} is monotonically declining in φ^{**}/φ^*: $\sigma > \psi > 0$, noting that the denominator of (21) is positive. It ranges from a value of $P_{ft}/P_{pg} = [s_{ft}/s_{pg} + X_d\theta e_{ft}/(f s_{pg})]^{1/(\sigma-\psi)}[a/(1-a)]^{\psi/(\sigma-\psi)}(s_{ft}/s_{pg})^{(\sigma-1)/(\sigma-\psi)} > 0$ when $\varphi^{**}/\varphi^* = 1$ to a lower value of $P_{ft}/P_{pg} = X_d[a/(1-a)]^{\psi/(\sigma-\psi)}(s_{ft}/s_{pg})^{(\sigma-1)/(\sigma-\psi)} > 0$ when φ^{**}/φ^* goes to infinity. From (22) it follows that P_{ft}/P_{pg} is increasing in φ^{**}/φ^*, ranging from zero if φ^{**}/φ^* approaches one to infinity if φ^{**}/φ^* approaches infinity. This proof is in line with Bernard et al. (2003).

up in the next section.

To facilitate the analysis we follow Bernard et al. (2003) and assume productivities φ are distributed according to a Pareto-1 distribution: $g(\varphi) = ak^a\varphi^{-(a+1)}$, with a and k parameters that are both greater than zero. The associated cumulative distribution function is $G(\varphi) = 1 - \left(\frac{k}{\varphi}\right)^a$. This implies that $\varphi^{\sigma-1}g(\varphi)$ is also Pareto-distributed. Define $h(\varphi) \equiv \gamma k^\gamma \varphi^{-(\gamma+1)}$, with $\gamma \equiv a - \sigma + 1$ and $\xi \equiv ak^{a-\gamma}/\gamma$ and assume $a > \sigma - 1$. The distribution of $\varphi^{\sigma-1}g(\varphi)$ then follows $\xi h(\varphi)$. The cumulative distribution function of $h(\varphi)$ is $H(\varphi) = 1 - \left(\frac{k}{\varphi}\right)^\gamma$.

In the Appendix we report what this implies for the equilibrium conditions that were established before. Here we concentrate on outcomes of changes in e_{ft}, X_d, a, s_{ft} and s_{pg}. The key equation for all comparative statics results is:

$$\left[\left(\frac{\varphi^{**}}{\varphi^*}\right)^\gamma - 1\right]^{\frac{1}{\sigma-1}} \left(\frac{1}{X_d}\right)^{\frac{1}{1-\sigma}} = \left\{\left(\frac{\varphi^{**}}{\varphi^*}\right)^{1-\sigma}\left[\frac{s_{ft}}{s_{pg}} + \frac{X_d\theta e_{ft}}{fs_{pg}} - X_d\right] + X_d\right\}^{\frac{1}{\sigma-\psi}} \left(\frac{a}{1-a}\right)^{\frac{\psi}{\sigma-\psi}} \cdot \left(\frac{s_{ft}}{s_{pg}}\right)^{\frac{\psi-1}{\sigma-\psi}} \tag{24}$$

This equation has been obtained by combining (21) and (22), applying the Pareto-distribution. It defines a unique equilibrium for φ^{**}/φ^*.[19]

Totally differentiating (24) with respect to e_{ft}, X_d, a, s_{ft} and s_{pg} gives:

$$d\left(\frac{\varphi^{**}}{\varphi^*}\right) = Q_1 de_{ft} + Q_2 dX_d + Q_3 da + Q_4 ds_{ft} + Q_5 ds_{pg} \tag{25}$$

where $Q_1 > 0$, $Q_2 \gtreqless 0$, $Q_3 > 0$, $Q_4 > 0$, and $Q_5 < 0$ are shorthand notations for expressions that are given in the appendix. This equation is key to understanding how the model's endogenous variables change when exogenous variables change. Take for instance an increase in the entry costs of fair trade: $de_{ft} > 0$, ceteris paribus. Referring to the appendix for calculation details, by (25) this will unambiguously increase φ^{**}/φ^*. This in turn implies that also P_{ft}/P_{pg} increases, which follows directly from (22) once the Pareto-distribution is applied:

$$\frac{d(\frac{P_{ft}}{P_{pg}})/\frac{P_{ft}}{P_{pg}}}{d\left(\frac{\varphi^{**}}{\varphi^*}\right)/\left(\frac{\varphi^{**}}{\varphi^*}\right)} = \frac{\gamma}{\sigma-1}\left[\frac{\left(\frac{\varphi^{**}}{\varphi^*}\right)^\gamma}{\left(\frac{\varphi^{**}}{\varphi^*}\right)^\gamma - 1}\right] > 0.$$

Furthermore, by equation (11) it follows that also φ^* must go up, implying that φ^{**} will

[19] The left-hand-side of (24) is monotonically increasing in φ^{**}/φ^*. It ranges from zero at $\varphi^{**}/\varphi^* \to 1$ to infinity when $\varphi^{**}/\varphi^* \to \infty$. The right-hand-side is strictly decreasing in φ^{**}/φ^*. It ranges from a value greater than zero at $\varphi^{**}/\varphi^* \to 1$ to a smaller yet positive asymptote when $\varphi^{**}/\varphi^* \to \infty$.

go up by even more. Finally, the steady-state conditions for entry (19) imply:

$$\frac{M_{pg}}{M_{ft}} = \left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{a} - 1\right] X_d \tag{26}$$

so that $d\left(\frac{M_{pg}}{M_{ft}}\right)/d\left(\frac{\varphi^{**}}{\varphi^{*}}\right) = a\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{a-1} X_d > 0$ as well.

These effects are all as expected, implying that if FTOs want to attract firms with lower productivity, a decrease in the entry costs is warranted. Recall in this respect that the entry costs for Fair Trade were introduced in the model to parameterize the transition costs of becoming a Fair Trade firm, including learning costs of adopting new production methods and the ambiguity of moving into something new. Hence, increased FTO effort in assisting local farmers to make the transition could tip the balance for producers with productivity marginally below φ^{**} towards becoming a fair trade producer. Also for firms in the higher productivity range, the lower entry cost will make fair trade production a more attractive option and more firms will enter. The lower fair trade entry costs also requires a lower productivity to enter the market as a plain good firm: the expected costs of entry decrease, requiring a lower expected profit as well. Finally, with more yet less productive fair trade firms around, the price index of fair trade goods decreases.

Analogous reasoning can be applied to understand the implications of other changes that make it less attractive to become a fair trade firm, for instance an increase in a or s_{ft}, or a decrease in s_{pg}. By (25), these changes have qualitatively the same effect on φ^{**}/φ^{*} as an increase in e_{ft}.[20] Consequently, attracting the less productive firms into Fair Trade arrangements would be helped by a higher societal preference for Fair Trade goods and relatively lower Fair Trade standards. The former would call for an intensification of awareness campaigns in consumer markets of these goods. The latter would call for exerting pressure on local governments to raise standards in non-fair-trade good production, presuming that it is not an option for FTOs to lower their own standards.

Proposition 3 *Lower Fair Trade market entry costs, higher consumer preferences for Fair Trade products and lower Fair Trade production standards decrease the required productivity level φ^{**} to become a Fair Trade firm.*

Another instrument for FTOs to influence φ^{**} is the relative advantage fair trade firms have over plain good firms in surviving exogenous market shocks. Recall $X_d \equiv \theta_{ft}/\theta$, so that an increase in X_d implies a lower advantage for fair trade firms in this respect. The

[20] The results on changes in standards remain qualitatively the same if we would assume that the difference in standards is different for the fixed cost of production than for the variable costs of production. This can be directly inferred from (24), noting that the standards in $[s_{ft}/s_{pg} + X_d\theta e_{ft}/fs_{pg} - X_d]$ refer to differences in standards regarding fixed costs, while $(s_{ft}/s_{pg})^{\frac{\psi-1}{\sigma-\psi}}$ refers to differences in standards in variable costs.

effect of a change in X_d is unclear however. On the one hand, an increase in X_d would make it less attractive to become a fair trade firm, implying φ^{**}/φ^* should increase. On the other hand, an increase in X_d also has a direct impact on φ^{**}/φ^* by the steady state equilibrium condition (26). Ceteris paribus, an increase in X_d works to increase M_{pg}/M_{ft}, making it more attractive to become a fair trade firm. This would lower φ^{**}/φ^*. An ambiguous effect on φ^{**}/φ^* results, impairing an assessment of the implications of an increase in X_d on the other endogenous variables as well. However, we show in the appendix that an increase in X_d will more likely increase φ^{**}/φ^* the smaller X_d and the smaller $(\sigma-1)(\sigma-\psi)$. Enjoying a high (initial) advantage of fair trade production in terms of survival and a low extent of substitution between fair trade product varieties both imply that the negative effects of an upward change in X_d are felt harder.[21] For FTOs this implies that a continuous effort to maintain or improve the securing of distribution channels is warranted. It also raises concerns about the tendency towards the mainstreaming of distribution channels by FTOs, which is likely to lead to an increase in X_d.[22]

Proposition 4 *The more secure market demand is for Fair Trade products and the lower the extent of substitution between Fair Trade goods, the more likely an increase in the relative advantage of Fair Trade in surviving exogenous market shocks (a decrease in X_d) will decrease the required productivity level φ^{**}.*

6 Incomplete information

A key aspect of our modelling set-up is that potential market entrants know of the possibility of Fair Trade prior to their decision to enter the market. This section discusses the consequences when potential entrants are unaware of this option and would only learn about the possibility of engaging in fair trade after they have entered as a plain good firm. In a setting of poor developing countries with few and dispersed Fair Trade operations (see section 1), this is not an unlikely scenario. This leaves the decision to stay in the market and/or to become a fair trade firms in tact – once firms have entered they get to

[21] It also implies that our results hold for values of X_d higher than one. In that sense our assumption that $X_d < 1$ is not critical for the results we derive.

[22] Mainstreaming is defined as the step-by-step introduction of market channels at various stages of the supply chain (Raynolds, 2009). Originally, FTOs – then known as alternative trade organizations – functioned almost completely outside conventional trade channels, organizing trade and distribution through alternative structures, such as 'world shops'. Only consumption was organized along market lines. The foundation of Max Havelaar in the Netherlands in 1988 marks the beginning of using conventional distribution channels to sell fair trade products to consumers (e.g. supermarkets). A further step in the mainstreaming process has been the move towards certification, allowing commercial companies to enter the market for supplying fair trade goods (Renard, 2005). Finally, by now some FTOs also leave the relations with producers of raw materials to the market, provided they meet certain standards (e.g. Utz Certified).

know that fair trade is an option – but clearly it has consequences for the initial decision to enter the market or not. Without knowing about the possibility of fair trade, the free entry condition would become:

$$\nu'_e = \frac{G(\varphi^{**}) - G(\varphi^*)}{\theta}\tilde{\pi}'_{pg} + \frac{1 - G(\varphi^{**})}{\theta}\tilde{\pi}'_{pg} = e. \tag{27}$$

where we use a "′" to indicate variables that might change due to wrong information. The notable difference between (27) and the original free entry condition (18) is the absence of average fair trade profits, as well as the absence of the expected entry costs of fair trade. Moreover, average profits may change, depending on the implied changes in price indices. The values for the cut-off points φ^* and φ^{**} remain the same: the what-if schemes of the previous section become known once firms have entered and found out about their productivity.

Without prior knowledge of fair trade production possibilities the expected value of a firm will decrease: $v'_e < v_e$. To see this it is key to understand that without the right information potential entrants will base their ex ante calculations on a version of Figure 1 that only includes (future) profits for plain good firms. Hence they believe profitability to be lower than it will actually be, expecting a lower mass of incumbent firms. To see this formally consider Figure 2 below. The figure depicts the expected value of entry as a negative function of the number of incumbent firms.[23] The full information scenario is depicted by M, at the intersection of v_e and $e + (1 - G(\varphi^{**}))e_{ft}$. Having limited information implies lower expected entry costs, and, as we will show, a lower value of the firm. To make the argument we draw $v_e(\tilde{\varphi} = \varphi^{**})$ as a special case for the full information scenario, giving the value of the firm if the net benefit of fair trade to the average firm just matches the additional entry cost. Logically, if fair trade does not bring additional benefits, the number of firms is invariant to having the right information or not. Hence, the curves for the incomplete information scenario must also intersect at M'. Since $e < e + (1 - G(\varphi^{**}))e_{ft}$, it must be that $v'_e < v_e(\tilde{\varphi} = \varphi^{**})$, as depicted by the dashed lines. Clearly, average productivity of fair trade will exceed φ^{**} and hence v_e will be higher than this borderline case, resulting in $v'_e < v_e$ and $M' < M$.

(Insert Figure 2 about here)

The consequence is that when fair trade is not anticipated, fewer firms will enter the market than is required for labor market equilibrium. With a fixed overall labor supply, this implies either unemployment of $L - (L'_e + L_p) > 0$, or a decline in real wages that

[23] Average profits decline in the number of firms: $d\tilde{\pi}_i/dP_i = (\sigma - 1)(\tilde{\pi}_i + fs_i)/P_i > 0$ and $dP_i/dM_i = \frac{1}{1-\sigma}P_i/M_i < 0$.

ensures that L_p increases to match the decline in L_e. In either case, the relative position of laborers in society deteriorates. When unemployment arises this would manifest itself through a portion of the labor force receiving no wage income at all, as well as through excess profits that will arise for firms. With real wages unchanged L_p, R and Π are the same as before, implying $\Pi - L'_e > 0$. When the adjustment occurs through a decline in real wages, total profits fall to L'_e, which matches the required entry costs. These adverse effects can be prevented by announcing the possibility of fair trade to potential entrants.

Proposition 5 *Local labor markets will be adversely affected by the existence of Fair Trade if potential producers are not aware of the possibility of engaging in Fair Trade arrangements prior to making their entry decisions.*

7 Conclusion

The moment fair trade arrangements are introduced, the more productive firms in society would want to switch to fair trade production. Though confronted with an additional entry cost, besides higher costs of production, for them the benefits of a higher rate of survival are highest. Fair Trade clearly entails a selection effect. While reaching out to help the least well-off in society, the firms attracted to the arrangement are the larger, more productive firms.

This conclusion is reached in a framework where firms differ in their productivity and where Fair Trade is portrayed as a sustainable alternative to ordinary production arrangements, both in terms of labor standards as well as in terms of enduring partnerships. The paradoxical results is that when fair trade succeeds in its inherent workings, the benefits will go to the 'wrong' set of producers. What's more, when the possibility of fair trade is not commonly known to new firms prior to entry, too few firms will enter leading to a real wage decline and/or excess profits for incumbent firms.

Fair Trade Organizations (FTOs) could take measures to decrease the threshold level of productivity required to become a fair trade firm. The lowering of fair trade entry costs, raising awareness amongst consumers and exerting pressure on local governments to increase the standards in plain good production, would all help in this respect. However, to fundamentally resolve these issues may require unorthodox measures. When productivity differences between firms exist, higher standards and the existence of transition costs mean there is no way to escape from the selection effect. One solution could be to set a maximum profit level for those firms FTOs want to include. This would at least make Fair Trade unattractive for the most productive firms, though it is not clear what it would imply for the level of productivity required to profitably enter fair trade arrangements. Another, more direct solution is to strengthen the admission criteria to fair trade arrangements:

FTOs may want to (re)consider which firms they allow to enter the partnership. To counter the selection effect a strong selection policy may be warranted, focussing on a firm's productivity rather than on a firm's capacity to adhere to the requirements of Fair Trade arrangements.

References

[1] Bernard, A.B., Redding, S.J. and Schott, P.K. (2003), "Product choice and product switching", NBER Working Paper Series WP9789, NBER, Cambridge MA..

[2] Bernard, A.B., Redding, S.J. and Schott, P.K. (2010), "Multiple products and Product Switching", American Economic Review, 100 (1): 70–97.

[3] de Janvry, A., C. McIntosh and E. Sadoulet (2010), Fair Trade and free entry: The dissipation of producer benefits in a disequilibrium market, mimeo, University of California at Berkeley.

[4] Bustos, P. (2011), "Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian Firms." American Economic Review, 101(1): 304–40.

[5] FAO (2011), The state of food and agriculture: Statistical Annex, Table A5, Rome: Food and agriculture organisation of the United Nations.

[6] FLO International (2011a), Challenge and Opportunity, Supplement to Annual Review 2010-11: Financials and Global Sales Figures, Bonn: Fairtrade International.

[7] FLO International (2011b), Monitoring the scope and benefits of Fairtrade, third edition, Bonn: Fairtrade International.

[8] Hayes, M. (2006), "On the Efficiency of Fair Trade", Review of Social Economy, 64(4): 447-468.

[9] Leclair, Mark S. (2002), "Fighting the tide: Alternative trade organizations in the era of global free trade", World Development, 30(6): 949-958.

[10] Lindsey, B. (2004), Grounds for Complaint? 'Fair trade' and the coffee crisis, Adam Smith Institute, London.

[11] Maseland, R. and A. de Vaal (2002), "How fair is fair trade?", De Economist, 150 (3): 251-272.

[12] Maseland, R. and A. de Vaal (2008), "Looking beyond the cooperative: Fair Trade and the income distribution", Chapter 10 in Ruerd Ruben (ed.), The impact of Fair Trade, Wageningen Academic Publishers, Wageningen, 223-237.

[13] Melitz, M.J. (2003), "The impact of trade on intra-industry reallocations and aggregate industry productivity", Econometrica, 71(6): 1695-1725.

[14] Milford, A. (2004), Coffee, Co-operatives and Competition: The impact of Fair Trade. Bergene: CHR Michelson Institute.

[15] Moore, G. (2004), "The Fair Trade Movement: Parameters, Issues and Future Research", Journal of Business Ethics, 53: 73-86.

[16] Murray, D.L. and L.T. Raynolds (2007), "Globalization and its antinomies – Negotiating a Fair Trade movement", in Raynolds, L.T., D. Murray and J. Wilkinson (eds.): Fair Trade –The challenges of transforming globalization, New York: Routledge

[17] Nicholls, A. and Opal, C. (2005), Fair Trade: Market-Driven Ethical Consumption, London: SAGE.

[18] Raynolds, L.T. (2009), "Mainstreaming Fair Trade Coffee: From Partnership to Traceability, World Development, 37 (6), 1083-1093.

[19] Raynolds, L.T. and M.A. Long (2007), "Fair/Alternative Trade – Historical and empirical dimensions", in Raynolds, L.T., D. Murray and J. Wilkinson (eds.): Fair Trade –The challenges of transforming globalization, New York: Routledge.

[20] Renard, M-C. (2005), "Quality certification, regulation and power in fair trade", Journal of Rural Studies, 21:419-431.

[21] Ruben, R. (2008), The Impact of Fair Trade, Wageningen: Wageningen Academic Publishers.

[22] Yanchus, D. and X. de Vanssay (2003), "The Myth of Fair Prices: A Graphical Analysis", Journal of Economic Education, 34(3): 235-40.

A Mathematical derivations

A.1 Consistency of φ^{**}-condition and $\varphi^*_{ft} > \varphi^*_{pg}$ condition

To determine a condition for $\varphi^*_{ft} > \varphi^*_{pg}$, we use (9) and (11) to obtain:

$$\frac{r_{ft}(\varphi^*_{ft})}{r_{pg}(\varphi^*_{pg})} = K\cdot\left[\frac{\varphi^*_{ft}}{\varphi^*_{pg}}\cdot\frac{s_{pg}}{s_{ft}}\cdot\frac{P_{ft}}{P_{pg}}\right]^{\sigma-1} = \frac{f\sigma s_{ft}}{f\sigma s_{pg}}$$

$$\implies \frac{\varphi^*_{ft}}{\varphi^*_{pg}} = \left[\left(\frac{1-a}{a}\right)^{-\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{\psi-\sigma}\right]^{1/(\sigma-1)}\left[\frac{s_{ft}}{s_{pg}}\right]^{\sigma/(\sigma-1)}$$

Hence, $\varphi^*_{ft} > \varphi^*_{pg}$ if:

$$\left[\left(\frac{P_{ft}}{P_{pg}}\right)^{\psi-\sigma}\right]\left[\frac{s_{pg}}{s_{pft}}\right]^{-\sigma} > \left(\frac{1-a}{a}\right)^{\psi}$$

The condition for existence of fair trade production (14) can be written as:

$$\underbrace{\frac{\theta}{\theta_{ft}}}_{>1}\underbrace{\left(\frac{s_{ft}}{s_{pg}}\right)}_{>1} > \left(\frac{a}{1-a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{\psi-\sigma}\left(\frac{s_{pg}}{s_{ft}}\right)^{-\sigma}.$$

If $\varphi^*_{ft} > \varphi^*_{pg}$ holds then the right-hand-side of this equation is at least twice the value of $\left(\frac{a}{1-a}\right)^{\psi}$. The left-hand-side is clearly larger than one, as indicated. Both conditions are therefore consistent.

B Comparative statics results

Assume productivities φ are distributed according to a Pareto-1 distribution: $g(\varphi) = ak^a\varphi^{-(a+1)}$, with a and k parameters that are both greater than zero. The associated cumulative distribution function is $G(\varphi) = 1 - \left(\frac{k}{\varphi}\right)^a$. Furthermore, define $h(\varphi) \equiv \gamma k^\gamma\varphi^{-(\gamma+1)}$, with $\gamma \equiv a-\sigma+1$ and $\xi \equiv ak^{a-\gamma}/\gamma$ and assume $a > \sigma - 1$. The distribution of $\varphi^{\sigma-1}g(\varphi)$ is then $\xi h(\varphi)$. The cumulative distribution function of $h(\varphi)$ is $H(\varphi) = 1 - \left(\frac{k}{\varphi}\right)^\gamma$.

Applying this, equilibrium relation (22) becomes:

$$\frac{P_{ft}}{P_{pg}} = \left[\left(\frac{\varphi^{**}}{\varphi^*}\right)^{\gamma} - 1\right]^{\frac{1}{\sigma-1}}\frac{s_{ft}}{s_{pg}}\left(\frac{1}{X_d}\right)^{\frac{1}{1-\sigma}} \tag{A.1}$$

Labor market equilibrium (20) becomes:

$$M_{pg}\tilde{\pi}_{pg} + M_{ft}\tilde{\pi}_{ft} = M_e e + M_e e_{ft}\left(\frac{k}{\varphi^{**}}\right)^{a}. \tag{A.2}$$

Equilibrium equation (21) remains unchanged but it is helpful to rewrite it into:

$$\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi} = \left\{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\frac{s_{ft}}{s_{pg}} + \frac{X_d\theta e_{ft}}{f s_{pg}} - X_d\right] + X_d\right\}\left(\frac{a}{1-a}\right)^{\psi} \cdot \left(\frac{s_{ft}}{s_{pg}}\right)^{\sigma-1}. \quad \text{(A.3)}$$

Inserting this in (A.1) gives equation (24) in the main text.

Inserting $\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}$ from (A.3) in the free entry condition, (23) can be rewritten to (solving for the integral terms on the LHS is not very illuminating):

$$\begin{aligned}
& \frac{f s_{pg}}{\theta}\left[\int_{\varphi^{*}}^{\varphi^{**}}\left[\left(\frac{\varphi}{\varphi^{*}}\right)^{\sigma-1} - 1\right] g(\varphi)d\varphi\right] \\
& + \frac{f s_{pg}}{X_d\theta}\int_{\varphi^{**}}^{\infty}\left[\left\{\left(\frac{\varphi^{**}}{\varphi}\right)^{1-\sigma}\left[\frac{s_{ft}}{s_{pg}} + \frac{X_d\theta e_{ft}}{f s_{pg}} - X_d\right] + X_d\left(\frac{\varphi^{*}}{\varphi}\right)^{1-\sigma}\right\} - \frac{s_{ft}}{s_{pg}}\right] g(\varphi)d\varphi \\
= \quad & e + e_{ft}\int_{\varphi^{**}}^{\infty} g(\varphi)d\varphi.
\end{aligned}$$

which could be rearranged to, by using (24):

$$\begin{aligned}
& \frac{f s_{pg}}{\theta}\left[\int_{\varphi^{*}}^{\varphi^{**}}\left[\left(\frac{\varphi}{\varphi^{*}}\right)^{\sigma-1} - 1\right] g(\varphi)d\varphi\right] \\
& + \frac{f s_{pg}}{X_d\theta}\int_{\varphi^{**}}^{\infty}\left[\left(\frac{1-a}{a}\right)^{\psi}\left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma} - 1\right]^{\frac{\sigma-\psi}{\sigma-1}}\left(\frac{1}{X_d}\right)^{\frac{\sigma-\psi}{1-\sigma}} \cdot \left(\frac{s_{ft}}{s_{pg}}\right)^{1-\psi}\left(\frac{\varphi}{\varphi^{*}}\right)^{\sigma-1} - \frac{s_{ft}}{s_{pg}}\right] g(\varphi)d\varphi \\
= \quad & e + e_{ft}\int_{\varphi^{**}}^{\infty} g(\varphi)d\varphi.
\end{aligned}$$

Totally differentiating (24) yields, after rearranging:

$$d\left(\frac{\varphi^{**}}{\varphi^{*}}\right) = Q_1 de_{ft} + Q_2 dX_d + Q_3 da + Q_4 ds_{ft} - Q_5 ds_{pg}$$

with:

$$
\begin{aligned}
Q_1 &\equiv \frac{(\varphi^{**}/\varphi^{*})^{1-\sigma}\,\dfrac{X_d\theta}{f s_{pg}}}{DEN} > 0 \\
Q_2 &\equiv \frac{\left[(\varphi^{**}/\varphi^{*})^{1-\sigma}\left(\dfrac{\theta e_{ft}}{f s_{pg}}-1\right)+1\right][1-(\sigma-1)(\sigma-\psi)] - \frac{(\sigma-1)(\sigma-\psi)}{X_d}\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}\right]}{DEN} \gtrless 0 \\
Q_3 &\equiv \frac{\frac{\psi}{a\cdot(1-a)}\left\{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{f s_{pg}}-X_d\right]+X_d\right\}}{DEN} > 0 \\
Q_4 &\equiv \frac{\frac{(\psi-1)}{s_{ft}}\left\{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{f s_{pg}}-X_d\right]+X_d\right\}+\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\frac{1}{s_{pg}}}{DEN} > 0 \\
Q_5 &\equiv -\frac{\frac{\psi-1}{s_{pg}}\left\{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{f s_{pg}}-X_d\right]+X_d\right\}+\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{f s_{pg}}\right]\frac{1}{s_{pg}}}{DEN} < 0
\end{aligned}
$$

and with $DEN \equiv \dfrac{\begin{array}{c}\left[\gamma\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}(\sigma-\psi)+(\sigma-1)^2\left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}-1\right]\right]\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{-\sigma}\left[\dfrac{s_{ft}}{s_{pg}}+\dfrac{X_d\theta e_{ft}}{f s_{pg}}-X_d\right] \\ +\gamma\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma-1}(\sigma-\psi)X_d\end{array}}{(\sigma-1)\left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}-1\right]}$,
which is positive.

To see the effects of $de_{ft} > 0$, we use (25) to get $d(\varphi^{**}/\varphi^{*})/de_{ft} > 0$. From (A.1) it follows that:

$$
d(\frac{P_{ft}}{P_{pg}})/\frac{P_{ft}}{P_{pg}} = \frac{\gamma}{\sigma-1}\left[\frac{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}}{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}-1}\right] d\left(\frac{\varphi^{**}}{\varphi^{*}}\right)/\left(\frac{\varphi^{**}}{\varphi^{*}}\right).
$$

Rewriting (11), using (3), gives $R\left(\frac{p_{pg}(\varphi^{*})}{P_{pg}}\right)^{1-\sigma}/\left[1+\left(\frac{1-a}{a}\right)^{\psi}\left(\frac{P_{ft}}{P_{pg}}\right)^{1-\psi}\right] = f\cdot s_{pg}\cdot\sigma$. The denominator of the left-hand-side decreases, requiring $\left(\frac{p_{pg}(\varphi^{*})}{P_{pg}}\right)$ to increase for the equation to remain holding. Since $p_{pg}(\varphi^{*})$ is the minimum value of the price index P_{pg}, $d\left(\frac{p_{pg}(\varphi^{*})}{P_{pg}}\right)/d\varphi^{*} > 0$ and φ^{*} must go up. Equation (19) implies, after invoking $G(\varphi) = 1-\left(\frac{k}{\varphi}\right)^{a}$:

$$
\frac{M_{pg}}{M_{ft}} = \frac{G(\varphi^{**})-G(\varphi^{*})}{[1-G(\varphi^{**})]/X_d} = \left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{a}-1\right]X_d
$$

so that $d\left(\frac{M_{pg}}{M_{ft}}\right)/d\left(\frac{\varphi^{**}}{\varphi^{*}}\right) = a\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{a-1}X_d > 0$.

It is straightforward to verify that the results for $da > 0$, $ds_{ft} > 0$ and $ds_{pg} < 0$ are qualitatively the same to those of $de_{ft} > 0$. By (25), all these changes imply an unambiguous increase in φ^{**}/φ^{*} causing similar effects on P_{ft}/P_{pg} and M_{ft}/M_{pg} as well. Regarding the effect of $ds_{ft} > 0$ and $ds_{pg} < 0$ we note however that $d(P_{ft}/P_{pg})$ also involves a direct effect, which however reinforces the effect $d(\varphi^{**}/\varphi^{*})$ has on $d(P_{ft}/P_{pg})$:

$$\begin{aligned} d\left(\frac{P_{ft}}{P_{pg}}\right)/\left(\frac{P_{ft}}{P_{pg}}\right) &= \frac{\gamma}{\sigma-1}\left[\frac{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}}{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{\gamma}-1}\right] d\left(\frac{\varphi^{**}}{\varphi^{*}}\right)/\left(\frac{\varphi^{**}}{\varphi^{*}}\right) \\ &\quad + ds_{ft}/s_{ft} - ds_{pg}/s_{pg}. \end{aligned}$$

By contrast, a change in X_d leads to an ambiguous effect on φ^{**}/φ^{*}, obstructing finding clear effects for the other variables as well. For X_d to have a positive effect on φ^{**}/φ^{*}, requires the numerator of Q_2 to be positive:

$$\left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left(\frac{\theta e_{ft}}{f s_{pg}}-1\right)+1\right][1-(\sigma-1)(\sigma-\psi)] - \frac{(\sigma-1)(\sigma-\psi)}{X_d}\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left[\frac{s_{ft}}{s_{pg}}\right] > 0,$$

which is is equivalent to:

$$\left[\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left(\frac{\theta e_{ft}}{f s_{pg}}-1\right)+1\right] - \frac{(\sigma-1)(\sigma-\psi)}{X_d}\underbrace{\left\{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left(\frac{s_{ft}}{s_{pg}}+\frac{X_d\theta e_{ft}}{f s_{pg}}-X_d\right)+X_d\right\}}_{*} > 0.$$

Using (A.3) to substitute for the starred term in this equation yields:

$$\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left(\frac{\theta e_{ft}}{f s_{pg}}-1\right)+1-(\sigma-1)(\sigma-\psi)\frac{1}{X_d}\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}\left(\frac{s_{pg}}{s_{ft}}\right)^{\sigma-1}\left(\frac{1-a}{a}\right)^{\psi} > 0.$$

The sign of the first term is unclear but we know that $\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\left(\frac{\theta e_{ft}}{f s_{pg}}-1\right) > -1 - \left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\frac{s_{ft}}{s_{pg}}\frac{1}{X_d}$, for else the starred term would be negative. Hence, the condition can be written to, defining Con as an arbitrarily chosen constant > 0:

$$(Con/X_d) > \underbrace{\left(\frac{\varphi^{**}}{\varphi^{*}}\right)^{1-\sigma}\frac{s_{ft}}{s_{pg}}}_{\gtrless 1} + \underbrace{(\sigma-1)(\sigma-\psi)}_{\gtrless 1}\underbrace{\left(\frac{P_{ft}}{P_{pg}}\right)^{\sigma-\psi}\left(\frac{s_{ft}}{s_{pg}}\right)^{1-\sigma}\left(\frac{1-a}{a}\right)^{\psi}}_{>1 \text{ by condition (14)}}.$$

All terms in this expression are positive. Furthermore both sides of the expression may be smaller or greater than one. Among other things, the condition is more likely to hold the smaller X_d, increasing the LHS of the equation, and the smaller $(\sigma-1)(\sigma-\psi)$, lowering the condition's RHS.

Figure 1. Productivity cut-off points

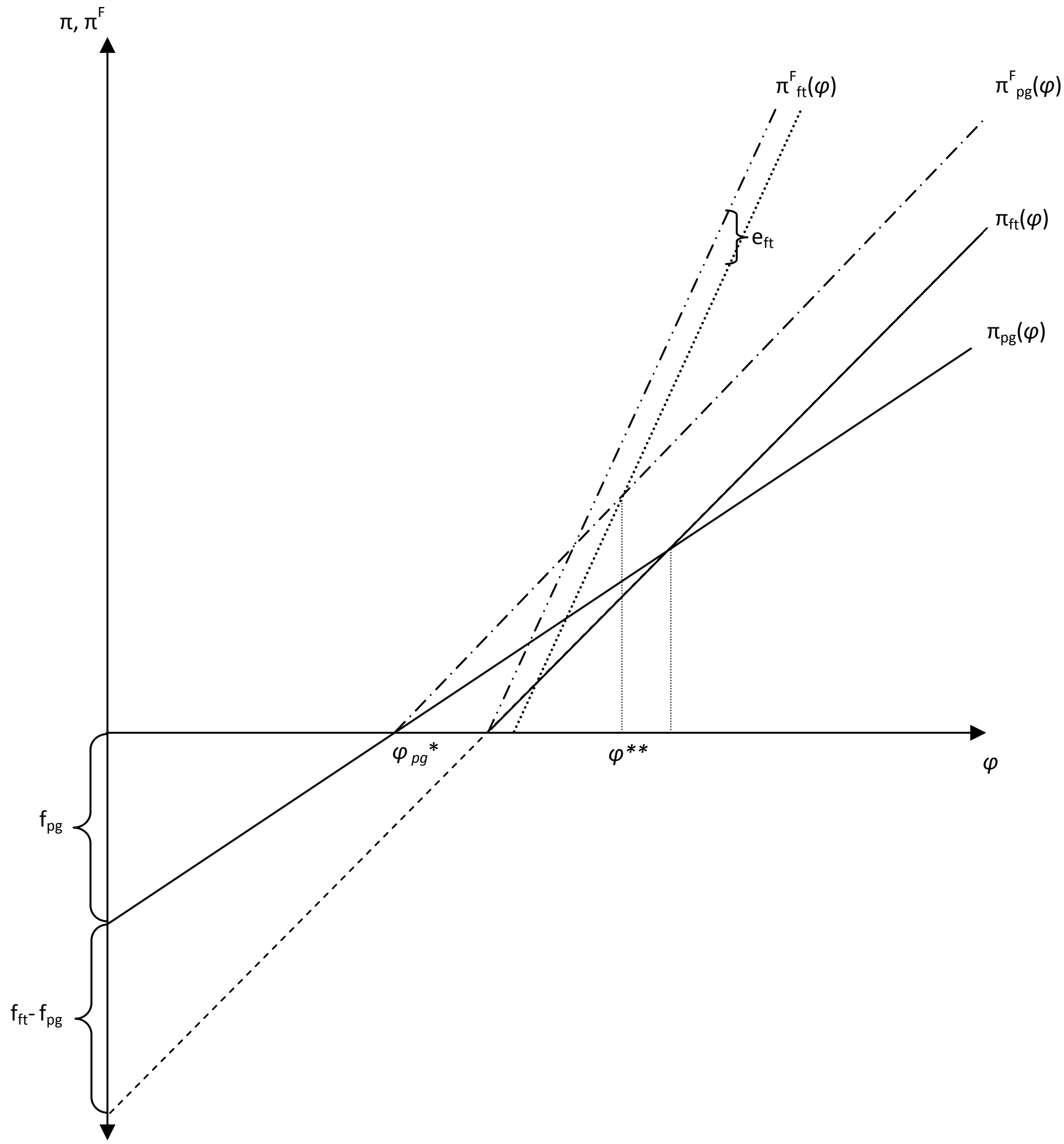

Figure 2: Expected value of a firm