The Certification Game

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Abstract

Ethical certification labels are increasingly popular as people become more conscious of global trade inequality. However, verifying the truthfulness of these certification labels is difficult in a deep global supply chain, and false certification exists. I propose a two-seller, one-buyer duopoly signaling game to study how prosocial preferences and information barriers contribute to false certification in the market for ethically sourced and labelled products. My results show that buyer-side prosocial preferences, such as warm glow and altruism, make room for false certification. When the buyer is driven by warm glow, false certification occurs regardless of information availability. When the buyer has no information on the seller's prosocial type, sellers who certify truthfully are at a competitive disadvantage and the market is flooded with falsely certified products. Also, when buyers are more likely to believe in products that exhibit high certification effort, such as fancier packaging and more elaborate websites, sellers try to out-certify each other in order to out-compete each other, and certification becomes even more costly.

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1 Introduction

In recent years, ethical certification has become increasingly popular. Many certification standards, such as Fair Trade, Rainforest Alliance and UTZ Certification, offer certification labels for environmentally and socially responsible production processes. There can be multiple organizations enforcing each certification standard. For example, Fairtrade international, the umbrella association for multiple national labeling initiatives, maintains a "Fairtrade" label, whereas Fair Trade USA manages its separate "Fair Trade USA" label (Dragusanu et al., 2014).

Ethical certification is gaining popularity because many consumers prefer purchasing ethically produced goods. Even if the physical attributes of the ethically sourced products are not observably different, these consumers are willing to pay a premium for products with certification labels. For example, consumers are willing to pay higher prices for Fair Trade certified coffee, as Hainmueller et al. (2015) show in their experiment, and as Hertel et al. (2009) show in their survey.

Despite consumers' good intentions, certification is not always an effective way to make global trade more equitable and certification providers sometimes fail to meet all of their promises. While one of the goals for Fair Trade is to improve working conditions and provide institutional support for workers, many farm workers receive meager wages and no social security or medical care while producers receive higher prices for Fair Trade coffee (Valkila and Nygren, 2010). In some cases, certification might even be false. Fair Trade certifiers collude with large coffee retailers by lowering certification standards (Jaffee, 2014). Penha (2018) and Camargos (2019), contributors for Reporter Brasil, both reported slavery-like

conditions in Starbucks-certified plantations in Brazil, though Starbucks claims to source ethically. In the cocoa business, Whoriskey (2019) at Washington Post reports that Utz, a large international label for sustainable farming, certified farms that harm rain forests and use child labor.

While ethical certification practices are not always effective, the literature on ethical certification seems to focus more on their potential benefits. Dragusanu et al. (2014) characterize certification as a mechanism to allow consumers to fulfill their sense of social responsibility, and to use their purchasing power to encourage producers to adopt more socially and environmentally responsible production practices. Certification labels provide sellers a credible way to signal the ethical qualities of their products, which are hard to observe and verify. As a result, certification likely increases the proportion of ethically sourced products in the market (Mason, 2009), benefits producers in the global South (Basu et al., 2006), and reduces pollution (Ibanez and Grolleau, 2008).

The examples above reveal an understudied area in the eco-labeling literature, which is false certification. I turn to the finance literature for inspiration. In the finance literature, Bolton et al. (2012) study the incentives for credit rating agencies to inflate ratings. Bolton et al. (2012) suggest that the presence of a larger portion of trusting investors encourages inflated ratings, and that competition between rating agencies reduces rating efficiency. In addition, Becker and Milbourn (2011) find that the entry of a rating agency might encourage other rating agencies to inflate ratings. The development of ethical labeling practices mirrors what happens in the credit ratings industry in key ways: investigating whether a product is produced ethically is as opaque as figuring out the quality of an investment project, and the ethical certification space is seeing increasing competition as the credit ratings industry did

in the early 2000s.

However, the agents in ethical sourcing have fundamentally different incentives from those of the agents in the credit ratings game. While financial firms are motivated by profits and investment returns, many ethical buyers and sellers are driven by non-pecuniary incentives, such as social responsibility. To get a complete picture of ethical certification practices, I incorporate behavioral assumptions, such as warm glow and altruism (for example, Becker (1974); Andreoni (1990); Niehaus (2013)) into modeling buyers' and sellers' preferences. My paper constructs a "credence goods" variation of the credit ratings game and contributes to the eco-labeling literature by extensively studying the incentives for false certification, and by providing in-depth behavioral analysis of market participants.

In this paper, I study how prosocial preferences and information barriers on seller prosocial types and sourcing practices affect certification outcomes in the market for ethically sourced products. I propose a certification game with two sellers and one buyer, in which one seller is altruistic and the other profit-maximizing. The buyer can have prosocial preference utility, such as warm glow or altruism, or not. I use certification effort, such as attaching a certification label to the product, as the sellers' main competition and signaling device. I examine two variations of the model. In the first variation, the buyer has information on whether a seller is altruistic. In the second variation, the buyer has no information on whether a seller is prosocial, and guesses the sellers' types based on their certification effort. In both variations, the buyer does not know if a seller sources ethically and infers their sourcing practices by attaining information on their prosocial type.

I first examine a benchmark in which the buyer knows the sellers' type and has no prosocial preference. In this scenario, no certification occurs. I then show that certification only

occurs when the buyer is prosocial. When the buyer has warm glow preferences, which means they derive additional utility from purchasing certified goods, there will be an even split of truthfully and falsely certified products in the market. When the buyer is altruistic, which means the buyer derives additional utility from purchasing ethically sourced goods, certification outcome depends on information availability. When the buyer knows sellers' types, certification is truthful. When the buyer doesn't, all products in the market exhibit high certification effort, but a large portion will be falsely certified. In the cases that sellers' prosocial types are unobservable, certification gives no credible signal, since the profit-maximizing seller can at least imitate the altruistic seller.

My model suggests that, in the real world where seller ethics and sourcing practices are unobservable to buyers, certification fails to separate ethically sourced products from others, and there will be a lot of falsely certified products in the market. Furthermore, even if seller's altruistic preferences are observable, false certification still exists if the buyer is driven mainly by warm glow. These results seem pessimistic, but understanding the failure of the ethical sourcing system is an essential first step to design mechanisms that better incentivize ethical sourcing and create a more just global trade network.

The paper is organized as follows. Section 2 presents a case study of the Fair Trade Coffee movement to motivate stylized facts for consumer preferences and certification practices. Section 3 surveys the literature on ecolabelling, competing crediting rating agencies, and prosocial preferences. Section 4 presents the two variations of the two-seller, one-buyer certification game. Section 5 summarizes and discusses the model's main results. Section 6 concludes by discussing implications of my findings and areas for future research.

2 The Fair Trade Coffee Movement

The Fair Trade label is among the most well-known ethical certification labels. The Fair Trade label attempts to empower coffee farmers by creating an alternative trade network that offers better trading terms. It tries to ameliorate the structural trade injustice between the Global North and the Global South and to improve the low prices paid for agricultural products. The first Fair Trade labels were issued by the Max Havelaar foundation in 1988 to coffee roasters and retailers who comply with its rules of fairness in coffee trades (Jaffee, 2014). Today, Fair Trade coffee is found not only in quaint cafes, but also in major supermarkets and major coffee corporations such as Starbucks.

One of the important reasons for Fair Trade coffee's rapid growth is that it offers a new form of consumption. In addition to the simple pleasure of drinking a cup of coffee, consumers can now use their consumption to promote more ethical production and fulfill their sense of social responsibility. The utility consumers get from promoting ethical production and fulfilling social responsibility often encourages them to pay a premium and increase demand for a product. Hainmueller et al. (2015) designed a field experiment to explore how the Fair Trade label can impact coffee sales. They conducted a label experiment and found that sales of the two most popular coffees rose by almost 10 percent when they carried a Fair Trade label. They also conducted a price experiment and discovered heterogeneity in consumers who purchase Fair Trade goods. While both coffee products were Fair Trade-labelled, demand for the higher-priced coffee remained steady when its price was raised by 8 percent, but demand for the lower-priced coffee was elastic. Similarly, Hertel et al. (2009) conduct a public opinion survey on attitudes towards human rights and ethical consumption.

They show that consumers have a high willingness to pay for Fair Trade coffee and over half of the survey respondents are willing to pay more than a dollar per pound for Fair Trade certified coffee.

Valkila et al. (2010) analyze the value chain of coffee production and consumption in Nicaragua and Finland. Their findings show that although Fair Trade coffee is sold at a significantly higher margin in Finland, the producers in Nicaragua did not benefit nearly as much. A large share of retail revenue remains domestic, benefiting roasters and retailers. This is due to the fact that while consumers feel good by fulfilling their social responsibility, they have little information on how much they are really contributing to the cause and have no way to ensure that the premium they pay is distributed fairly across the global supply chain. Their research also suggests that Fair Trade price floors have no persistent effect on farmers and the farmers' wages and revenues only improve marginally.

De Janvry et al. (2015) show that the oversupply of certified coffee due to low entry barriers also hinders the Fair Trade movement's ability to empower poor farmers. They examine how free entry and costly excess certification would affect expected producer benefits. De Janvry et al. (2015) use evidence from the association of coffee cooperatives to examine historical trends and to estimate Fair Trade premiums and producer welfare, and find that Fair Trade's expected long-run payoff for farmers is approximately zero. From the zero long-run expected payoff, they conclude that it is very likely that Fair Trade benefits certifiers and sellers more than the farmers.

Not only does Fair Trade provide lower-than-expected benefit to coffee farmers, certifiers also collude with sellers. Jaffee (2014) exposes such collusion between certifying agencies and large corporations. In the late 1990s, large corporations under social pressure ,such as

Starbucks, started selling Fair Trade coffee and the Fair Trade market grew significantly. Because of the dominance of large corporations in commodity markets, some Fair Trade activists believed that they needed to work with these large corporations for the Fair Trade system to grow, which created tension with its social justice ideology. While some activists saw the large corporations' agreements to purchase Fair Trade coffee as a victory, Jaffee reveals that Transfair lowers the Fair Trade certificate standard for super-giant roasters like Starbucks and certifies Starbucks even if it only purchased a very minimal amount of Fair Trade coffee. According to Jaffee, some of Transfair USA's licensees have accused Transfair not only of being too friendly to big corporations, but also of applying Fair Trade standards unequally, by promoting certain licensees over others. Therefore, whether the Fair Trade label is a ploy for transnational behemoths to improve public relations and impose price premiums is becoming an increasingly salient issue, and consumers have no way to tell.

In sum, the Fair Trade coffee case study reveals a few key insights that I will use as stylized facts in my model. First, purchasing Fair Trade coffee provides some consumers a sense of fulfilling social responsibility and many consumers are willing to pay extra. Second, the deep global supply chain makes it difficult for consumer to understand or audit sourcing processes. Third, certification standards sometimes fail to meet their goals, and inflated and false certification exists. Last, farmers seem to not be the group that benefits the most from Fair Trade certification. These stylized facts serve as the foundation and the inspiration for the certification game.

3 Literature Review

I now look at the broader literature on certification and prosocial preferences.

3.1 Certification

Stahl and Strausz (2017) analyze the effects of seller-induced certification and buyer-induced certification in a market where the quality of goods is hard for consumers to observe. The quality of the goods are only known to the seller and can only be made public when certification occurs. In their setup, either the seller or the buyer can initiate the certification. In seller-induced certification, since certifiers will truthfully reveal the quality observed, sellers who produce high quality goods will choose to certify as a signal, and buyers can gain information even when certification doesn't occur, since they can infer that those who aren't certifying their goods produce low quality products. As a result, Stahl and Strausz claim that seller-induced certification leads to more transparency.

Ecolabelling, a form of seller-induced certification, is a certification service that identifies firms that are environmentally friendly. While some consumers value consuming environmentally sustainable products, they often cannot infer a product's environmental quality from consumption, which makes the product a "credence good." As a result, consumers often rely on certifying agencies for signals. In fact, many authors show that ecolabeling has positive impacts. Mason (2009) indicate that ecolabelling is likely to increase the fraction of environmentally responsible products in the market. Ibanez and Grolleau (2008) believe that under the right conditions, ecolabeling can be environmentally effective and economically efficient. Basu et al. (2006) point out that "Child-Labor Free" labels on child labor

employment benefit consumers and producers in the global South. However, researchers also raise potential concerns. Mason (2009) suggest that certifying agencies receive noisy signals from firms, but good firms are more likely to pass than bad firms. Basu et al. (2006) find that "Child-Labor Free" labels does not address the underlying causes for child employment, and more needs to be done to improve education and subsistence. The ecolabelling literature reveals benefits of ecolabelling and attempts to address some concerns. However, the literature generally assumes certifying agencies attempt to deliver accurate certification, and does not emphasize false certification.

The finance literature studies false and inflated certification, especially in credit ratings, more extensively. Bolton et al. (2012) provide a theoretical framework to analyze rating agency competition in the financial industry. The paper proposes a model with three agents: the credit rating agency, the investors, and the bond issuers, and implements features such as rating shopping, reputation costs, and heterogeneous investors to model the payoffs. They find that competition between certifiers will reduce efficiency since it facilitates rating shopping. They also find that a larger portion of trusting investors, who invest based on the reports and are not aware of other players' payoffs, will lead to inflated credit rating. Becker and Milbourn (2011) analyze the effects of the entry of a third rating agency. Their finding strengthens Bolton et al. (2012)'s point that more credit rating agencies might reduce reputation incentives and induce more inflated ratings. Their analysis shows that Fitch's increasing market shares is generally correlated with increases in S&P and Moody's ratings.

3.2 Prosocial Preferences

To study the market outcome for certified credence goods, it is essential to understand the non-pecuniary incentives that drive consumers to pay a premium for these ethical products and sellers to source ethically. Thus, I will incorporate literature on prosocial preference, such as warm glow and altruism, into modeling sellers and buyers in the ethical certification market.

Becker (1974) defines an agent to be purely altruistic if their motivation to donate to a charitable cause is solely driven by the charity's output. Andreoni (1990) proposes the idea of impure altruism, which occurs when agent's utility depends on their private consumption, their private giving to the public good, and the overall public good. He refers to the additional utility an agent gains from their private giving as "warm glow."

Ottoni-Wilhelm et al. (2017) confirm impure altruism experimentally by testing the crowd-out effects of lump-sum taxes. They find that crowd-out decreases with the level of charity output, a result supporting the impure altruism hypothesis. Their experimental affirmation of the impure altruism hypothesis indicates the significance of understanding both warm glow and pure altruism, since impure altruism is a mix of the two.

Niehaus (2013) notices that people are often well-intentioned, but not well-informed. He indicates that despite the large amount of donations going to non-profit organizations, a negligible portion of donors has done research on the effectiveness of projects their donations go to or of their alternatives. While others suggest that information on effectiveness might be costly, he asserts that altruists want to believe that their actions will have intended outcomes. Niehaus indicates that such motives from donors will discourage charities from

revealing information on effectiveness.

4 The Certification Game

In this section, I present a three-player competition model. There is one buyer and two sellers competing for market share. One seller id altruistic, which means this seller gets disutility from not sourcing ethically (i.e. not following Fair Trade standards), and the other to be profit-maximizing. The buyer will choose a seller they want to buy from. The buyer can be prosocial or not. The standard, non-prosocial buyer derives utility solely from observable attributes, such as taste, that do not relate to how ethical the sourcing process is. The prosocial buyer can be either altruistic or driven by warm glow. The former cares about whether the product is *truly* ethically sourced, and the latter derives additional utility from purchasing certified goods. I create this setup as a simplified microcosm of seller competition in real life.

In this model, I will focus on certification effort as the main instrument for competition. To certify a product, a minimum certification effort is required to put the label on the product. Sellers can increase certification effort by having more elaborate websites, fancier packaging, and more advertisement. When the buyer have no information on sellers type, higher certification effort helps build a better brand image and convince the buyers that these firms are ethical.

With certification being the main competition and signaling device, I will focus on two variations of the game. In the first variation, the buyer knows the sellers' types but is unaware of their sourcing actions. In the second variation, the buyer has no information on

the seller other than the certification effort they exhibit.

In the first variation, I will show that when buyers are aware of each seller's type, certification has no signaling effect, but serves as a price-setting device that allows prosocial buyers to pay higher prices for ethically sourced or labelled products. In this variation, there is no false certification when the buyer is standard or altruistic. When the buyer is driven by warm glow, false certification occurs despite the fact that the buyer has information on sellers' types, which shows an information barrier is not necessary for false certification to occur. In the second variation in which seller types are unknown, the sellers use certification effort as a competition mechanism. In this variation, false certification occurs when the buyer is prosocial, and certification is a lot more expensive when the buyer is altruistic. Together, the two variations of models illustrate why sellers certify, how sellers compete, and when false certification occurs.

Before solving for equilibria, I will introduce the model setup.

4.1 Players

There are three players - two sellers and one buyer. One seller is ***altruistic*** and the other is ***profit-maximizing***. There are three possible specifications for the buyer: 1) ***standard***, 2)***warm glow***, and 3) ***altruistic***. Below are the definitions of these player types:

1. **Sellers**

   The only distinction between the altruistic seller and the profit-maximizing seller is that the altruistic seller gets a disutility θ if they don't source ethically. The sellers certify their own products. This setup represents either a seller who self-certifies, or

an incentive-compatible collective of sellers and certifiers, such as a seller and a third-party certifier whose common mission is to alleviate trade imbalances. Also, the sellers prefer producing to not producing, even when these actions result in the same profit.

In the following sections, without loss of generality, I will let seller 1 be profit-maximizing and seller 2 be altruistic.

2. **Buyer**

There are three specifications for the buyer:

A *standard* buyer does not care about the production process. This buyer values all goods at v_0.

An *altruistic* buyer cares about the environmental and social impact their purchase makes. This buyer values ethically-sourced goods at v_a and v_0 otherwise.

A *warm glow* buyer derives utility from their act of private giving, i.e. paying for the certification label. Thus, this buyer values certified goods at $v_0+u(d)$ and non-certified goods at v_0, where d denotes the premium for certified goods. Since d is exogenously given, which is an assumption I will go over in section 4.3, I will denote $v_0 + u(d)$ as v_w.

I will assume $v_a, v_w \geq d$. I will further assume $\frac{1}{2}v_w \geq d$, which means the altruistic buyer is willing to buy certified products if both sellers exhibit the same certification effort. For notation simplicity, I will set $v_0 = 0$.

4.2 Timing

The timing of the game is as follows:

1. The two sellers are in the market. The sellers are aware of the buyer's prosocial type.

2. Each seller decides whether to source the product ethically. This action is unobservable to the buyer.

3. Each seller chooses how much effort they want to put into creating the certification label. If they choose not to certify, their products will sell for p. If they choose to certify, their products will sell for $p + d$. Certification efforts are observable to the sellers and the buyer.

4. Observing the certification labels and the certification efforts, the buyer will choose to buy from the seller whose product gives the highest net utility.

The only distinction between the two variations is whether the buyer knows the sellers' types before deciding which seller to buy from.

4.3 Assumptions

- **Prices:**

  Let p denote the price of uncertified product, and d denote the premium. I assume p and d to be both exogenously given. This assumption that p is exogenous is motivated by the fact that coffee or cocoa prices are determined on a commodity exchange. The assumption that d is fixed allows the model to focus only on the effects of certification

effort, since the buyer might require different certification efforts for products that charge different premiums to have the same belief that the seller sources ethically.

I will assume that the premium d is larger than the sum of the minimum cost of certification c_c and the cost of sourcing ethically c_f. For simplicity, I will assume $p = 0$, which is equal to v_0.

- **Cost Function:**

  Let $f_i \in \{0, 1\}$ denote a seller's decision to source ethically, e_i denote a seller's certification effort, c_f be the fixed additional cost of sourcing a unit of product ethically, and θ_i denote the disutility the seller gets from not sourcing ethically. The cost function C_i for seller i is:

$$C_i(f_i, e_i, \theta_i) = f_i * c_f + e_i + (1 - f_i) * \theta_i.$$

  In addition, there is a minimum cost of putting on a label. I will denote the minimum cost of certification by c_c. If a seller needs to certify a product, they will need to exhibit $e_i \geq c_c$.

  In my cost function, I choose to not include a penalty. This is because there is a low probability of discovering false certification, and when people find out about false certification, there is minimal pecuniary consequence.

  The produced goods are identical in every aspect except for whether they are certified and/or sourced ethically.

- **Market:** There is a total demand of 1 unit of goods. The sellers can produce 1 unit of

goods, 0.5 unit of goods, or no goods. The seller produces 1 unit of goods when they have the entire market, 0 when they have none of the market share, and 0.5 unit if the buyer is indifferent between their product and their competitor's product.

4.4 Equilibrium Sourcing Strategies

Based on the altruistic seller's and the profit-maximizing seller's cost functions, I show that the altruistic seller always chooses to source ethically, and the profit-maximizing seller always chooses to not source ethically.

Proposition 1. *In equilibrium, the profit-maximizing seller never sources ethically, and the altruistic seller always sources ethically.*

Proof. I will prove this by contradiction.

Let seller 1 be profit-maximizing and seller 2 altruistic.

Seller 1's cost function is given by:

$$C_1(f_1, e_1) = f_1 * c_f + e_1.$$

Seller 2's cost function is given by:

$$C_1(f_2, e_2) = f_2 * c_f + e_2 + (1 - f_2) * \theta,$$

where $\theta > c_f$.

Assuming there exists an equilibrium $\{(e_1^*, f_1^*), (e_2^*, f_2^*)\}$ in which $f_1^* = 1$ or $f_2^* = 0$. Since sourcing action is unobvserved, the profit-maximizing seller will be better off choosing $f_1 = 0$ and the altruistic seller will be better off choosing $f_2 = 1$ to minimize their production cost.

Thus, the profit-maximizing seller does not source ethically, and the altruistic seller sources ethically. □

This result comes from my previous assumptions on the additional cost of ethically sourcing and the disutility the altruistic sellers gets from not sourcing ethically. The profit-maximizing seller does not want to bear the additional cost of sourcing ethically, and the altruistic seller would rather pay the additional cost of sourcing ethically than suffering from the disutility of not sourcing ethically. The buyer can now infer a seller's sourcing practice by finding out their prosocial type.

4.5 Competition with Known Seller Types

In this variation, the buyer knows the sellers' types and can infer whether the sellers source ethically or not by proposition 1. The standard buyer specification serves as a benchmark case in which no certification occurs and there is no market for ethically sourced products. The warm glow and altruistic specifications emphasize that prosocial preferences are the reason there is a market for ethically sourced products. In particular, the warm glow specification demonstrates that unknown seller types are not necessary for false certification to occur. Overall, this variation showcases prosocial preferences motivate ethical certification, and warm glow preferences lead to false certification even under available seller type information.

4.5.1 Standard Buyer

The standard buyer's valuation of the products depends on neither whether they are sourced ethically nor whether they are certified. Since sellers' products only differ in how they are sourced and how they are labelled, the standard buyer values all products equally at $v_0 = 0$. In addition, since the standard buyer does not value ethically sourced products differently, they do not pay a premium for certified goods.

Proposition 2. *When the buyer is standard and knows the sellers' types, the altruistic seller does not produce and the profit-maximizing seller produces uncertified products.*

Proof. Let Q_1 denote the quantity the profit-maximizing seller produces and Q_2 denote the quantity the altruistic seller produces.

Since the standard buyer values all products equally at $v_0 = 0$, the standard buyer does not buy certified products ($v_0 < d$) and only buys uncertified products.

If the altruistic seller chooses to certify, the standard buyer will not buy from the altruistic seller, and the altruistic seller does not produce. In this case, the altruistic seller has payoff $P_2 = 0$.

However, if the altruistic seller chooses not to certify, the standard buyer will buy at least 0.5 units of goods from the altruistic seller, resulting in the payoff

$$P_2 = 0.5(-c_f) < 0.$$

As a result, the altruistic seller is better off certifying and not producing.

Therefore, if the profit-maximizing seller chooses not to certify, they will have all the market share with $Q_1 = 1$.

The profit-maximizing seller's payoff is:

$$P_1 = 1 * (c_f * 0) = 0.$$

The profit-maximizing seller will also make 0 if they choose to certify. However, since I assume the seller to prefer producing when payoffs are the same, the profit-maximizing seller will produce 1 unit of uncertified goods. □

The benchmark specification of the standard buyer shows what the market outcome is when buyers do not care about ethical sourcing and labels at all. The result demonstrates that products are not labelled when the buyers do not demand it for additional utility or signals. Their utility determines that they are not willing to pay the premium to buy certified goods. As a result, the altruistic seller does not produce, as they are dissatisfied by unethical sourcing practices but cannot make positive profits if they source ethically and produce. The benchmark specification depicts a scenario in which the altruistic seller does not produce and there will be no certification label.

4.5.2 Warm Glow Buyer

The warm glow buyer does not derives additional utility from buying ethically sourced goods, but from paying a premium for ethically labelled goods. As a result, the warm glow buyer prefers buying certified goods than uncertified goods, but has no preference between buying from the altruistic seller and buying from the profit-maximizing seller.

Proposition 3. *When the buyer has warm glow and knows the sellers' types, both sellers certify their products, exhibit minimum certification efforts c_c, and split the market evenly.*

Proof. The buyer's utility from buying from seller i is:

$$u_i(e_1, e_2) = \begin{cases} v_w - d & \text{if } e_i \geq c_c \\ 0 & \text{otherwise.} \end{cases}$$

It is clear that in this scenario, since the buyer's utility for certified goods $v_w > p+d$, and the buyer's expected utility does not depend on the level of certification effort, both firms choose to certify their products. Thus, $e_1, e_2 \geq c_c$. When both sellers certify their products, the buyer is indifferent between purchasing from either seller.

The quantity a profit-maximizing seller produces is:

$$Q_1(e_1) = 0.5.$$

The profit-maximizing seller earns the following payoff:

$$P_1(e_1) = 0.5 * (d - e_1).$$

The profit-maximizing seller:

$$\max_{e_1} 0.5 * (d - e_1),$$

$$\text{subject to } e_1 \geq c_c.$$

The profit-maximizing seller maximizes their payoff with $e_1 = c_c$, and their payoff P_1 is $0.5(d - c_c)$.

The quantity an altruistic seller produces is:

$$Q_2(e_2) = 0.5.$$

An altruistic seller has the following payoff:

$$P_2(e_2) = 0.5 * (d - c_f - e_2).$$

The altruistic seller:

$$\max_{e_2} 0.5 * (d - c_f - e_2),$$

$$\text{subject to } e_2 \geq c_c.$$

Their payoff is maximized with $e_2 = c_c$, resulting in a payoff of $0.5 * (d - c_f - c_c) > 0$.

Therefore, in equilibrium, both sellers certify with minimal effort c_c.

□

The result that the warm glow buyer still purchases falsely certified products even if they have complete information on the sellers' types is an alarming one. This result comes from the assumption that warm glow buyers only care about paying for the label but not the underlying sourcing practice. In this world, altruistic sellers and profit-maximizing sellers co-exist, and altruistic sellers can support their ethical sourcing initiatives via the premium earned by selling certified product. This shows that even if information is complete, warm glow leads to false certification.

4.5.3 Altruistic Buyer

Unlike the warm glow buyer, the altruistic buyer attains additional utility only from purchasing ethically sourced products. Therefore, their knowledge of the sellers' types is vital to their decision making, since the altruistic buyer uses this information to infer whether a seller sources ethically. In other words, the altruistic buyer makes their purchasing decision based on sellers' types.

Proposition 4. *If the buyer is altruistic and knows the sellers' types, the altruistic seller sets $e_1 = c_c$ and captures all the market share.*

Proof. Since the buyer is altruistic, the buyer gains v_w from buying from the altruistic seller, and 0 otherwise.

The buyer's utility per unit, when buying from the profit-maximizing seller 1:

$$u_1(e_1) = \begin{cases} -d & \text{if } e_1 \geq c_c, \\ 0 & \text{otherwise.} \end{cases}$$

The buyer's utility per unit, when buying from the altruistic seller 2:

$$u_2(e_2) = \begin{cases} v_a - d & \text{if } e_2 \geq c_c, \\ v_a & \text{otherwise.} \end{cases}$$

Since $v_a > v_a - d > 0$, the buyer prefers purchasing goods from the altruistic seller.

Thus, the quantity a profit-maximizing seller produces is:

$$Q_1(e_1) = 0.$$

The seller earns the following payoff:

$$P_1(e_1) = 0.$$

The quantity an altruistic seller produces is:

$$Q_2(e_2) = 1.$$

An altruistic seller has the following payoff:

$$P_2(e_2) = \begin{cases} d - e_2 - c_f & \text{if } e_2 \geq c_c, \\ \frac{-c_f}{2} & \text{if } e_2 = 0. \end{cases}$$

From the above payoff, the altruistic seller chooses $e_2 = c_c$ to maximize their payoff.

Thus, when both sellers are in the market, the altruistic seller captures all the market share. □

When the buyer is altruistic and knows the seller's types, the outcome is optimal in that there is a market only for truthful certification. This can also be thought of as the case in which no certification is needed, but the buyer is willing to pay a higher premium to support the altruistic seller ($c_c = 0$). This shows that, when an altruistic buyer knows that a seller is altruistic, the buyer chooses this seller even if the seller exhibits minimal certification effort. In this scenario, certification is only a device designed to allow the altruistic seller to charge a premium for their ethical sourcing practice. Effectively, if the restriction that sellers need to certify their products to charge the additional premium is lifted, or c_c is close or equal to zero, there is no wasteful certification and false certification does not occur.

4.6 Competition with Unknown Seller Types

In this variation of the model, the buyer no longer has any knowledge of the sellers' types. The buyer now has to rely on certification effort to identify which seller sources ethically. I will skip the standard buyer specification, as it offers no new significant perspective on the issue. The main insight this variation delivers is that under no circumstance will the profit-maximizing seller be driven out of the market. The altruistic seller cannot separate themself from the profit-maximizing seller and the two sellers split the market. The analysis implies that false certification exists in the ethical labeling space whenever profit-maximizing sellers are present.

In addition, I show that, when the buyer is altruistic, there exists a continuum of pooling

equilibria in which both sellers exhibit the same certification effort. The multiplicity of equilibria undermines the power of theory and makes predictions difficult. I add the assumption that the higher the certification effort a seller exhibits, the more the buyer believes the seller is altruistic. This additional assumption allows for competition by raising certification effort and eliminates equilibrium multiplicity. Both sellers try to out-certify each other, which will make certification more costly, and the altruistic seller is at a competitive disadvantage since sourcing ethically costs extra.

4.6.1 Warm Glow Buyer

With unknown seller types, the warm glow buyer's expected utility from purchasing from seller i does not change:

$$u_i(e_1, e_2) = \begin{cases} v_w - d & \text{if } e_i > c_c \\ 0 & \text{otherwise.} \end{cases}$$

Therefore, we have:

Proposition 5. *When the buyer has warm glow and doesn't know the sellers' types, the sellers certify their products, exhibit certification efforts c_c, and split the market evenly.*

This, again, comes from the stylized fact that warm glow buyers only care about paying for the label and do not respond to certification efforts as long as the efforts are above a threshold. In this world, both sellers certify with minimal effort.

4.6.2 Altruistic Buyer

When sellers' types are unknown, the altruistic buyer only buys certified products when they expect the product to be ethically sourced.

Proposition 6. *If the buyer is altruistic and doesn't know the sellers' types, there is a continuum of pooling equilibrium wtih $e_1 = e_2 \in [c_c, d - c_f]$, in which both sellers exhibit the same certification effort and split the market evenly.*

Proof. First, let us look at whether there can be a separating equilibrium.

If $e_1 > e_2$, then the buyer can distinguish the profit-maximizing seller from the altruistic seller. The altruistic buyer prefers buying from the altruistic seller and the profit-maximizing makes zero profit. As a result, the profit-maximizing seller deviates, and there is no separating equilibrium. The same applies for $e_1 < e_2$.

Let's look at what happens when $e_1 = e_2$. If $e_1 = e_2$, the altruistic buyer believes that each seller is altruistic with probability 1/2, and the altruistic buyer's expected utility from buying half a unit of certified goods from each seller is

$$0.5 * (v_a - d) + 0.5 * (v_0 - d) = \frac{1}{2} v_a - d.$$

Now we need to find the off-equilibrium belief with which neither seller has the incentive to deviate.

Note that at $e_1 = e_2$, the profit-maximizing seller has payoff

$$P_1 = 0.5(d - e_1)$$

and the altruistic seller has

$$P_2 = 0.5(d - c_f - e_1).$$

They only deviate to e' if they can provide the buyer with higher expected utility and claim the whole market, or they can give the buyer the same expected utility, but with lower certification effort, meaning $e' < e_i$.

For the first scenario to happen, the buyer's off-equilibrium belief that the seller exhibiting e' is altruistic must be greater than 1/2.

For the second scenario to happen, $e' < e_i$ and the buyer's off-equilibrium belief that the seller exhibiting must equal $\frac{1}{2}$.

Thus, if the buyer's off-equilibrium belief that a seller exhibiting e' is smaller than $\frac{1}{2}$ for all certification efforts $e' \neq e_1 = e_2$, neither seller has the incentive to deviate.

Now, we need to look for the range of this continuum of pooling equilibria. Note that the sellers don't sell uncertified products, since they can deviate to selling certified products to make more profit. Thus, both sellers must certify and $e_i \geq c_c$.

However, the altruistic seller bears the additional cost of c_f from sourcing ethically. Since the profit-maximizing seller does not want to separate from the altruistic seller, the profit-maximizing seller does not exhibit certification efforts infeasible for the altruistic seller's budget. Thus, a continuum of pooling equilibria exists with $e_1 = e_2 \in [c_c, d - c_f]$.

□

This result shows that the profit-maximizing seller is incentivized to exhibit the same certification effort as the altruistic seller to be able to charge the ethical labeling premium.

4.6.3 Eliminating Equilibrium Multiplicity

Although the multiple equilibria reveal the important insight that the profit-maximizing seller simply follows what the altruistic seller is doing, the multiplicity of equilibria makes it difficult to pinpoint the exact certification efforts the sellers make. To eliminate this multiplicity, I deviate from the Perfect Bayesian Equilibrium framework and introduce a new belief system.

Let $\pi_i(e_i)$ denote the buyer's degree of certainty regarding whether seller i is altruistic and $\mu(s_i = 1|e_1, e_2)$ denote the buyer's updated belief regarding whether seller i is altruistic, we have:

$$\mu(s_i = 1|e_1, e_2) = \frac{\pi_i(e_i)}{\pi_1(e_1) + \pi_2(e_2)}.$$

To avoid division by zero, if $\pi_1(e_1) = \pi_2(e_2) = 0$, I will assume $\mu(s_1 = 1|e_1, e_2) = \mu(s_2 = 1|e_1, e_2) = \frac{1}{2}$.

When seller types are unobserved, I assume that the buyer's belief depends on the effort sellers put into the certification label (i.e. more elaborate website, more convincing slogans, and better PR). Thus, the higher the certification effort observed, the stronger the buyer's belief that the seller sources ethically, which means:

$$\frac{d\pi_i}{e_i} > 0,$$

and

$$\mu(s_i = 1|e_i > e_j) > \mu(s_j = 1|e_i > e_j),$$

which states that the buyer is more likely believe whichever seller that exhibits a higher effort.

However, the buyer is aware of the budget constraint that the altruistic seller cannot exhibit certification effort larger than $d - c_f$. So

$$\mu(i = 1|e_i > d - c_f) = 0.$$

Now, let's pinpoint the equilibrium. When the buyer is altruistic, their utility depends on whether the product is ethically sourced. Given the exhibited certification efforts, the altruistic buyer forms a belief of which seller is altruistic. From seller i, the buyer observes signal e_i, and forms the belief that, with probability $\mu(e_i)$, the seller i is altruistic. The more elaborate the display of a seller ethical sourcing practice is, the more the buyer is going to believe that the product is ethically sourced.

The altruistic buyer's belief system now allows the sellers to compete with certification effort. The buyer is relying on certification signals to form beliefs about the ethical nature of products. The equilibrium is as follows:

Proposition 7. *If the buyer is altruistic and seller type is unknown, there is a pooling equilibrium in which both sellers set $e_1 = d - c_f$ and the sellers split the market evenly.*

Proof. The buyer's expected utility per unit, when purchasing a unit of certified product from seller i is:

$$u_i(e_1, e_2) = \begin{cases} \mu(s_i = 1|e_1, e_2)v_w - d & \text{if } e_i \geq c_c, \\ \mu(s_i = 1|e_1, e_2)v_w & \text{otherwise.} \end{cases}$$

As a result of the above expected utility and the assumed buyer beliefs, the altruistic buyer favors high certification costs that are also no greater than $d - c_f$.

The quantity a profit-maximizing seller produces is:

$$Q_1(e_1) = \begin{cases} 1 & \text{if } d - c_f \geq e_1 > e_2, \\ 0.5 & \text{if } e_1 = e_2, \\ 0 & \text{if } e_1 < e_2. \end{cases}$$

The seller earns the following payoff:

$$P_1(e_1) = \begin{cases} d - e_1 & \text{if } d - c_f \geq e_1 > e_2 \text{ and } e_1 > c_c, \\ \frac{d-e_1}{2} & \text{if } e_1 = e_2 \text{ and } e_1 > c_c, \\ 0 & \text{otherwise.} \end{cases}$$

The quantity an altruistic seller produces is:

$$Q_2(e_2) = \begin{cases} 1 & \text{if } e_1 < e_2 \leq d - c_f, \\ 0.5 & \text{if } e_1 = e_2, \\ 0 & \text{if } e_1 > e_2. \end{cases}$$

An altruistic seller has the following payoff:

$$P_2(e_2) = \begin{cases} d - e_2 - c_f & \text{if } e_1 < e_2 \leq d - c_f \text{ and } e_2 \geq c_c, \\ \frac{d-e_2-c_f}{2} & \text{if } e_1 = e_2 \text{ and } e_2 \geq c_c, \\ \frac{-c_f}{2} & \text{if } u(e_1) = u(e_2) \text{ and } e_2 = 0, \\ 0 & \text{otherwise.} \end{cases}$$

In a pooling equilibrium, the altruistic seller and the profit-maximizing seller choose $e_1 = e_2$. However, $e_1 = e_2 = 0$ is immediately ruled out, since the altruistic seller will make

negative profit, and will be better off doing something else.

If $e_1 = e_2 \geq c_c$, $P_1(e_1) = \frac{d-e_1}{2}$ and $P_2(e_2) = \frac{d-e_2-c_f}{2}$.

Now, let's look at the separating equilibrium. In a separating equilibrium, either $e_1 > e_2$ or $e_2 > e_1$.

If $e_1 > e_2$, then $P_1(e_1) = d - e_1$ and $P_2(e_2) = 0$.

If $e_2 > e_1$, then $P_1(e_1) = 0$ and $P_2(e_2) = d - e_2 - c_f$.

Looking at the payoff above, it is clear that when $e_1 = e_2 \geq c_c$, seller 1 will be better off if they raise e_1 marginally, and similarly, seller 2 will be better off if they match seller 1, or raise higher than seller 1.

Therefore, both sellers are incentivized to out-compete the other seller via increasing certification effort, but they are still constrained by $d - c_f$. As a result, both sellers raise their effort to $d - c_f$, a pooling equilibrium.

However, although the altruistic seller makes zero profit by certifying with $e_2 = d - c_f$, they prefer that to exhibiting lower certification efforts and not producing since they want to capture market share.

So now, there exists a unique pooling equilibrium in which both sellers exhibit certification effort $d - c_f$. □

When the buyer is altruistic and forms beliefs based on certification efforts, the altruistic seller is at a competitive disadvantage since their production of ethically sourced products is more costly, and leaves less room for costly certification. Thus, the profit-maximizing seller can show at least as high of an exhibition effort, which forces the altruistic seller to raise its certification effort and make zero profit.

Table 1: Do sellers certify when the buyer knows their types?

	Standard Buyer	Warm Glow Buyer	Altruistic Buyer
Altruistic Seller	No	Truthfully	Truthfully
Profit-maximizing Seller	No	Falsely	No

Table 2: Do sellers certify when the buyer doesn't knows their types?

	Standard Buyer	Warm Glow Buyer	Altruistic Buyer
Altruistic Seller	No	Truthfully	Truthfully
Profit-maximizing Seller	No	Falsely	Falsely

5 Discussion

Tables 1 and 2 summarize certification outcomes of the certification game. In the standard buyer benchmark model, there is no market for certification, which means there is neither truthful nor false certification. The rest of the outcomes illustrate the two main reasons for false certification. The first contributing factor is buyer warm glow. When the buyer is driven mainly by warm glow, they are equally willing to buy falsely certified products and truthfully certified products, as long as the label is there. The second contributing factor is information asymmetry. While the altruistic buyer cares about the social and environmental impact of their purchase, their lack of information on sellers' types limits them from choosing the right seller to buy from. In a world where sellers' actions are unobservable, sellers have to signal the ethical nature of their products through certification effort. However, whatever the altruistic seller signals, the profit-maximizing seller imitates, since the profit-maximizing seller does not bear the additional cost of sourcing ethically.

Tables 3 and 4 look at how information asymmetry and competition via certification

Table 3: Certification efforts when the buyer is altruistic

	Complete Information	Incomplete Information
Altruistic Seller	c_c	$\boldsymbol{d - c_f}$
Profit-maximizing Seller	0	$\boldsymbol{d - c_f}$

Table 4: Sellers' payoffs when the buyer is altruistic

	Complete Information	Incomplete Information
Altruistic Seller	$d - c_f$	0
Profit-maximizing Seller	0	$c_f/2$

effort make certification even more costly when the buyer is altruistic. When the buyer has complete information on the sellers' types, the altruistic seller can certify minimally and capture the entire market. However, when the buyer does not know sellers' types, the buyer relies on certification effort. This puts the altruistic seller at a disadvantage. In this case, both sellers will try to out-certify each other, until the altruistic seller makes no profit. The altruistic seller stays in the market because I assume the buyer to be aware of the sellers' fiscal constraints. However, if this assumption fails to hold, which can easily happen in the real world, the profit-maximizing seller can out-certify the altruistic seller, and capture all the market share.

Overall, the two variations illustrate four key insights. First, certification is driven by buyer-side warm glow and altruism. Second, false certification happens even if information on sellers' types is available. Third, the altruistic seller has a competitive disadvantage and cannot separate themself from the profit-maximizing seller. Last but not least, certification becomes more costly when sellers compete by increasing certification efforts.

6 Conclusion

Ethical certification labels are more relevant as people become more conscious of global trade inequality. In this paper, I propose a model to analyze whether ethical certification labels are truthful. Although my main assumptions are based mostly on a Fair Trade coffee case study, my model provides a general and applicable conceptual framework for looking at ethically certified goods, for which the quality of certification is hard to judge. My results show that, when information on the seller's prosocial type and their sourcing practices is unavailable, the market will be flooded with falsely certified products and wasteful certification signals. My results suggest that many ethical certification labels, even the ones with fancy packages and elaborate slogans, are not as reliable and truthful as we have thought.

How can we ensure certification is truthful? To do this, we need to understand that profit-maximizing sellers are unwilling to source ethically because it costs extra. To change this, governments in the global South should implement trade policies that lower the relative cost of ethical production, such as taxing unethical sourcing practices. In addition, false certification needs to be more costly, with harsher pecuniary penalties for false certification. Also, sourcing practices can be made transparent with the help of technologies, such as blockchain, that make consumers more knowledgeable of the production process. This can improve buyers' ability to spot false certification and even help eliminate the need for certification eventually.

Another issue I expose in this paper is that truthful certification might not matter for all consumers. In my model, I show that while incomplete information hinders the altruistic buyer's ability to discern and purchase ethically sourced products, it does not impact

the warm glow buyer and the standard buyer's welfare, as they are not concerned about sellers' types at all. Therefore, increasing the salience of unethical sourcing practices and raising awareness for consumers who are standard or mainly driven by warm glow will motivate them to become more altruistic and pursue truthful certification, thus facilitating the aforementioned institutional changes needed to enforce truthful certification.

In this paper, I focus on the important first step of solving a problem, which is to recognize the problem. I show that when buyers are prosocial and sellers are profit-maximizing, false certification exists. It is important for researchers, regulators, and ethical sourcing advocates to design appropriate mechanisms to enforce truthful certification and ensure that farmers benefit from the sourcing process.

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Appendices

A Toy Models with Discrete Certification Efforts

I present two toy models to illustrate the key ideas of my main model. The toy models have two sellers and one buyer. The buyer has no information on the sellers' types or their actions, and observes only the certification label and effort exhibited. I then simplify this into a job market signaling type game by showing that the altruistic seller sources ethically and the profit-maximizing seller does not source ethically in equilibrium. I will then solve for Perfect Bayesian Equilibrium.

The first variation of the game allows sellers to choose to certify or not. When the buyer is standard, no certification occurs. When the buyer is prosocial, however, both sellers certify, a pooling equilibrium. This variation shows that buyer-side prosocial preferences drives certification.

The second variation of the game allows sellers to choose to certify high or low. This variation shows what drives excessive certification. When the buyer is warm glow, there is only one pooling equilibrium in which both sellers choose to certify low. When the buyer is altruistic, the sellers either both certify high, or both certify low. This shows that the altruism assumption on buyers allows the existence of multiple pooling equilibria.

I then add an assumption that the buyer's belief on whether a seller is altruistic is an increasing function of the certification effort that seller shows, which reflects the real life since people tend to be more convinced when efforts are more elaborate. This helps eliminate one of the pooling equilibria that both sellers certify low, since the buyer now prefers high-

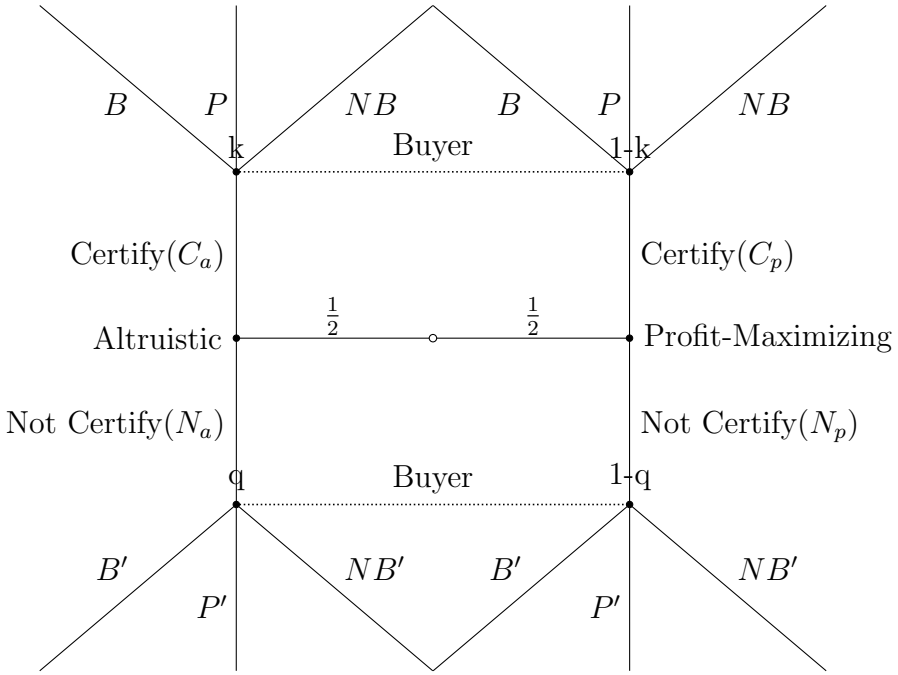
certification-effort products. Note that an important element of the model that forces both to raise certification effort is competition. This is if you don't raise your certification effort, you will get no market share and make zero profit.

To summarize the above findings, the main message that these models deliver is that whenever certification is lucrative, the profit-maximizing seller will mimic altruistic seller's actions. The profit-maximizing seller can always do so since the altruistic seller lacks the resources to separate themself from the profit-maximizing seller.

The capture the dynamic of competition, in addition to Buy and Not Buy, I give the buyer an additional action: Prefer (P). The *buy* action is for when the buyer is willing to purchase, and the *prefer* action is for when the buyer is willing to purchase product A, but they prefer purchasing product B. For example, the warm glow buyer will play "buy" when the product is uncertified, but the buyer will "prefer" buying products that are certified since they give the buyer higher utility. If both sellers choose not to certify, the buyer will buy uncertified products from both sellers. However, if either seller deviates to certifying, the buyer will only buy the certified products.

A.1 Will Sellers Certify?

In the first toy model I show, the sellers can choose two levels of e. The sellers can either choose $e = 0$ or $e = c_c$, which corresponds to 1) not certifying and 2) certifying with minimal effort.



Recall that when the sellers certify, they charge $p + d = d$, and when they don't, they charge $p = 0$.

A.1.1 Standard Buyer:

When the buyer is standard, he values certified and non-certified products equally at $v_0 = 0$. Therefore, the standard buyer will only buy when the sellers don't certify.

Proposition 8. *When the buyer is standard, there is a separating equilibrium in which the altruistic seller certifies, and the profit-maximizing seller doesn't. The standard buyer will only buy from the profit-maximizing seller.*

Proof. Let C denote certify and N denote not certify and subscript a denote actions of altruistic seller and subscript p denote actions of profit-maximizing seller.

Note that the standard buyer will always choose NBB', since they only want to buy non-certified products and gain $-d$ when they purchase certified products.

Separating equilibrium:

C^aN^p: At this separating equilibrium, $k = 1$ and $q = 0$. The buyer will play NBB'. Neither seller has incentive to deviate. The altruistic selelr will make 0 and the profit-maximizing seller will have payoff 0.

N^aC^p: At this separating equilibrium, $k = 0$ and $q = 1$, and the buyer plays NBB'. The altruistic seller wants to deviate so that the standard buyer doesn't buy from them. Not an equilibrium.

Pooling Equilibrium:

C_aC_p: The buyer plays NBB'. Thus, the profit-maximizing seller will prefer capturing market share, thus switching to not certify. Not an equilibrium.

N_aN_p: The buyer plays NBB'. The altruistic seller now makes a negative profit $-\frac{1}{2}c_f$. They are better off switching to C_a. Not an equilibrium.

Thus, there is only one separating equilibrium in which the profit-maximizing seller doesn't certify and the altruistic seller does.

□

A.1.2 Warm Glow Buyer

The warm glow buyer obtains additional utility when purchasing certified products. As a result, when sellers certify, the warm glow buyer is always willing to pay a reasonable premium for certified products.

Proposition 9. *When the buyer is warm glow, there is a pooling equilibrium in which both sellers certify. The sellers split the market.*

Proof. Since the warm glow buyer derives v_0 from consuming uncertified products, they are willing to buy when the sellers do not certify. Since the buyer derives $v_w - d > 0$ when buying certified products, the warm glow buyer prefers buying certified products to non-certified products. This means the warm glow buyer has dominant strategy (PB')

Separating equilibrium:

C^aN^p: At this separating equilibrium, $k = 1$ and $q = 0$. The buyer will play PB'. The profit-maximizing seller will earn $\frac{1}{2}(d - c_c) > 0$ if they choose to certify. Not an equilibrium.

N^aC^p: At this separating equilibrium, $k = 0$ and $q = 1$, and the buyer plays PB', which means the buyer will buy 1 unit from the profit-maximizing seller and none from the altruistic seller. The altruistic seller wants to deviate to make $\frac{1}{2}(d - c_c - c_f) > 0$. Not an equilibrium.

Pooling Equilibrium:

C_aC_p: The buyer plays PB' for $k = \frac{1}{2}$ and any q. In this case, both sellers certify, charge a premium, and split the market. The profit-maximizing seller will make $\frac{1}{2}d$ and the altruistic seller will make $\frac{1}{2}(d - c_c - c_f)$.

N_aN_p: The buyer plays PB' for $q = \frac{1}{2}$ and any k. The altruistic seller now makes a negative profit $-\frac{1}{2}c_f$ and the profit-maximizing seller makes zero profit. If the altruistic seller deviates, they will make $d - c_c - c_f$ profit. If the profit-maximizing seller deviates, they will make d profit. If both deviate, they will make the same as described in the pooling equilibrium C_aC_p. Thus, not an equilibrium.

Thus, there is only one pooling equilibrium in which both sellers certify and share the market. □

A.1.3 Altruistic Buyer

The altruistic buyer derives additional utility when purchasing products from the altruistic seller. Thus, whether the altruistic seller prefers buying certified products depends on k and q. They will only buy a certified product if the expected utility $k * v_a$ is larger than the cost d. They will prefer buying a certified product only if $k * v_a - d > q * v_a$, which means the expected utility from buying certified exceeds that from buying uncertified.

Proposition 10. *When the buyer is altruistic, there is a pooling equilibrium in which both sellers certify. The sellers split the market.*

Proof. Separating equilibrium:

C_aN_p: At this separating equilibrium, $k = 1$ and $q = 0$. The buyer will play PB'. The profit-maximizing seller will earn $\frac{1}{2}(d - c_c) > 0$ if they choose to certify. Not an equilibrium.

N_aC_p: At this separating equilibrium, $k = 0$ and $q = 1$, and the buyer plays NBB', which means the buyer will buy 1 unit of uncertified product from the altruistic seller and none from the profit-maximizing seller. The altruistic seller makes $-c_f$ so they will deviate to certify and not produce. The profit-maximizing seller wants to deviate to make zero profit but obtain market share. Not an equilibrium.

Pooling Equilibrium:

C_aC_p: At this pooling equilibrium, $k = 1-k = \frac{1}{2}$. The buyer is expected to get $\frac{1}{2}v_a - d > 0$ from buying certified products. Note that the expected payoff per unit of product if the buyer buys non-certified product depends on off-equilibrium belief q. Such payoff is $k * v_a$.

If $\frac{1}{2}v_a - d > q * v_a \Rightarrow q < \frac{1}{2} - \frac{d}{v_a}$, the altruistic buyer will prefer buying certified product, resulting in PB'.

If $q > \frac{1}{2} - \frac{d}{v_a}$, the altruistic buyer will prefer buying uncertified product, resulting in BP'.

If $q = \frac{1}{2} - \frac{d}{v_a}$, the altruistic buyer will be indifferent between buying certified and uncertified, resulting in BB'.

In all three cases, without deviating, the altruistic seller makes $\frac{1}{2}(d - c_c - c_f)$ and the profit-maximizing seller makes $\frac{1}{2}(d - c_c)$. If they deviate, the best they will make is 0. Thus, this is an pooling equilibrium.

$N_a N_p$: At this pooling equilibrium, $q = 1 - q = \frac{1}{2}$. The buyer is expected to get $\frac{1}{2}v_a$ when buying uncertified product. Note that the expected payoff per unit of product if the buyer buys certified product depends on off-equilibrium belief k. Such payoff is $k * v_a - d$.

If $kv_a - d > \frac{1}{2} * v_a \Rightarrow k > \frac{1}{2} + \frac{d}{v_a}$, the altruistic buyer will prefer buying certified product, resulting in PB'.

If $k = \frac{1}{2} + \frac{d}{v_a}$, the altruistic buyer will be indifferent between buying certified and uncertified, resulting in BB'.

If $\frac{d}{v_a} \leq k < \frac{1}{2} + \frac{d}{v_a}$, the altruistic buyer will prefer buying uncertified product, resulting in BP'.

If $k < \frac{d}{v_a}$, the altruistic buyer will not buy certified products, resulting in NBB'.

In the first three cases, the profit-maximizing seller earns zero profit and the altruistic seller earns $\frac{1}{2} - c_f$ profit. Both will want to deviate but certifying.

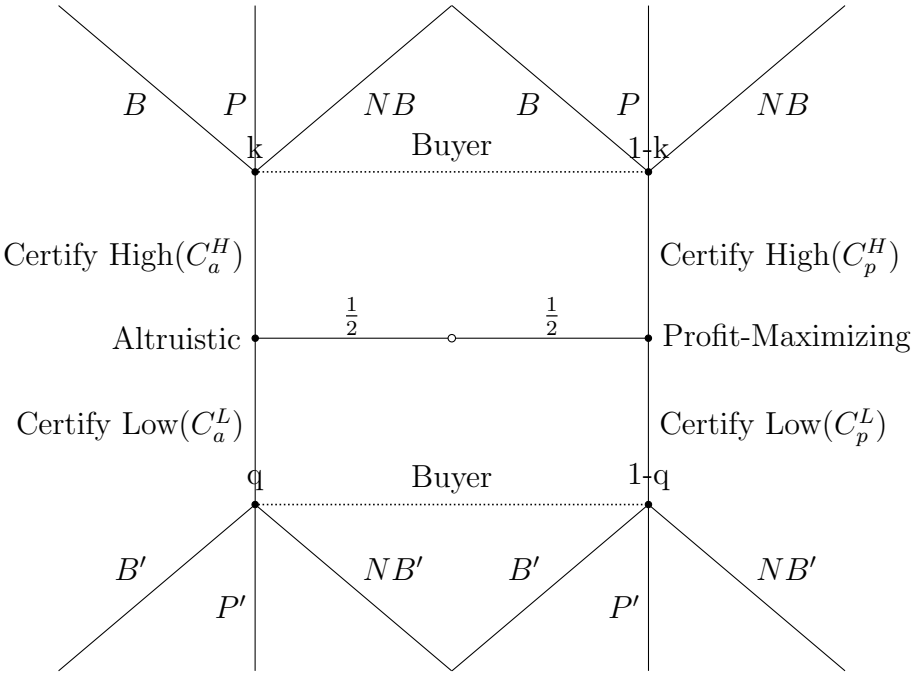
In the last case, the altruistic seller will want to deviate despite that the altruistic seller won't buy any certified product. This is because the altruistic seller is making negative profit from selling uncertified products.

Thus, there is only one pooling equilibrium in which both sellers certify and share the market. □

A.2 Varying Certification Effort?

Now, after seeing in a simple toy model that describes the scenarios under which the sellers will certify, I will now show the conditions needed for sellers to raise their certification efforts.

Instead of certify or not, sellers are now choosing between certify high and certify low. Certify low requires $e = c_c$, and certify high requires effort $c_c + \alpha$.



In this section, we will ignore the analysis of standard buyers. This is because with a standard buyer, certification won't occur.

Let's now look at the cases of warm glow and altruistic buyers.

A.2.1 Warm Glow Buyer

The warm glow buyer obtains additional utility when purchasing certified products. However, they don't care about how much certification efforts are exhibited, as long as a minimum effort is met.

As a result, when sellers certify, the warm glow buyer's willingness to pay is the same for a product exhibiting high effort and for a product exhibiting low effort.

Proposition 11. *When the buyer is warm glow, there is a pooling equilibrium in which both sellers certify low. The sellers split the market.*

Proof. Since the warm glow buyer derives v_w from consuming certified products, they gain $v_w - d$ from buying certified goods from both sellers regardless of the level of efforts. Thus, the buyer will play BB'.

Therefore, it is fairly obvious that since certify high costs extra for both sellers, and the best they can do is split the market, both sellers will choose to certify low. □

A.2.2 Altruistic Buyer

The altruistic buyer obtains additional utility when purchasing products from the altruistic buyer. Whether they will buy high certification or low certification product depends on k and q.

Proposition 12. *When the buyer is altruistic, there are two pooling equilibria that are contingent on off-the-equilibrium beliefs. Either both sellers certify high or both certify low. In both cases, the sellers split the market evenly.*

Proof. Separating equilibrium:

$C_a^H C_p^L$: At this separating equilibrium, $k = 1$ and $q = 0$. The buyer will play PB' and won't buy any products with low certification effort. The profit-maximizing seller will earn $\frac{1}{2}(d - c_c - \alpha) > 0$ if they choose to certify high and zero if they certify low. Not an equilibrium.

$C_a^L C_p^H$: At this separating equilibrium, $k = 0$ and $q = 1$, and the buyer plays NBB', which means the buyer will buy 1 unit of low cerfication effort product and no high certification effort product. The profit-maximizing seller makes $\frac{1}{2}(d - c_c)$ if they deviate to certify low. Not an equilibrium.

Pooling Equilibrium:

$C_a^H C_p^H$: At this pooling equilibrium, $k = 1 - k = \frac{1}{2}$. The buyer is expected to get $\frac{1}{2}v_a - d > 0$ from buying high-effort products. Note that the expected payoff per unit of product if the buyer buys low-effort product depends on off-equilibrium belief q. Such payoff is $q * v_a - d$.

If $\frac{1}{2}v_a - d > q * v_a - d \Rightarrow q < \frac{1}{2}$, the altruistic buyer will prefer buying high-effort product, resulting in PB'. If either buyer deviates to producing low effort products, the buyer will not buy from them, leading to a profit of zero.

If $q > \frac{1}{2}$, the altruistic buyer will prefer buying low-effort product, resulting in BP'. In this case, the sellers will deviate to C^L since the buyer prefers low-effort products and they cost less to produce. Not an equilibrium.

If $q = \frac{1}{2}$, the altruistic buyer will be indifferent between buying high-effort and low-effort products, resulting in BB'. Thus, both sellers will deviate to producing low-effort products, since the production costs less and the revenues are the same. Not an equilibrium.

$C_a^L C_p^L$: At this pooling equilibrium, $q = 1 - q = \frac{1}{2}$. The buyer is expected to get $\frac{1}{2}v_a - d$ when buying low-effort product. Note that the expected payoff per unit of product if the buyer buys certified high-effort product depends on off-equilibrium belief k. Such payoff is $k * v_a - d$.

If $kv_a - d > \frac{1}{2} * v_a - d \Rightarrow k > \frac{1}{2}$, the altruistic buyer will prefer buying high-effort product,

resulting in PB'. This is the most interesting case to analyze, since sellers need to consider the tradeoff between producing high-effort products and the potential benefit of running a monopoly.

If $k > \frac{1}{2}$, the altruistic buyer will make $\frac{1}{2}(d - c_f - c_c)$ producing low-effort goods and the profit-maximizing seller will make $\frac{1}{2}(d - c_c)$.

If the altruistic seller deviate and the profit-maximizing seller doesn't, they will now have a monopoly on the market, since the buyer prefers high-effort goods, thus making $d - c_f - c_c - \alpha$.

If the profit-maximizing seller deviates and the altruistic seller doesn't, they will have a monopoly on the market, thus making $d - c_c - \alpha$.

Thus,for any $\alpha \leq \frac{1}{2}(d - c_c)$, at least one seller has the incentive to deviate.

If $k \leq \frac{1}{2}$, the altruistic buyer at least prefer low-effort products as well as high-effort products. Thus, both sellers will not deviate since exhibiting high certification effort won't help them make more profits.

Therefore, there are two pooling equilibria - one in which both sellers certify high, and one in which both sellers certify low.

□

A.3 Eliminating Equilibrium Multiplicity

The varying certification cost with altruistic seller illustrates the possibility of multiple equilibriia. Although the result reveals the key insight that the profit-maximizing seller will want to imitate the altruistic seller, the multiplicity doesn't give theory the power of predicting

whether wasteful certification will take place.

To eliminate equilibrium multiplicity, I impose the following assumption regarding certification effort.

I assume that the buyer's belief depends on the effort sellers put into the certification label (ie more elaborate website, more convincing slogans, and better PR). Thus, the higher the certification effort observed, the stronger the buyer's belief that the seller sources ethically, which means:

$$\frac{d\pi_i}{e_i} > 0$$

and

$$\mu(f_i = 1 | e_i > e_j) > \mu(f_j = 1 | e_i > e_j),$$

which states that the buyer will more likely believe whichever seller that exhibits a higher effort.

However, the buyer is aware of the budget constraint that the altruistic seller is facing, that such seller cannot exhibit certification effort larger than $d - c_f$. So

$$\mu(f_i = 1 | e_i > d - c_f \geq e_j) = 0$$

The above assumption requires k to be greater than q. Plugging this back into the PBE proof, we can easily show that the only remaining pooling equilibrium is when both sellers certify high, thus creating increasingly wasteful certification signals.