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Image concerns and the provision of quality

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Abstract

Image concerns and the provision of quality

by Jana Friedrichsen*

In this paper, I study markets where consumers are heterogeneous with respect to both their concerns for the quality of goods and the image associated with them. Consumers with a taste for quality lend a positive image to the product of their choice and thereby increase the product's value to others. A monopolist restricts the product portfolio and charges price premia to allocate image along with quality. Heterogeneity in image concerns thereby provides a rationale for pooling consumers with differing quality preferences. Although image is correlated with a product's quality in equilibrium, an increase in the value of image may decrease quality provision. In a competitive market, premium prices are unsustainable so that image-concerned consumers buy excessive quality instead. Monopoly may therefore yield higher welfare than competition. Policy options to remedy the efficiency losses are discussed.

Keywords: image motivation, conspicuous consumption, two–dimensional screening, ethical consumption

JEL classification: D21, D82, L15

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"People buy things not only for what they can do, but also for what they mean."
-Levy (1959)-

1. Introduction

Goods are valuable not only through their intrinsic characteristics but consumption also has a symbolic value (e.g. Campbell, 1995). As consumers express their preference for a certain type of production through their consumption decisions (The Economist, 2006; Ariely and Norton, 2009) the purchasing choice becomes a signal of a consumer's type. Consequently, each product is associated with an image which reflects the type of consumer who buys it. It is well-documented that consumers are willing to pay for this image (see e.g. Chao and Schor 1998; Charles et al. 2009; Heffetz 2011). Prominently, Toyota's hybrid car Prius sells well because consumers feel it "makes a statement about [them]" (Maynard, 2007). Regarding the Prius, Sexton and Sexton (2011)'s empirical analysis indicates that "consumers are willing to pay up to several thousand dollars to signal their environmental bona fides through their car choices." In this paper, I study the impact of such image concerns in markets. Specifically, I analyze quality provision and prices when individuals differ both in their valuations of quality and their desire for social image.[1] I first solve for the optimal product line offered by a monopolist and then a perfectly competitive setting. This allows me to disentangle the effects of strategic consumer behavior from the effects due to the strategic behavior of a (monopolistic) producer.

Anecdotal evidence suggests that, indeed, firms strategically tailor their products to consumers' desire to be identified with certain characteristics. Advertisements play with product images. Examples include the German "Bionade", which was advertised as "the official beverage of a better world" (see e.g. Ullrich, 2007), and the soft drinks "ChariTea" and "LemonAid".[2] The latter two appeal to non-consumption values through a clever word play that links the name of the drink with charitable acts. Alternatively, the reader may think of expensive watches or cars (see Seabright, undated, for examples) or the wine market (Bruwer et al., 2002). While conspicuous consumption is a well-researched

[1] I employ the term image motivation or image concern for consumers' interest in an observer's inference about their type (for similar use see e.g. Ariely et al., 2009). Signaling motivation, status concern, or conspicuous consumption refer to the same phenomenon but sometimes restrict attention to the signaling of wealth. Cabral (2005) suggests to use "reputation" for situations "when agents believe a particular agent to be something." The term "image" is more common in the relevant literature and thus used here.

[2] These two drinks are advertised with "Drinking helps!". See e.g. `http://www.lemon-aid.de/`.

behavior (see e.g. in economics, Veblen, 1915; Ireland, 1994; Bagwell and Bernheim, 1996; Glazer and Konrad, 1996; Corneo and Jeanne, 1997, in sociology Campbell, 1995; Miller, 2009, psychology Griskevicius et al., 2010, and popular media The Economist, 2010; Beckert, 2010), little work formally investigates how the supply side reacts to consumers' signaling desires (but see Rayo 2013; Vikander 2011).

To the best of my knowledge, the strategic implications of heterogeneous image concerns on quality provision have not yet been studied without restrictions on the correlation of quality preferences with intrinsic motivation. Rayo (2013) analyzes how a monopolist allocates image if consumers differ in their image and quality concerns and both are proportional to each other. Interestingly, this proportionality assumption prevents any pooling that would not already occur in a simple model of quality provision without image concerns (e.g. Mussa and Rosen, 1978). This paper illustrates a different reason for pooling, namely that marginal utilities in both dimensions are not aligned. In addition, it proposes a new model for competition and shows that image concerns remain relevant if producers are price-takers and market outcomes are driven by consumer preferences alone.

To analyze these issues, I set up a simple model where consumers may derive utility from quality as well as from the image associated with a product. The image of a product emerges endogenously from the consumption decisions of individual consumers. Image is the conditional expectation of a consumer's type after purchases have been observed. Consumption is conspicuous in that it provides evidence of the personal characteristic "taste for quality".[3] The notion of quality is a general one here. For instance, quality can also refer to the extent to which production is environmentally friendly.

The first part of the paper concentrates on a monopolistic market. This captures an essential aspect of status goods, namely their inimitability. I extend a standard monopolistic model of quality provision (Mussa and Rosen, 1978) to allow for heterogeneity on the consumer side in both preferences for quality and in image motivation. This model allows me to study how the producer strategically adjusts product variety and prices in response to consumers' image concerns. Since in the long run, substitutes may evolve which also confer image, the analysis is complemented with a fully competitive setting.

The analysis reveals that monopolists react to heterogeneity of image concerns by distorting quality provision and not only prices. While a high-quality product with a quality level that is first best in the absence of image concerns is always available, the

[3] Conspicuous consumption according to Veblen (1915, p. 47) is the "specialized consumption of goods as an evidence of pecuniary strength". Here, the "taste for quality" can be driven by wealth or expertise and thereby signaling this trait is equally valuable as signaling "pecuniary strength".

corresponding price as well as available alternatives reflect image concerns unless the value of image is sufficiently low. For intermediate levels of image concerns, the monopolist introduces a lower-(but positive)-quality, lower-price product to profitably screen consumers with respect to their willingness to pay a premium for image and increase market coverage. Purely image-concerned consumers pool with purely quality-concerned consumers and buy the lower-quality product. Hence, fewer consumers decide in favor of a zero-quality outside good. The high-quality product's price reflects its premium image and is attractive only to consumers who value both quality and image. Therefore, fewer consumers choose high quality than in the absence of image concerns. Depending on the distribution of consumer types, total provision of quality may even decrease as the value of image increases because the reduction in average quality outweighs the increase in market coverage. If image is very valuable, the monopolist does not offer a low-quality product. Instead he sells exclusively to consumers who value image in addition to quality so that market coverage and total quality provision decrease. In general, in response to image concerns, quality provision of monopolists may either increase or decrease.

In contrast to a monopolist, firms operating in perfect competition cannot strategically react to image concerns. Still, if the value of image is sufficiently large, the market outcome features product differentiation which is not driven by heterogeneous valuations for quality but by heterogeneous image concerns. In a competitive market, prices are driven down to marginal cost so that consumers cannot simply overpay to obtain a good image as they would be encouraged to do by a monopolist's product menu. Thus, in a competitive market, consumers who value both image and quality buy inefficiently high quality. Higher quality serves as a "functional excuse" to separate from lower valuation consumers. The quality used as functional excuse is too expensive for purely image-concerned consumers even if sold at marginal cost. Purely image-concerned consumers pool with purely quality-concerned consumers on a lower quality product. The lower quality product features exactly the same quality which is offered as "high quality" by the monopolist so that total quality provision is higher in competition than in monopoly. Interestingly, however, monopoly often yields higher welfare than competition. The reason is that consumers buy excessive quality in the competitive market in the sense that producing these quality levels is inefficient. Consumers need to use quality to acquire a good image but this way of signaling is inefficient. A monopolist allows for less wasteful signaling by restricting the product space.

The model applies to a wide range of settings; wine, cars or watches as well as technological devices such as mobile phones or notebooks are sold in the presence of image concerns. Recently buying green or ethical has become conspicuous, the Prius being a popular example. To fix ideas, I illustrate the model and the main implications of image concerns within the framework of green consumption. The public good character of environmentally friendly production gives the problem another interesting twist because in that case total quality is particularly relevant.

Example: green consumption Suppose the production of a certain good exerts positive externalities on others, e.g. refraining from the use of hazardous inputs or using less polluting technology. In this context, quality measures to what extent the production process creates such positive externalities. Several empirical studies find that consumers are willing to pay a higher price for green products, i.e. products with positive externalities (e.g Casadesus-Masanell et al., 2009). Suppose some consumers value these externalities as such while some value products with positive externalities because they are connected to higher social esteem.[4] My results explain how these image concerns affect the production process (i.e. the "quality") as well as prices in monopoly and competition.

The main results translate to the example of green consumption as follows. In monopoly, the first-best quality, understood as the green quality which would be sold if image concerns were absent and preferences known, is always available. Product differentiation occurs through an additional green product with lower degree of environmental friendlyness (lower production standards). Propagating green production through the introduction of a lower quality product is a strategic choice by the monopolist to maximize profits. Even though this increases the market share of green production, it does not necessarily indicate social responsibility on the monopolist's part. Instead, the monopolist engages in strategic corporate social responsibility (Baron, 2001): he tailors his products to individuals' demand for responsible products for profit-maximizing reasons. In competition, green quality is available at a much lower price than in monopoly. Thus, consumers who only value image pool with all intrinsic buyers at the green quality which is first best, i.e. the high quality level in monopoly. This dilutes the image associated with this level of green quality. Those who value image and quality resort to green products with even higher standards to sustain the image of being the most environ-

[4] It does not matter whether intrinsic interest arises from externalities or from e.g. private health benefits. It is enough that some consumers derive intrinsic benefit from the green character of a product. Such an intrinsic motivation could also be motivated by altruism or "warm glow" (Andreoni, 1990). Image motivation has been studied in Glazer and Konrad (1996) and Harbaugh (1998) and is empirically documented in e.g. Griskevicius et al. (2010) and Sexton and Sexton (2011).

mentally responsible consumers. To summarize, my model predicts situations where (1) in monopoly, increases in image concerns increase the market size of green products but simultaneously decrease the quality of the average green product. (2) In competition, image concerns trigger sales of "greener" products and green production (weighted by standard) increases with image concerns.

These model predictions fit well with empirical observations. As consumers become more interested in social and environmental characteristics, supply responds to these preferences with corporate social responsibility becoming more and more widespread. The market for organic products grew on average by more than 14% per year between 1999 and 2007 (Sahota, 2009), and similarly Fairtrade sales experience two-digit annual growth rates in many European markets (Transfair.org, 2011). While the mainstreaming of responsible consumption seems to be welcome, critical voices lament a dilution of the underlying principles as products are tailored to a broader audience.[5] More recently, several actors in Fairtrade and organic production have introduced their own standards above the one implemented in mainstream retailing, as my model predicts for a competitive environment.[6,7]

The rest of the paper is structured as follows. I first introduce the monopolistic model and discuss two benchmark cases (Section 2) before the full model is analysed in detail in Section 3. Section 4 studies heterogeneous image concerns in a competitive market before welfare implications are addressed in Section 5. Section 6 presents possible policy interventions as well as extensions to interpreting quality as a public good and to a monopolistic market where the value of image is negative. In Section 7, I discuss how my work relates to other approaches in the literature. Section 8 concludes. Proofs which are not included in the main text are relegated to Appendix A.

[5]See for instance Clark (2011) in Bloomberg Businessweek and Stevens (2011). Regarding the discussion about discounters engaging in Fairtrade sales see also `http://www.taz.de/!40673/`.

[6]See for instance `http://fair-plus.de/`, and Purvis (2008) on Fairtrade. For organic products, a number of voluntary agreements exist which enforce more stringent standards than e.g the certified organic standard of the European Union (see IFOAM, undated).

[7]Social responsible investing (SRI) has also grown rapidly since the late nineties and faster than investing in conventional assets under management with critical voices similarly calling in question the benefits (Haigh and Hazelton, 2004).

2. Monopolistic quality provision and image concerns: Model and benchmarks

2.1. The model

Consider a monopolist who sells products of potentially different quality to heterogeneous consumers from a population of unit mass. Quality is chosen by the monopolist on a continuous scale and perfectly observable. A product is a combination of quality and price and is in equilibrium associated with an image that reflects which consumer type buys the respective product.

Consumers' utility depends positively on quality $s \in \mathbb{R}_{\geq 0}$ and image (or reputation) $R \in [0,1]$, and negatively on price $p \in \mathbb{R}_{\geq 0}$ of a product. Consumers can differ in both, their interest σ in quality (intrinsic motivation) and their interest ρ in image (image motivation). The two-dimensional type (σ, ρ) is drawn from $\{0,1\} \times \{0,1\}$ with $\text{Prob}(\sigma = 1) = \beta$, $\text{Prob}(\rho = 1|\sigma = 1) = \alpha_s$, and $\text{Prob}(\rho = 1|\sigma = 0) = \alpha_n$. The resulting four different types of consumers are indexed by $\sigma\rho$; their frequencies are stated in Table 1. The parameter $\lambda > 0$ describes the value of image relative to the marginal utility from quality.[8] Utility takes the form:

$$U_{\sigma\rho}(s, p, R) = \sigma s + \rho\lambda R - p \tag{1}$$

The image R of consumer (σ, ρ) is the expectation of her quality preference parameter σ conditional on her purchasing decision. It reflects an outside spectator's (or the consumer mass') inference of a consumer's interest in quality. A formal definition of image follows with the equilibrium definition in Section 2.3.

Table 1: Consumer types and their frequencies.

	image concern	no $\rho = 0$	yes $\rho = 1$	$\sum$
quality concern	no: $\sigma = 0$	$(1-\beta)(1-\alpha_n)$	$(1-\beta)\alpha_n$	$(1-\beta)$
	yes: $\sigma = 1$	$\beta(1-\alpha_s)$	$\beta\alpha_s$	β

[8] Alternatively I could allow for (σ, ρ) drawn from $\{0, \bar{\sigma}\} \times \{0, \bar{\rho}\}$ for arbitrary $\bar{\sigma}, \bar{\rho} > 0$. This is equivalent to my formulation with $\lambda = \frac{\bar{\rho}}{\bar{\sigma}}$. Since λ gives the relative weight on image concerns I can also rewrite the analysis with a weight $\gamma \in [0,1]$ on image and a weight $1-\gamma$ on quality such that I obtain the above formulation with $\lambda = \frac{\gamma}{1-\gamma}$.

The **monopolist** offers a menu of products $\mathcal{M} \subset \mathbb{R}^2_{\geq 0}$ to maximize expected profit given that consumers self-select (second-degree price discrimination); due to privacy of consumer types perfect price discrimination is impossible. The monopolist cannot choose image directly, but takes into account which image will be associated with each of his products in equilibrium. Unit costs are assumed to be linear in quantity sold and convex increasing in quality, specifically $c(s) = \frac{1}{2}s^2$.[9]

Each consumer can choose a preferred product from the menu of quality-price offers or decide not to buy any of them. The latter case corresponds to obtaining the outside good of zero quality at a price of zero. Reservation utility is then equal to the utility derived from the image of non-buyers (=outside good buyers). The analysis remains essentially unchanged if buying an outside good with zero quality gives the same utility, say $\bar{a}$, for all consumers. Voluntary participation is taken care off by requiring the outside option $(0, 0)$ to be part of the product menu $\mathcal{M}$.[10] If the monopolist allocates $(0, 0)$ to a consumer type this means this type chooses the outside option.

2.2. The structure

The distribution of σ and ρ and the value of λ are common knowledge and so is the setup of the market interaction. Consumers privately learn their types. Quality is correctly perceived by consumers; cheating on quality is prevented e.g. through third-party verification or because it is obvious from inspection.

The timing is as follows (see also Figure 1):

(i) The monopolist offers a menu $\mathcal{M}$ of products. Qualities and prices are observed by all consumers.

(ii) Consumers learn their types.

(iii) All consumers simultaneously choose a product which maximizes utility for their type.

(iv) Images associated with each product emerge according to purchasing decisions and payoffs realize.

[9]Specifying a functional form allows to obtain closed form solutions. The results are qualitatively the same with constant unit costs $c(s) = c$ (see Appendix B).

[10]In the following, taking $(0, 0)$ will also be referred to as non-participation since this is the meaning of it. Strictly speaking all types participate by construction.

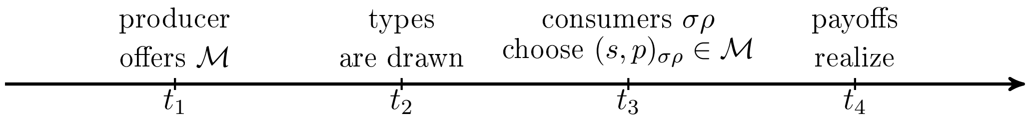

Figure 1: Timing

Whenever in the following the term "game" is used, this is to be understood as a "psychological game" (Geanakoplos et al., 1989) since consumers' reduced form utilities directly depend on beliefs of others. A possible mechanism to microfound an image or status concern is a matching technology as in Pesendorfer (1995) or Rege (2008), where agents are interested in signaling that they are "good" to increase their chances of interacting with other "good" agents in the future. Agents may differ in image motivation because they engage in different types of interactions where the other's type is more payoff-relevant or less so.[11]

2.3. Equilibrium

In the presence of image concerns the menu offered by the monopolist induces a game among consumers. Image-concerned consumers' payoffs depend on image and thereby on equilibrium play. Consumers form beliefs about which products other consumer types buy and take this into account when deciding on their purchases. Consumers who value image have an incentive to buy a product which they believe is bought by consumers with an intrinsic interest in quality since this signals caring about quality and is rewarded with a higher image. Whether or not a consumer cares about image does not influence her image directly but influences the choice of a product and can thereby indirectly impact on the image. Image depends on the partition of consumers on different products and thereby only indirectly on absolute product quality.

For every menu $\mathcal{M} \in \mathcal{P}(\mathbb{R}^2_{\geq 0})$ the choice function $b_{\mathcal{M}} : \{0, 1\}^2 \to \mathcal{M}$ states which product $(s, p) \in \mathcal{M}$ is chosen by consumer type $\sigma\rho$.[12] For every menu $\mathcal{M}$ the belief function $\mu_{\mathcal{M}} : \mathcal{M} \to [0, 1]$ assigns probabilities to a consumer having $\sigma = 1$ given that she buys a specific product (s, p) or does not participate. Beliefs are assumed to be identical for all consumers. Since there is a belief function for each menu, the

[11] This microfoundation implicitly assumes that there is a consensus about what is "good" and what is "bad". Mailath and Postlewaite (2006) show how the value of an attribute (like quality here) can depend on social institutions (matching patterns) in a society.

[12] For ease of notation and because Appendix C shows that mixed strategies are not optimal, I restrict attention to pure strategies here.

same product occurring in different menus can be associated with different beliefs. In equilibrium the posterior belief and thereby images must be consistent with Bayes' rule, that is they must reflect the actual distribution of types. Given that a choice occurs with positive probability the posterior belief $\mu_{\mathcal{M}}$ must fulfill

$$\mu_{\mathcal{M}}(s,p) = \frac{\sum_{\rho=0,1} \mathrm{Prob}(1,\rho)\mathrm{Prob}(b_{\mathcal{M}}(1\rho) = (s,p))}{\sum_{\sigma=0,1}\sum_{\rho=0,1} \mathrm{Prob}(\sigma,\rho)\mathrm{Prob}(b_{\mathcal{M}}(\sigma\rho) = (s,p))} \tag{2}$$

Definition 1. *Given any menu $\mathcal{M}$, a pure-strategy equilibrium in the consumption stage is a set of functions $b_{\mathcal{M}} : \{0,1\}^2 \to \mathcal{M}$ and $\mu_{\mathcal{M}} : \mathcal{M} \to [0,1]$ such that*

(i) $b_{\mathcal{M}}(\sigma\rho) \in argmax_{(s,p)\in\mathcal{M}} \sigma s + \rho\lambda R(s,p) - p$ for $\sigma, \rho \in \{0,1\}$ (Utility maximization).

(ii) $R(s,p,\mathcal{M}) = E[\sigma | b_{\mathcal{M}}(\sigma\rho) = (s,p)] = \mu_{\mathcal{M}}(s,p)$ and $\mu_{\mathcal{M}}$ is defined in (2) if (s,p) is chosen with positive probability and $\mu_{\mathcal{M}} \in [0,1]$ otherwise (Bayesian Inference).

Mixed-strategy equilibrium is defined accordingly.

An equilibrium of the complete game is given by a menu $\mathcal{M}$, a correspondence $b_{\mathcal{M}}$ and a belief function $\mu_{\mathcal{M}}$ such that among the feasible menus, $\mathcal{M}$ gives the highest profit to the producer given that for each feasible menu consumer behavior is consistent with equilibrium as defined in Definition 1.[13] This equilibrium definition corresponds to a Perfect Bayesian Equilibrium in an extended game, where consumers are punished whenever their perceived image does not coincide with the Bayesian posterior. To simplify notation, in the following the argument $\mathcal{M}$ in the image is dropped unless this creates ambiguities.

I assume throughout that in case of multiple equilibria in the consumption stage, the preferred equilibrium of the monopolist is played.[14] Furthermore, let the following tie-breaking rule hold for consumers who value quality but not image to facilitate the analysis. Appendix D relaxes Assumption 1 and shows that it does not qualitatively affect the results.

[13] With slight abuse of notation I do not distinguish between the sets of offered and accepted products but denote both by $\mathcal{M}$. Since the two sets can only differ in options not taken in equilibrium one could assume an ϵ cost for putting a product on the market to ensure that the monopolist offers only products which are accepted in equilibrium.

[14] This amounts to the monopolist maximizing also over $\mu_{\mathcal{M}}$ in Problem 3. Each consumer in the continuum is atomless so that individual deviations are not profitable. However, sometimes profitable collective deviations exist and lead to multiple equilibria. Qualitatively similar results hold up when one instead assumes that, in every subgame, consumers coordinate on the equilibrium which maximizes consumer surplus (see Appendix E).

Assumption 1. *Consumers with* $\sigma = 1, \rho = 0$ *always buy* (s,p) *if indifferent with not participating, i.e. if* $U_{10}(s,p) = s - p = 0 = U_{10}(0,0)$.

The monopolist solves the following Problem (3).

$$
\begin{aligned}
(3) \qquad & \max_{\mathcal{M}} \quad \sum_{\sigma,\rho\in\{0,1\}} \sum_{(s,p)\in\mathcal{M}} \text{Prob}(\sigma,\rho)\text{Prob}(b_{\mathcal{M}}(\sigma\rho) = (s,p))(p - c(s)) \\
& \quad \text{s.t.} \\
(IC_{\sigma\rho-\sigma'\rho'}) \qquad & \sigma s_{\sigma\rho} + \rho\lambda R(s_{\sigma\rho}, p_{\sigma\rho}) - p_{\sigma\rho} \geq \sigma s_{\sigma'\rho'} + \rho\lambda R(s_{\sigma'\rho'}, p_{\sigma'\rho'}) - p_{\sigma'\rho'} \\
& \quad \text{for } \sigma, \rho, \sigma', \rho' \in \{0,1\} \text{ and } (\sigma,\rho) \neq (\sigma',\rho') \\
(PC_{\sigma\rho}) \qquad & \sigma s_{\sigma\rho} + \rho\lambda R(s_{\sigma\rho}, p_{\sigma\rho}) - p_{\sigma\rho} \geq \rho\lambda R(0,0) \\
& \quad \text{for } \sigma, \rho \in \{0,1\} \\
(BI) \qquad & R(s_{\sigma\rho}, p_{\sigma\rho}) = E[\sigma | b_{\mathcal{M}} = (s_{\sigma\rho}, p_{\sigma\rho})] \quad \text{for all } (s_{\sigma\rho}, p_{\sigma\rho}) \in \mathcal{M},\ \sigma, \rho \in \{0,1\} \\
& \quad \text{which are bought with positive probability in equilibrium}
\end{aligned}
$$

Lemma 1. ***(Existence)*** *For each product offer of the monopolist there exists a (not necessarily pure-strategy) equilibrium in the consumption stage.*

It is easily verified that for some product offers a pure-strategy equilibrium does not exist but at least one consumer type randomizes in equilibrium (see Example 1). With a continuum of consumers, such a mixed strategy can be interpreted as shares of consumers of the same type choosing different actions with certainty. At the population level this corresponds to a mixed strategy.

Example 1. *Suppose the monopolist offers* $\mathcal{M} = \{(0,0),(1,1)\}$ *and* $\lambda \in (1, \frac{\beta+\alpha_n(1-\beta)}{\beta})$. *A pure-strategy equilibrium does not exist. Type 01 does better buying* $(1,1)$ *than not buying when none of his type buys. However, when all of his type buy* $(1,1)$ *he does better not buying.*

While mixed strategies are required to prove existence of equilibrium in every subgame (see Example 1), the product menus for which only mixed-strategy equilibria exist are not profitable to the monopolist (see Appendix C). The following derivations therefore concentrate on the monopolist offering a product menu which induces a pure-strategy equilibrium in the consumption stage.

2.4. Benchmark cases: nobody or everyone values image

This section presents two benchmark cases with heterogeneity in quality preferences only: First, no consumer cares about image and, second, all consumers care about image. Importantly, this shows that homogeneous image concerns do not influence the production of quality, whereas heterogeneous image concerns do, as will be shown in Section 3.

In both cases where either none or all consumers value image, the monopolist faces only two consumer types which are distinguished by their valuations for quality. A fraction β of consumers value quality ($\sigma = 1$), the others do not. Without loss of generality the analysis therefore only involves menus with at most two different qualities s_0, s_1.[15]

Lemma 2. ***(No image motivation)*** *If $\alpha_s = \alpha_n = 0$, the unique equilibrium is separating. Consumers obtain $(s,p) = (1,1)$ if they value quality and $(0,0)$ otherwise.*

Without image concerns, neither the quality-concerned consumer nor the unconcerned consumer obtain any rent; consumer surplus is equal to zero. The monopolist receives the entire surplus $\beta(s_1 - c(s_1)) = \frac{\beta}{2}$.

Lemma 3. ***(Homogeneous image motivation)*** *If $\alpha_s = \alpha_n = 1$, the unique equilibrium is separating. Consumers buy $(1, 1+\lambda)$ if they value quality and $(0,0)$ otherwise. The images associated with the two products in equilibrium are $R_0 = R(0,0) = 0$ and $R(1, 1+\lambda(1-R_0)) = 1$.*

Homogeneous image motivation increases the utility of buying a product which is bought by good types and thereby increases the price a monopolist can charge for it without changing the allocation of quality. The prize increase corresponds exactly to the image gain and, as in the absence of image motivation, aggregate consumer surplus is zero. The monopolist's profit is $\beta(\frac{1}{2} + \lambda)$. Image motivation increases the monopolist's profits by $\beta\lambda$. If $p > s$, the monopolist charges an **image-premium**. The image-premium is justified through the consumers' willingness to pay for the image associated with the product.

3. Monopoly with heterogenous image concerns

This section covers the general case of Problem 3, where consumers may differ in their marginal utility from quality $\sigma \in \{0,1\}$ as well as their marginal utility from image

[15] With full information and the ability to price-discriminate between consumers efficient qualities without image concerns are s_0^*, s_1^* such that $c'(s_0) = 0$ and $c'(s_1) = 1$. This implies $s_0^* = 0$ and $s_1^* = 1$.

$\rho \in \{0, 1\}$. To abstract from less interesting non-generic cases, I assume that each of the four feasible consumer types is indeed present in the market.

Assumption 2. *All consumer types occur with positive probability,* $\beta, \alpha_s, \alpha_n \in (0, 1)$.

Note that beliefs about other consumer types' play enter the final payoffs. Thus, before solving the game backwards, I identify potentially profitable consumer partitions in the consumption stage (Subsection 3.1). The partition that is associated with an equilibrium in the consumption stage pins down equilibrium beliefs and allows to subsequently characterize the optimal menus which induce these partitions as equilibrium outcomes. Finally, I compare profits across these menus to determine the profit maximizing menu (Subsection 3.2).

3.1. The consumption stage

Only four types of pure-strategy equilibria in the consumption stage are consistent with profit maximization. Since in equilibrium, the monopolist maximizes his profits, it is without loss of generality that other equilibria in the consumption stage are not characterized here.

Proposition 1. *In equilibrium, only a standard good, a mass market, an image building menu, or an exclusive good as specified in Table 2 may be offered by the monopolist.*

Table 2: Equilibrium candidates from Proposition 1, products stated as (quality,price), purchasing group in curly brackets. Consumer types choosing $(0, 0)$ are omitted.

<table>
<tr><th></th><th>$\sigma\rho$</th><th>$\lambda \leq 1$</th><th>$1 < \lambda \leq \lambda_1$</th><th>$\lambda_1 < \lambda \leq \lambda_2$</th><th>$\lambda_2 < \lambda \leq 2$</th><th>$\lambda > 2$</th></tr>
<tr><td>standard good</td><td>{10,11}</td><td>(1,1)</td><td colspan="3">(λ, λ)</td><td>n.a.</td></tr>
<tr><td>mass market</td><td>{01,10,11}</td><td colspan="2">$(\lambda\frac{\beta}{\beta+\alpha_n(1-\beta)}, \lambda\frac{\beta}{\beta+\alpha_n(1-\beta)})$</td><td colspan="3">(1,1)</td></tr>
<tr><td>image building</td><td>{01,10}
{11}</td><td colspan="3">$(\lambda\frac{(1-\alpha_s)\beta}{(1-\alpha_s)\beta+\alpha_n(1-\beta)}, \lambda\frac{(1-\alpha_s)\beta}{(1-\alpha_s)\beta+\alpha_n(1-\beta)})$
$(1, 1+\lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)})$</td><td colspan="2">(1,1)
$(1, 1+\lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)})$</td></tr>
<tr><td>exclusive good</td><td>{11}</td><td colspan="5">$(1, 1+\lambda\frac{1-\beta}{1-\alpha_s\beta})$</td></tr>
</table>

$\lambda_1 = \frac{\alpha_n(1-\beta)+\beta}{\beta}$, $\lambda_2 = \frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$

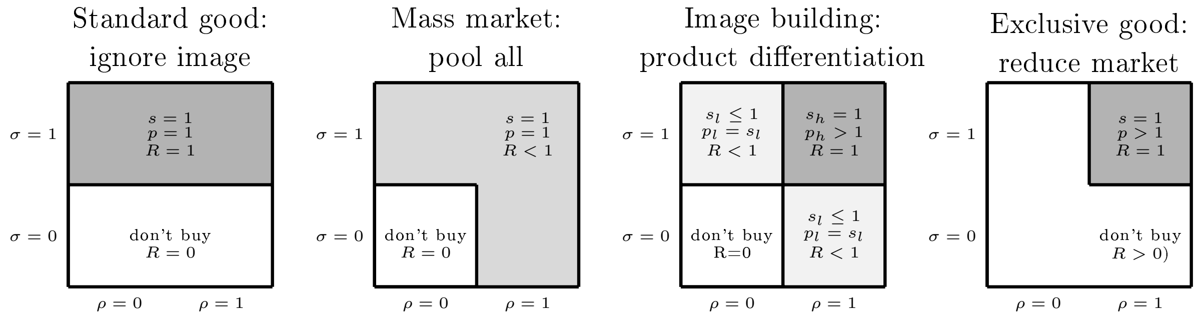

Figure 2: Possible market partitions in equilibrium (Proposition 1).

In the proof, I first exclude all but four partitions of consumers as inconsistent with profit maximization. Second, I derive the prices and qualities which maximize the monopolist's profit subject to the corresponding incentive compatibility and participation constraints *given* each of the four partitions.

The **standard good** menu is identical to the separating menu without image motivation (see Lemma 2); all quality-concerned consumers buy a product $(s, p) \neq (0, 0)$ whether or not they are also interested in image. In a **mass market** only ignorant consumers who do not care about either quality or image are excluded and consumers who value at least one of the two characteristics buy the same product. This is the menu with the largest market coverage and no differentiation with respect to the level of quality or price. The **image building** menu has the same market coverage but offers two distinct products, a lower quality, lower price version for consumers who care about either image or quality and a premium version for image-concerned consumers with a taste for quality, which offers higher quality and higher image at a higher price. If image motivation is large, the two products can even have the same quality and differ only in image and price. Prices, of course are chosen strategically and induce consumers who value only image not to imitate those who value both quality and image. If the monopolist sells only an **exclusive good**, this product–independently of the value of image–features the quality level that would be first-best without image concerns. A premium price reflecting the image gain is sufficient to deter purely image-concerned consumers from buying this product because the cost of quality exceeds there willingness-to-pay. At the same time, however, the price premium is so high that it renders the exclusive product unattractive to purely quality-concerned consumers who therefore choose the outside good too. The purchasing behavior of consumers is illustrated in Figure 2.

In a fully separating equilibrium, consumer types must be correctly identified with respect to their interest in quality since their purchases disclose their types. This prevents purely image-concerned consumers from buying positive quality since this alone is worthless to them. Thereby they pool with consumers interested in neither image nor quality on the outside option $(0, 0)$. The attempt of separating all four consumer types from each other fails.

Corollary 1. *An equilibrium with a fully separating menu does not exist.*

Moreover, pure image goods which would be bought by all image-concerned consumers irrespective of their quality concern are not viable. In terms of Figure 2, any product menu which induces a vertical partition of consumer types is unprofitable even for the highest values of image.

Corollary 2. *An equilibrium in which image-concerned consumers purchase from the monopolist and those not concerned with image choose the outside good does not exist.*

A pure image good would allow the monopolist to fully charge consumers for the value of their image gain without incurring any costs of producing quality for which purely image-concerned consumers would not pay for. However, exactly these consumers lower the image associated with the pure image good whereas the outside option is associated with a positive image too since purely quality-concerned consumers choose it. This implies that the gain in image when choosing the image good is relatively low. In fact, the monopolist makes strictly higher profits by offering an exclusive good instead which pools the purely image-concerned with the purely quality-concerned consumers and those who do not value either quality or image. This deteriorates the image on the outside good and improves the image on the good sold. In addition, the consumers who value quality and image are willing to pay for quality so that the monopolist incurs additional profit from producing a quality product instead of a pure image good with zero quality.

Formally, $\Pi_{\text{pure image}} \leq (\alpha_s\beta + \alpha_n(1-\beta))(\frac{\alpha_s\beta}{\alpha_s\beta+\alpha_n(1-\beta)} - \frac{(1-\alpha_s)\beta}{(1-\alpha_s)\beta+(1-\alpha_n)(1-\beta)}) < \alpha_s\beta(1 - \frac{(1-\alpha_s)\beta}{1-\beta+(1-\alpha_s)\beta}) < \Pi_{\text{exclusive good}}$.

3.2. Profit maximization

Having understood how consumers behave for given product offers, I identify for each value of image, which menu the monopolist offers to maximize his profits.

Proposition 2. *There exist $0 < \tilde{\lambda}_m \leq \tilde{\tilde{\lambda}}_m$ such that the profit-maximizing product offer of a monopolistic producer is given by*

(i) standard good if $\lambda \leq \tilde{\lambda}_m$.

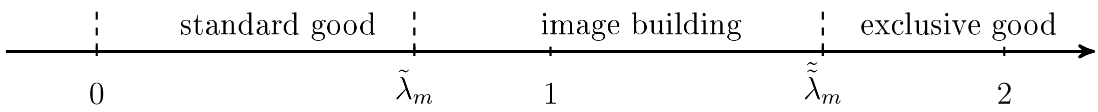

Figure 3: Equilibrium in monopoly.

(ii) image building if $\tilde{\lambda}_m \leq \lambda \leq \tilde{\tilde{\lambda}}_m$.

(iii) exclusive good if $\lambda \geq \tilde{\tilde{\lambda}}_m$.

If $\alpha_s > \frac{1}{3}$ *and* $\beta < \frac{3\alpha_s - 1}{\alpha_s + \alpha_s^2}$ *and* $\alpha_n < \frac{\beta(1+\alpha_s(\beta+\alpha_s\beta-3))^2}{4\alpha_s(1-\beta)^2}$, $\tilde{\lambda}_m = \tilde{\tilde{\lambda}}_m$. *Thus, only standard good and exclusive good can be optimal.*

In the proof, the characterization of products from Proposition 1 is used to compute profit as a function of λ for each product offer. The optimal product offer for each distribution of preferences and each value of image is derived by comparing profits across menus. The profit-maximizing menu, optimal consumer behavior, and consistent beliefs together constitute the equilibrium of the complete game according to Section 2.3.

It is important to note that the threshold values of λ depend on the parameters but holding fixed a parameter set, the equilibrium is a standard good for low λ, an exclusive good for high λ and possibly image building for intermediate values of λ.

Corollary 3. *The interval of* λ *where image building is optimal is empty only if image concerns and intrinsic motivation are positively correlated,* $\alpha_n < \alpha_s$.

Image motivation only matters if it is intense enough. For λ close to zero, profits with the exclusive good and profits from image building are lower than profits from standard good so that offering a standard good must be optimal. Since not all consumers value image, the monopolist cannot charge an image-premium and the offer is identical to the one observed in the absence of image motivation (cf. Section 2.4).

When image motivation becomes more important, λ increases, profits from image building and exclusive good increase in λ while standard good profits remain constant or even decrease. Thus, the monopolist profits from modifying the menu. For intermediate values of image motivation, two products are sold and all consumers who value quality or image buy. One product is of high-quality and sells with an image-premium; the other is priced at the monopoly price for quality[16], can be of lower quality and has lower

[16] This equals the marginal cost of increasing quality, s, and has to be distinguished from the unit cost $\frac{1}{2}s^2$. For $s < 2$ the monopoly price is greater than the unit cost such that the monopolist makes positive profits from selling.

image. The introduction of the low quality into the market allows the monopolist to "build image" and sell to more consumers as well as increase prices for those who value both image and quality. When image motivation becomes even more important, the monopolist has an incentive to market a high-quality product exclusively to consumers who value both image and quality, so that the share of consumers buying high quality decreases as compared to the benchmark cases.

Figure 3 illustrates the findings of Proposition 2. In addition, Figure 4 shows a typical example for how the equilibrium thresholds depend on the fraction of intrinsically motivated consumers and demonstrates the relevance of the image building menu.

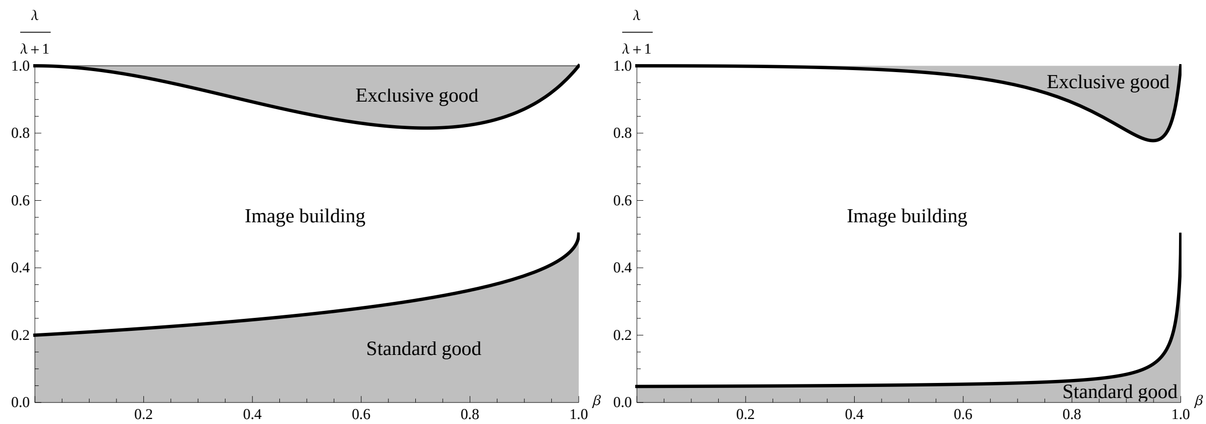

Figure 4: Equilibrium thresholds in monopoly for $\alpha_s = \alpha_n = 0.5$ (left panel) and $\alpha_s = \alpha_n = 0.9$ (right panel). The value of image is rescaled as $\frac{\lambda}{\lambda+1} \in [0, 1]$ which is the weight on image in the utility function.

Let us define **total quality** in the market as the sum over the fractions of consumers multiplied with the quality of the product that they buy in equilibrium. An implication of Proposition 2 is that total quality in the market is not in general increasing in the value of image as illustrated in Figure 5. The reason is that changes in the value of image may induce the monopolist to offer a different menu of product which affects total quality in the market through reduce product quality (moving from standard good to image building) or market coverage (moving from image building to exclusive good).

Corollary 4. *There exist parameters such that an increase in the value of image λ decreases the total provision of quality in monopoly.*

To complement the analysis, let us analyze how changes in the preference distribution influence the equilibrium provision of quality.

Increases in the fraction of image-concerned consumers, whether they occur within those concerned with quality (α_s) or within those who do not value quality (α_n), trigger

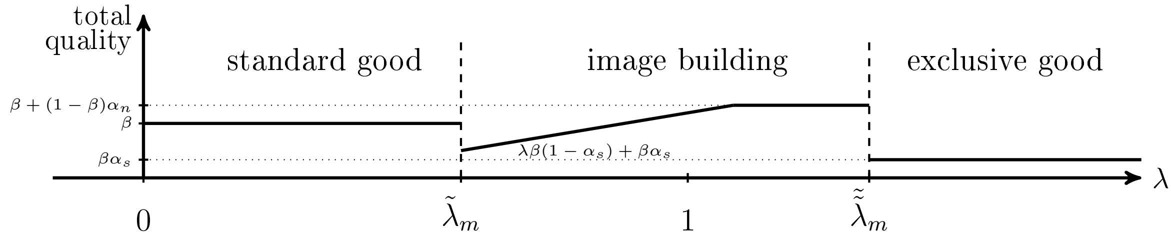

Figure 5: Total quality in monopoly. In the absence of image motivation, the first-best level of total provision is β.

the monopolist to reduce quality and increase prices. Whereas this increases profits, it makes individual consumers worse off. As the share of quality-concerned consumers (β) increases, the monopolist raises both quality (as long as it still below $s = 1$) and prices. Aside from affecting products offered within a given type of equilibrium, changes in the preference distribution also affect the prevalence of different types of equilibrium. Figure 4 illustrates the effect of a homogeneous increase in image concerns. More generally, the standard good is offered more often if the share of consumers who experience utility from quality directly (β) increases. However, if instead the fraction of consumers who buy a product only for its image (α_n) increases, the standard good becomes less attractive to the monopolist. Simultaneously, distortions in quality provision in form of either image building or the exclusive good become more prevalent the greater the share of consumers with image concerns.[17]

4. Competition

As a product becomes more familiar, more producers can credibly supply any desired quality level and a monopolistic market becomes less likely. This section illustrates that heterogeneous image concerns promote product differentiation which is not driven by heterogeneous quality valuations but by heterogeneous image concerns even in the absence of market power on the supply side. A crucial difference in a competitive market is, however, that for image motivation large enough all consumers who value image or quality buy a product with positive quality, whereas a monopoly would offer an exclusive good which is only bought by consumers who derive utility from both image *and* quality. Moreover, the mechanisms of separation are different. Taking the quality level which

[17] For formal statements and proofs see Appendix F.

would be sold in the absence of image concerns as a benchmark, product differentiation occurs through an additional product with higher quality in the competitive market (upward distortion). This is in contrast to the monopoly, where separation is induced through an additional product with lower quality (downward distortion).

The model is the same as in Section 2 except for the supply side. Suppose now that all qualities are available at different prices equal to or above the marginal cost of provision, $p(s) \geq c(s) = \frac{1}{2}s^2$. This captures a situation of competition without actually modeling the interaction among producers.[18] The game reduces to all consumers simultaneously choosing a product $(s, p) \in \mathcal{M}$ to maximize utility. The set from which they choose is now given as

$$\mathcal{M} = \left\{ (s, p) \in \mathbb{R}^2 | s \geq 0 \text{ and } p \geq \frac{1}{2}s^2 \right\}.$$

An equilibrium is given by consumer choices satisfying Definition 1. Images are formed as an outside spectator would form them and are consistent with consumers' actual choices in equilibrium. This spectator is a virtual second player who moves after consumers and who pays consumers in the form of image, so that the game resembles a signaling game. The equilibrium is generally not unique. I therefore rely on a refinement in the spirit of the Intuitive Criterion by Cho and Kreps (1987).[19]

4.1. Competitive equilibrium

Note first that consumers who value neither image nor quality never buy any product $(s, p) \neq (0, 0)$. Furthermore, a consumer who values quality alone will not be influenced by image and will always buy the product which offers the best deal in terms of quality and price. Her utility is independent of beliefs and maximized at $(s, p) = (1, \frac{1}{2}) \in \mathcal{M}$. Thus, the driving forces behind the equilibrium outcome are the decisions of the two consumer types who care about image. Since unconcerned consumers always choose the outside good, the image of not buying is equal to zero unless any intrinsically motivated consumer also chooses this option.

For $\lambda < \frac{1}{2}$ purely image-concerned consumers prefer $(0, 0)$ over buying the product $(s, p) = (1, \frac{1}{2})$ even when the latter is associated with the best image $R(1, \frac{1}{2}) = 1$. Since

[18] This assumption precludes multi-product firms which could otherwise cross-subsidize products.

[19] Formally, the model does not have a receiver of signals and therefore is not a proper signaling game. The refinement as in Cho and Kreps (1987) cannot be applied explicitly since it is formulated in terms of best responses. Here, no party acts upon the product choice. Still, since the image is a reduced form expression of an expected response, and all consumers choose their preferred product in response to the associated image, the same logic applies.

the choice of purely quality-concerned consumers is independent of beliefs, the image associated with product $(s,p) = (1, \frac{1}{2})$ is $R(1, \frac{1}{2}) = 1$. Thus, consumers who value image and quality also choose $(s,p) = (1, \frac{1}{2})$. For $\lambda < \frac{1}{2}$ this is the unique equilibrium.

For $\lambda \geq \frac{1}{2}$, purely image-concerned consumers gain from buying $(1, \frac{1}{2})$ because of its image. In general equilibria are not unique anymore. I therefore analyze different classes of equilibria separately. When deriving these equilibria I allow for consumer types to randomize across different choices.

Single-product equilibria Consider equilibria such that unconcerned consumers do not buy, and all other consumer types pool on the product $(1, \frac{1}{2})$.

Lemma 4. *There exists a partially pooling equilibrium where all consumers who value quality buy $(1, \frac{1}{2})$ and purely image-concerned consumers randomize between buying $(1, \frac{1}{2})$ with probability q and not buying at all with probability $1 - q$ where*

$$q = \begin{cases} 0 & \text{if } \lambda < \frac{1}{2} \\ (2\lambda - 1)\frac{\beta\alpha_s}{(2-\beta)\alpha_n} & \text{if } \frac{1}{2} \leq \lambda \leq \frac{1}{2}\frac{(1-\alpha_s)\beta + q\alpha_n(1-\beta)}{(1-\alpha_s)\beta} \\ 1 & \text{otherwise.} \end{cases} \tag{4}$$

The image associated with buying $(1, \frac{1}{2})$ is $R(1, \frac{1}{2}) = \frac{\beta}{q(1-\beta)\alpha_n + \beta}$.

In a competitive market, $(1, \frac{1}{2})$ is always available to purely quality-concerned consumers. Thus, a competitive equilibrium analogous to the exclusive good does not exist.

For values of image up to one half, the efficient quality level $s = 1$ is sold at a price equal to marginal cost to all consumers who care about quality and only to those. Those who do not value quality choose the outside option. This is the competitive version of the **standard good**; image does not manifest itself in changes in quality, price or purchasing behavior. For higher values of image, purchasing the product $(1, \frac{1}{2})$ becomes attractive to purely image-concerned consumers since it is associated with image $R(1, \frac{1}{2}) = 1$. Thus, the only one-product equilibrium for $\lambda > \frac{1}{2}$ is one of **(partial) mainstreaming** where consumers who value image or quality all buy $(1, \frac{1}{2})$. As purely image-concerned consumers buy $(1, \frac{1}{2})$ with positive probability, the associated image decreases though. When image becomes valuable enough, consumers who only value image buy $(1, \frac{1}{2})$ with probability 1 since even the resulting image (which is strictly lower than one) is worth more than the price of $\frac{1}{2}$. For intermediate values of image, however, only a fraction $q \in (0,1)$ of purely image-concerned consumers buys $(1, \frac{1}{2})$.[20] In contrast to the monopolistic mass market where quality would typically be distorted downward, the quality level within any competitive mainstreaming equilibrium equals the level that would be first best without image concerns. Moreover, the product is priced at marginal cost, whereas the monopoly charges the strictly higher monopoly price for quality.

Two-product equilibria First note that if there are separating equilibria, they must involve real differences in quality of the products used to separate. Suppose to the contrary that two products (s,p), (s',p') form a separating equilibrium and $s = s'$. Separation requires that consumers who value image and quality buy a different product than purely image-concerned consumers. But for $s = s'$ both prefer the same:

$$\begin{aligned}
&U_{11}(s',p') > U_{11}(s,p) \\
&\qquad \Leftrightarrow\; s' + \lambda R(s',p') - p' > s + \lambda R(s,p') - p' \\
&\qquad \Leftrightarrow\; \lambda R(s',p') - p' > \lambda R(s,p) - p \\
&\qquad \Leftrightarrow\; U_{01}(s',p') > U_{01}(s,p)
\end{aligned}$$

This is in contrast to the monopoly, where for high enough values of image, differentiation through price and image alone was sustainable as a special case of image building. The reason is that the monopolist can increase the price above marginal cost and thereby directs purely image-concerned consumers towards a lower-price product whereas those who value both image and quality are happy to pay a higher price for a better image.

It is easy to see that separating equilibria must induce a consumer partition where purely quality-concerned and purely image-concerned consumers pool on the product $(1, \frac{1}{2})$ and consumers who value both quality and image separate from the others by buying another product (s',p'); those who do not value either quality or image choose the outside option. Suppose to the contrary that consumers who value only quality buy $(1, \frac{1}{2})$ whereas purely image-concerned consumers and those who value image and quality pool on a different product $(s,p) \neq (1, \frac{1}{2})$. The image of (s,p) is smaller than 1 due to the purchases of purely image-concerned consumers. Thus, consumers who value image and quality would be better off by also purchasing $(1, \frac{1}{2})$ with associated image of 1.

[20] This type of randomization is consistent with Assumption 1 but never chosen by the monopolist.

Lemma 5. *For $\lambda > \frac{1}{2}$, we find $\varepsilon > 0$ such that the two products $(1, \frac{1}{2})$ and $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ form a separating equilibrium with*

$$R\left(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}\right) = 1, \quad R\left(1, \frac{1}{2}\right) = \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}, \quad R(0,0) = 0$$

where purely image-concerned consumers buy with probability q and

$$q = \begin{cases} (2\lambda-1)\frac{\beta\alpha_s}{(1-\beta)\alpha_n} & \text{if } \frac{1}{2} < \lambda \leq \frac{1}{2}\frac{(1-\alpha_s)\beta+q\alpha_n(1-\beta)}{(1-\alpha_s)\beta} \\ 1 & \text{if } \lambda > \frac{1}{2}\frac{(1-\alpha_s)\beta+q\alpha_n(1-\beta)}{(1-\alpha_s)\beta} \end{cases} \tag{5}$$

Consumers who are willing to pay for both quality and image buy $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$, a product which provides a **functional excuse**. These consumers use excessive quality as a way to pay a higher price to signal that they value quality. Purely image-concerned consumers refrain from imitating them because the price of the high quality product exceeds the value of the associated image. Instead, they buy $(1, \frac{1}{2})$. This same product is also bought by consumers who only value quality so that the associated image is positive.

4.2. Equilibrium refinement

There are generically many other separating equilibria. Furthermore, the pooling equilibrium from Lemma 4 also coexists with the separating one. I employ a refinement in the spirit of the Intuitive Criterion (IC) by Cho and Kreps (1987) to obtain a unique equilibrium prediction.[21] It turns out that the refinement rules out image-premia, i.e. equilibria in which consumers who value both quality and image buy overpriced products to obtain an image by spending more money than necessary. Instead they buy excessive quality at marginal cost. Furthermore, it rules out pooling equilibria where purely image-concerned consumers buy positive quality. Figure 6 illustrates the result.

Proposition 3. *The equilibrium satisfying the Intuitive Criterion is unique. All products are sold at marginal cost and the equilibrium is*

(i) the standard good if $\lambda \leq \frac{1}{2}$.

(ii) functional excuse with $\varepsilon = \sqrt{2\lambda\frac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}}$ if $\frac{1}{2} < \lambda$.

[21] Formally, my model is not a proper signaling game. See Footnote 19.

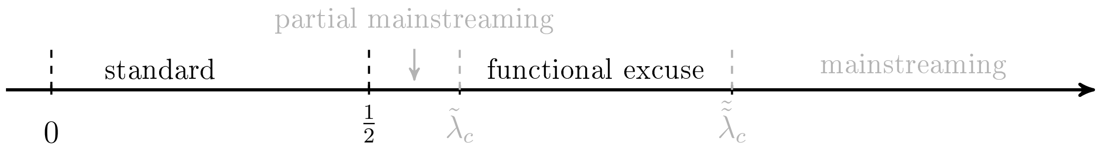

Figure 6: Competitive equilibrium for different values of image λ. Equilibria marked in gray fail the Intuitive Criterion but would make consumers better off.

In the proof, I first rule out other separating equilibria. Then, the pooling equilibrium is ruled out for $\lambda > \frac{1}{2}$. For this, I show that there always exists $\varepsilon > 0$ such that a consumer who values both quality and image profits from deviating to product $(1 + \varepsilon, \frac{(1+\varepsilon)^2}{2})$ if he beliefs this to be associated with $R = 1$, while purely image-concerned consumers cannot profit from deviating to product $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ for any belief. According to the Intuitive Criterion, this product can only be associated with $R = 1$ since otherwise we would assign positive probability to a type who would never gain from choosing this product.

If the intensity of image motivation is small, the equilibrium resembles the monopolistic **standard good** case: the efficient quality level $s = 1$ is sold to all consumers who care about quality. Those who do not value quality pick the outside option. This can be thought of as a conventional good without any quality component. If the value of image increases, purely image-concerned consumers are attracted by the same product and thus separation becomes worthwhile for the consumer who values image and quality. Product differentiation within the quality segment occurs even though the market is perfectly competitive. Consumers who value both quality and image are willing to buy overly high quality since utility is realized from both image and quality; they use a **functional excuse** to separate from other consumers and obtain higher image. Product differentiation then features an upward distortion in quality: The lower quality product has the efficient quality level $s = 1$ and is bought by consumers who value either image or quality.[22] The high quality is chosen such that the product is not attractive for the purely image-concerned consumers due to its high marginal cost.[23] Recall from Proposition 2 that a monopolist in contrast achieves differentiation by offering a product with lower quality. This leads to lower average quality.

[22]The participation probability of purely image-concerned types is 0 for $\lambda < \frac{1}{2}$, $q_{sep}(\lambda) = (2\lambda - 1)\frac{((1-\alpha_s)\beta))}{(\alpha_n(1-\beta))}$ for $\frac{1}{2} \leq \lambda < \frac{1}{2}\frac{(1-\alpha_s)\beta+\alpha_n(1-\beta)}{((1-\alpha_s)\beta))}$, and 1 otherwise.

[23]Note that this result is driven buy the additivity of utility from image and quality. The convex cost of quality production exceeds the value of quality for every quality level above one and only consumers who in addition realize image utility are willing to pay the price.

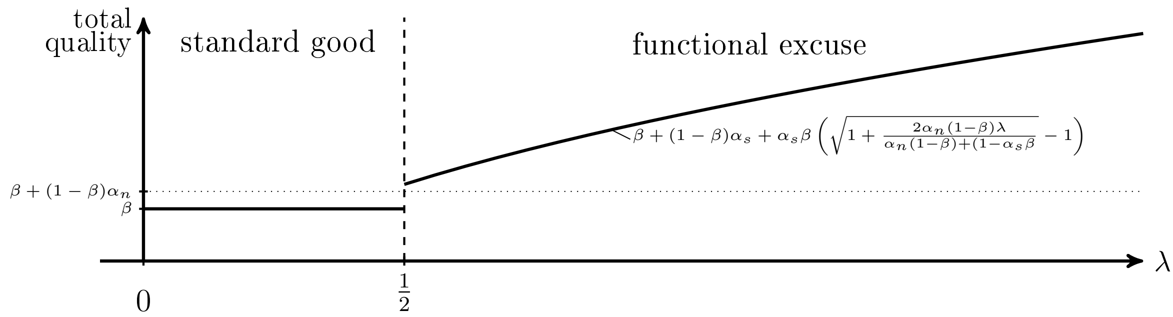

Figure 7: Total quality in the market with competition. In the absence of image motivation, the first-best level of total provision is β.

If the intensity of image motivation becomes very large, the upward distortion in quality becomes expensive. We find $\frac{1}{2} < \tilde{\lambda}_c < \tilde{\tilde{\lambda}}_c$ such that the consumer who values image and quality would be better off by pooling on the lower quality product for all $\lambda \in (\frac{1}{2}, \tilde{\lambda}_c)$ and $\lambda > \tilde{\tilde{\lambda}}_c$ (**mainstreaming**, see Figure 6). Such a pooling equilibrium features partial participation by consumers who only value image for low λ; it fails the Intuitive Criterion (see Appendix G for details on the derivation of $\tilde{\lambda}_c$ and $\tilde{\tilde{\lambda}}_c$).

Proposition 3 characterizes the competitive equilibrium as a function of the value of image λ. From this, one can compute total quality in the market as illustrated in Figure 7. Total provision of quality depends on the qualities sold to consumers as well as on the fractions of consumers who buy a given quality. The following result is directly read-off from the figure:

Corollary 5. *Total provision of quality in competition increases in the value of image λ.*

In contrast to the monopoly case, the prevalence of different equilibria is unaffected by changes in the preference distribution since the threshold between standard good and functional excuse is independent of the preferences distribution. Moreover, changes in the frequencies of consumer types affect products and purchases only if consumers behave according to functional excuse and purely image-concerned consumers purchase $(1, \frac{1}{2})$ with probability one. In this case, total provision of quality increases in α_s and α_n and is non-monotone in β (see Appendix F for details). As long as purely image-concerned consumers randomize over choosing $(0, 0)$ and buying $(1, \frac{1}{2})$, the products in "functional excuse" are independent of the preference distribution. Trivially, products and purchases do not depend on the preference distribution in "standard good" either.

5. Welfare analysis

Since image cannot be allocated independently of quality (it depends on equilibrium behavior), even a welfare maximizer would be bound to trade off efficiency in allocating image versus efficiency in allocating quality. Moreover, the partition of consumers determines how much image in total is allocated in the market. Since prices are an instrument to enforce a partition, they are in general not welfare neutral.

5.1. When does monopoly give higher welfare than competition?

Even though the monopolist does not in general implement the welfare maximizing allocation (see Friedrichsen, 2013, for details), competition does in general not do better. The reason is that the monopoly can stabilize separation through its pricing while consumers use excessive quality to separate in competition. The former often yields higher welfare. In a competitive market, a luxury tax on excessive qualities can therefore improve welfare.

Proposition 4. *There generically exist parameters such that monopoly yields higher welfare than competition.*

Proof. The proof is by example.

Example 2. *Suppose* $\lambda = 1$*,* $\beta = 0.5$*,* $\alpha_n = 0.5$*, and* $\alpha_s = 0.5$*. Then* $\tilde{\lambda}_m = .5 < \lambda < 6 = \tilde{\tilde{\lambda}}_m$*. Welfare from monopoly, which yields image building, is* 0.5625 *whereas welfare from competition, which yields functional excuse, is* 0.478553.

Let me point out that the chosen parameters are reasonable by rephrasing the example: Suppose half of the population values quality, half is concerned with their image, and the image concern is independent of the taste for quality. If image and quality are weighed equally in the utility function, monopoly yields higher welfare than competition.

Welfare in monopoly is continuous in λ for $\lambda \notin \{\tilde{\lambda}_m, \tilde{\tilde{\lambda}}_m\}$ and in competition for $\lambda \neq \frac{1}{2}$. Thus, we find parameter constellations close to the example such that welfare with monopoly is still higher than welfare with competition. $\square$

When competition leads to higher welfare than monopoly, it also leads to higher consumer surplus than monopoly. But even if competition reduces welfare, consumers may still profit. We have seen that monopoly may lead to higher welfare under some circumstances. Thus, one can again ask for the distributional effect behind this finding. It turns out that purely quality-concerned consumers always benefit from competition. In contrast to this, there exist parameters such that consumers who value image are better off in monopoly than in competition (see Friedrichsen, 2013, for details and derivations).

Note that the competitive equilibrium consistent with the Intuitive Criterion is not in general the best one in terms of welfare. Importantly, though, the claim in Proposition 4 that the competitive market outcome may lead to lower welfare than monopoly does not depend on the refinement. Even when I use the equilibrium which gives the highest welfare in the competitive market, there still exist parameter constellations such that monopoly yields higher welfare.

Lemma 6. *The competitive equilibrium which yields the highest welfare is*

(i) standard good for $\lambda \leq \frac{1}{2}$

(ii) image building with $s_l = s_h = 1$ *for* $\lambda > \frac{1}{2}$.

(a) for $\frac{1}{2} < \lambda < \frac{1}{2}\frac{\beta(1-\alpha_s)+(1-\beta)\alpha_n}{\beta(1-\alpha_s)}$, *purely image-concerned consumers participate with probability* $q = (2\lambda - 1)\frac{\beta}{(1-\beta)\alpha_n}$ *and prices are* $p_l = \frac{1}{2}$, $p_h = \frac{1}{2} + \lambda(1 - \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n})$.

(b) for $\lambda \geq \frac{1}{2}\frac{\beta(1-\alpha_s)+(1-\beta)\alpha_n}{\beta(1-\alpha_s)}$, *purely image-concerned consumers participate with probability one and prices are* $p_l = \frac{1}{2}$, $p_h = \frac{1}{2} + \lambda(1 - \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n})$.

Note that the "best welfare" competitive equilibrium pareto-dominates the equilibrium selected by the Intuitive Criterion. Consumer utilities are unaffected but producer profits are positive in the welfare-maximizing equilibrium whereas they are zero in the equilibrium selected by the Intuitive Criterion. Since welfare does not depend on prices other than through their effect on the partition, I obtain the following result.

Corollary 6. *For all sets of parameters such that monopoly and "best welfare" competition implement the same partition of consumers (i.e. either standard good or image building), they lead to the same welfare.*

Importantly, though, consumers are better off in "best welfare" competition because of lower prices, whereas producer profit is higher in monopoly where prices are higher.

The following examples show that Proposition 4 extends to a setting where I select the competitive equilibrium which yields the highest attainable welfare in competition. There are three important constellations. First, the exclusive good can be welfare optimal but is not implementable in competition (Example 3). Second, standard good is welfare optimal and implemented in monopoly but is not implementable in competition. This is illustrated in Figure 8, where for instance for $\lambda = .7$ and β close to 1, monopoly

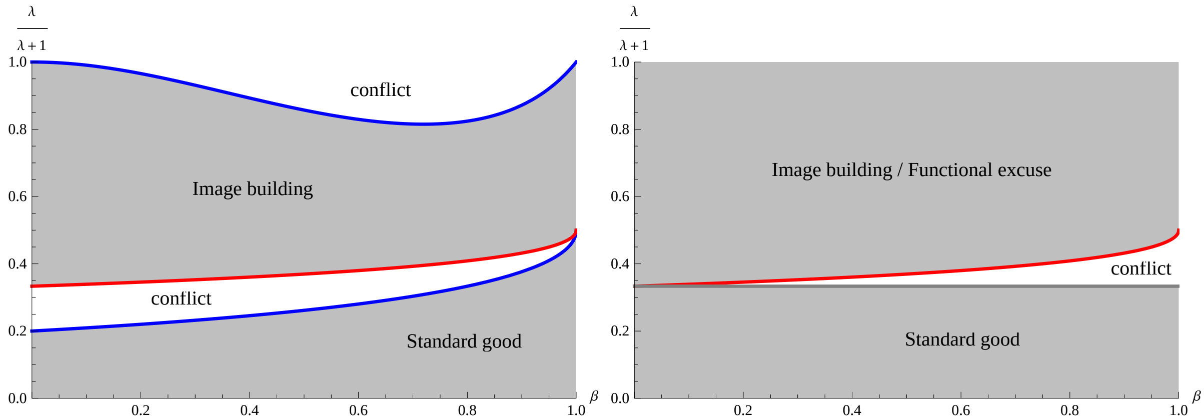

Figure 8: Welfare maximizing partitions (thresholds in red) compared with market outcomes for $\alpha_s = \alpha_n = 0.5$. Left panel shows monopoly (in blue), right panel refers to the "best-welfare" equilibrium in competition (in gray). *Conflict* denotes parameters for which the market outcome differs from welfare maximum.

implements the welfare optimum whereas competition leads to a conflicting allocation. Thus, competition must yield lower welfare than monopoly. Third, monopoly may induce more efficient separation for relatively low values of image by distorting the lower quality downwards. This increases participation by purely image-concerned types and thereby welfare (see Example 4).

Example 3. *Suppose* $\lambda = 1.71875$, $\beta = 0.484375$, $\alpha_s = 0.853859$, *and* $\alpha_n = \frac{1}{3}$. *Then,* $\tilde{\lambda}_m = \tilde{\tilde{\lambda}}_m = 0.0973251 < \lambda$. *Thus, monopoly offers the exclusive good which yields welfare* $W^E = 0.953308$. *Welfare from the best competitive equilibrium for these parameters is only* $W^{sep\text{-}all} = 0.953278$.

Example 4. *Suppose* $\lambda = 0.75$, $\beta = 0.5$, $\alpha_s = 0.0208333$, *and* $\alpha_n = 0.5$. *Then,* $\tilde{\lambda}_m = 0.5 < \lambda < \tilde{\tilde{\lambda}}_m = 212.276$. *Thus, monopoly implements image building which yields welfare* $W^E = 0.289058$. *In competition, the best welfare equilibrium for these parameters is a partially separating equilibrium. Purely image-concerned consumers participate with probability* $q = 0.755319$ *and welfare is only* $W^{sep\text{-}part} = 0.257813$.[24]

It is also noteworthy that the finding of Proposition 4 does not depend on the equilibrium selection in monopoly either. If instead of the equilibrium preferred by the monopolist, the equilibrium is selected which maximizes total consumer surplus, there still exist parameters such that monopoly yields higher welfare than competition even if compared with the "best-welfare" equilibrium in competition (see Appendix E for details).

[24] A standard good would yield exactly the same welfare as the best welfare competitive equilibrium.

5.2. A minimum quality standard decreases and a luxury tax increases welfare

The model allows for the analysis of some common policy measures. The introduction of a minimum quality standard (MQS) which is intended to ensure all consumers get a high quality product can hurt consumers. With a binding minimum quality standard, the monopolist has to adjust the low quality upwards and the price for high quality downwards to achieve product differentiation; this benefits consumers. However, since the adjustments make product differentiation less profitable, the monopolist will resort to an exclusive good or standard good regime for a larger set of parameters. Through this supply reaction, regulation can trigger decreases in consumer surplus and in welfare.

Lemma 7. *There exist parameters such that the introduction of a binding minimum quality standard in a monopolistic market decreases consumer surplus and welfare.*

We have just seen that image concerns distort qualities upwards in a competitive market through the use of excessive quality as a functional excuse (see Lemma 5, Proposition 3). Thus, a minimum quality standard as analyzed for the monopoly case does not bite. However, if product differentiation prevails under competition, a tax on higher qualities can improve welfare. By increasing consumer prices above marginal costs, it allows consumers to achieve a high image at lower qualities which can be produced more efficiently.

Corollary 7. *In competition, we can design a luxury tax on excessive quality such that welfare strictly increases.*

This finding mirrors the results in e.g. Ireland (1994) and Hopkins and Kornienko (2004) that taxation improves welfare in the presence of image or status concerns but in a very different model. In Ireland (1994), the tax corrects a problem of overconsumption by increasing the price of the good so that all consumption levels are shifted downwards without affecting the sorting of consumers. Here, the tax only affects the high quality product thereby shifting the separating equilibrium from where quality differences ensure separation to one where (mostly) price differences ensure separation. Hopkins and Kornienko (2004) analyze a consumption tax in the form of a Pigouvian tax that corrects the status externality. However, the optimal tax in their model depends on a consumer's income whereas in my model, a tax on certain qualities is sufficient to improve welfare. It is important to note, that in my model the tax does not necessarily constitute a Pareto improvement without further redistributive measures. Consumers who are concerned with quality and image might be worse off with a luxury tax than without it because the tax exceeds the private gain. The private gain is given by the reduction in price(=marginal cost) corrected for the reduction in quality.[25]

6. Extensions

My model applies to any context where the quality of a product matters and image concerns are relevant. This section deals with implications of this model if image is associated with a negative value or if quality has a public good character.

Interest in "quality" is seen badly Suppose the model is as laid out in the monopolistic case in Section 3 but now image decreases utility, $\lambda < 0$. Being recognized as a consumer who values quality gives a negative image and this image is more negative the better identified consumers preferences are from their consumption choice. Examples are goods where quality has a strong negative externality and its consumption is therefore seen as morally unacceptable. Imagine a preference for big, polluting cars. Being aware of the fact that showing this preference gives a negative image is likely to influence purchasing behavior and thus should also be reflected in the marketing strategy of the producer. Another way to interpret a negative value of image would be a social norm against showing off. Consumers might still value good quality but at the same time dislike being identified as those who are rich enough to afford it. For instance, showing a taste for expensive jewelry can lead to reduced status in a neighborhood where equality is valued above all. The Scandinavian Jante Law seems to describe a pattern of group behavior consistent with this interpretation.

If quality is associated with stigma, the monopolist either reduces the price of quality or accepts to sell less than in the absence of image concerns. For small negative image concerns, the stigma of being interested in quality implies a lower price. Consumers who are indifferent with respect to image concerns profit from the existence of image-concerned consumers through a lower price for both of them. For stronger negative image concerns, those who care about image choose the outside option. In this case, the product sold is identical to the one offered in the absence of image concerns.

Proposition 5. *Suppose image exhibits a negative effect on utility.*

[25] The quality valuation minus marginal cost of quality is negative since image concerns induce the consumer to choose a quality that is greater than what is first best without image concerns. A reduction in quality reduces this margin by moving the quality level closer to first best.

(i) *For* $\lambda < -\frac{1}{2}\alpha_s$ *only types who care about quality but not about image buy quality* $s = 1$ *at monopoly price* $p = 1$.

(ii) *For* $\lambda \geq -\frac{1}{2}\alpha_s$ *both types who care about quality buy quality* $s = 1$ *at price* $p = 1 + \lambda < 1$ *below the conventional monopoly price.*

Proof. It is clear that purely image-concerned consumers cannot be attracted to buy at any positive price. Only quality-concerned consumers with $\sigma = 1$ buy at all and therefore any product $(s, p) \neq (0, 0)$ will obtain $R(s, p) = 1$. This implies that no differentiation in terms of image is possible. The monopolist therefore has to decide only whether to offer a product which is accepted by both–consumers who only value image and consumers who additionally value quality–or whether to separate the two. Suppose first that only purely quality-concerned consumers are served. Then the participation constraint of consumers who only value quality must bind: $p_{10} = s_{10}$. The maximal profit in this case is at $s_{10} = 1$ with $\Pi = \frac{(1-\alpha_s)\beta)}{2}$. Suppose instead that also image aware consumers buy. Then, the binding participation constraint is the one of consumers who value both quality and image: $p_{11} = s_{11} - \lambda$. The profit maximizing quality level is $s_{11} = 1$ and profits are $\Pi = (\frac{1}{2} - \lambda)(\beta)$. The proof is completed by comparing the two expressions. □

An alternative view would not interpret image as a means of vertical dimension but instead take an identity perspective, where consumers are located on different value positions and try to find a product which matches their identity (Akerlof and Kranton, 2000). In a version of this model in which consumers derive utility from signaling their preference for quality instead of following a common norm of what is "good" behavior the set of profitable product offers changes as compared to the preceding analysis. Pooling on a positive quality level does not occur anymore. Instead, the monopolist offers two products at opposite quality levels and charges an image premium on both of them.

Quality as a public good Extending the application to ethical consumption, we can interpret the purchase of quality as a private contribution to a public good through consumption as is done in Besley and Ghatak (2007). The monopolistic producer bundles the private consumption good with a contribution to the public good by engaging in responsible production methods. These are interpreted as quality here. Some consumers experience warm glow utility from purchasing the good with the bundled contribution (for warm glow see Andreoni, 1990). Some experience utility from being seen as contributors (image utility). Noone, however, takes into account that her individual purchase has an impact on the total provision of the public good. Suppose the public good has a social value of $\gamma > 0$. Then, the efficient level of total quality provision is $\beta + \gamma$.[26]

Image concerns can help to move total consumption of quality closer to this target but can also drive it further away from it when image becomes too valuable. In general, efficient provision will not be reached with monopoly. Provision in the competitive market is typically higher than in monopoly but not in general at the efficient level either. The reason for this result is of course that–in contrast to the socially efficient level of provision–the market-based provision of quality is independent of the social value of quality. This finding is also evident in Figures 5 and 7: If the social value per unit of quality is γ, the socially efficient provision level is $\beta + \gamma$ which is constant in λ but in general different from the market-based levels of provision.

For products which have a public good character like Fairtrade or organic production, non-governmental organizations may try to "raise awareness" to foster their cause. However, "raising awareness" may, depending on its meaning, have unintended consequences. First, raising awareness can mean that public recognition increases and therefore the value of image, λ, increases. Second, raising awareness can mean that the number of intrinsically motivated consumers, β, increases. Finally, it can mean that the fraction of consumers who value image - α_s, α_n, whether or not they value quality - increases. Only the latter two affect the distribution of preferences. At first sight, one might guess that all effects go in the same direction since they all increase the population-wide willingness-to-pay for quality. As has been shown in Corollary 4, however, this intuition is wrong; increases in image concerns can decrease the provision of quality.

7. Discussion of existing and new insights

A classic conspicuous consumption model as in Corneo and Jeanne (1997) or Bagwell and Bernheim (1996) features two goods, only one of which is conspicuous and assumes that all consumers care about their images and can signal their types by adjusting their purchased quantity freely. In such a model, consumers typically consume inefficiently as they try to establish higher levels of status (Ireland, 1994). This paper departs from the existing literature in two aspects which I discuss one after the other.

First, I assume unit demand. Each consumer buys exactly one unit of one of the offered products, either one with positive quality from the monopolist or the zero-quality outside

[26] This analysis abstracts from distributional concerns. Taking into account heterogeneity in warm glow but ignoring image utility implies individually efficient contribution levels of $s = \gamma$ for consumers with $\sigma = 0$ and $s = 1 + \gamma$ for individuals with $\sigma = 1$.

good.[27] The unit-demand assumption forces the effect of image to show up in qualities. In the monopoly case, the producer decides on product offers and accordingly influences which images can be obtained.[28] In competition, consumers can freely choose quality but still are assumed to have unit demand so as to shut down signaling via consumed quantities. Without such an assumption, consumers use consumed quantities as signals (see e.g. Bagwell and Bernheim, 1996; Corneo and Jeanne, 1997). If image is not related to wealth but to other traits, however, signaling via quantity is unreasonable.

Second, I assume that consumers differ in their image motivation as well as in their intrinsic interest in quality whereas in other models consumers differ only in one dimension. This heterogeneity in image concerns yields interesting insights which are absent in one-dimensional models while keeping their results nested as special cases. In contrast to previous work, I do not impose any restriction on the correlation between both dimensions. Rayo (2013) extends a Mussa-Rosen type model of quality provision to allow for heterogeneous image motivation but assumes that marginal utility from quality and image are proportional to each other. This assumption implies that consumer heterogeneity can be captured by one dimension and it thereby precludes distortions in quality provision other than those well-known from the literature on one-dimensional screening. Pooling occurs if and only if the monopolist's marginal revenue function is somewhere decreasing in consumer type.[29] My model illustrates a different reason for pooling, namely that marginal utilities in both dimensions are not aligned.[30] If image and quality concerns are perfectly positively correlated this corresponds to the proportionality assumption in Rayo (2013), the hazard rate condition is trivially fulfilled, and pooling does not occur in my model either. Similarly, if everyone values image, my model's predictions are consistent with Vikander (2011) who assumes that all consumers care about status to the same degree but differ in intrinsic preference for the good in question.

By adding another preference parameter to a conspicuous consumption model, my model contributes to the literature on two-dimensional screening. In contrast to classical

[27]In particular with respect to food and clothes, which are necessary goods and purchased by (almost) everybody, this assumption seems a reasonable simplification.

[28]This also contrasts with models of prosocial behavior where individuals can choose their desired level of prosocial activity and thereby their signal freely (e.g. Bénabou and Tirole, 2006).

[29]This corresponds to a violation of the often made assumption that the hazard rate of the type distribution is increasing. In such a case pooling occurs also in the absence of image motivation. Bolton and Dewatripont (2004) discuss this phenomenon as "bunching and ironing" (p. 88ff).

[30]Note the similarity to a bundling problem. If the correlation between the individual valuations for the two commodities or dimensions are not too strongly positive, bundling is the optimal strategy for the monopolist (e.g. Bolton and Dewatripont, 2004, p. 210).

models of quality provision in the line of Mussa and Rosen (1978) and Maskin and Riley (1984), the monopolist here faces a two-dimensional screening problem. Types are binary in both dimensions as in the introduction to two-dimensional screening by Armstrong and Rochet (1999). In contrast to Armstrong and Rochet (1999), image as the additional product characteristic cannot be chosen freely in my model. The monopolist faces the additional restriction that image must be consistent with consumers' purchasing choices. He offers a product menu and lets consumers self-select (second-degree price discrimination). Thus, the monopolist manipulates signaling possibilities and images in the market through his product offers. In my model, pooling occurs generically and for reasons different from the bunching condition in standard screening models. Due to the heterogeneity in image concerns, allocating image is not a zero-sum game anymore. Pooling is then a tool to create value in the form of image to consumer types who value image but who by themselves do not contribute to a positive image.

While I model images as signals about a consumer's type, others model image as a consumption externality which depends only on the number of consumers (e.g. Pastine and Pastine, 2002; Amaldoss and Jain, 2011; Buehler and Halbheer, 2012). In those models, image is not related to the average consumer type who buys a certain product but image is simply a function of the number of consumers who purchase the product. In this approach, some authors distinguish "snobs" (Leibenstein, 1950) who prefer to consume in a small group and followers who gain utility the more others consume the same product. The signaling approach is more general: Corneo and Jeanne (1997) show that status concerns can induce a follower and a snob effect as in Leibenstein (1950).

8. Conclusion

In this paper, I analyze quality provision and prices under the assumption that individuals differ in their valuation of quality as well as in their interest in social image. Assuming that consumers can derive utility from the quality of a product or the social image attached to it, I derive the optimal product line offered by a monopolist for any combination of four types of consumers and compare it to a perfectly competitive market with respect to welfare and quality provision.

When image concerns are sufficiently strong, ignoring image concerns does not maximize either welfare or monopoly profits but instead product offers are distorted to take consumers' signaling desire into account. Even though not justified by heterogeneous valuations of quality, different quality levels can be sold in equilibrium to accommodate heterogeneous image concerns. By introducing a low quality product, the monopolist creates value in the form of the associated image and thereby manages to sell to more consumers. However, doing so may even decreases total quality provision. In a competitive market, consumers' image concerns also induce differentiated product purchases. In contrast to the monopoly case, consumers use inflated quality as a functional excuse to separate from others and improve their image. Consequently, total quality provision increases. The competitive outcome of separation via inflated quality is less efficient than separation in monopoly which is induced through menu restrictions. Therefore, welfare is higher in monopoly than in competition for generic sets of parameters.

Contrary to what one might expect, image concerns do not always increase the provision of quality. Instead, the monopolist tailors to image concerns by increasing prices for those consumers who are willing to pay a premium for the image in addition to the price for quality. To charge as high an image premium as possible on the highest quality product, the producer may either offer a low quality alternative and thus depress average quality or reduce the market to an exclusive high-price product. Thus, if quality is considered a public good, as seems reasonable when we talk about quality as representing working standards, environmentally friendly production methods, or other components of CSR, image concerns can be detrimental. If advertising these causes or campaigns which are intended to raise awareness do not increase consumers' intrinsic interest but raise only their image concerns, such publicity campaigns can induce a reduction in the total provision of the public good. Under competition, however, quality provision never decreases when image concerns increase. Even though competition leads to higher total consumption of quality, welfare may be lower than in monopoly if the cost of providing quality as well as the utility provided through image are taken into account.

The predictions for the monopoly case in my model depend on how both motivations are correlated. However, little research has investigated heterogeneity in image concerns. In related work (Friedrichsen and Engelmann, 2013), we conduct laboratory experiments to test whether intrinsically motivated individuals exhibit stronger or less pronounced image concerns when it comes to buying Fairtrade chocolate. We find evidence for a negative relationship, i.e. those who do not value Fairtrade chocolate intrinsically exhibit stronger image concerns.

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A. Proofs

In the proofs, I refer to unconcerned consumers as type 00, to purely image-concerned consumers as type 01, to purely quality-concerned consumers as type 10, and to consumers who value both quality and image as type 11. In the one-dimensional benchmarks, type 0 refers to consumers with $\sigma = 0$ and type 1 to consumers with $\sigma = 1$. Participation and incentive constraints are indexed correspondingly. The non-participation corresponds to a product $(0, 0)$, the image of which might be positive. I index images, qualities, and prices within a menu by L and H to indicate that these values belong to, respectively, the 'low' and 'high' product, where the ranking is based on the image. To simplify notation define $\lambda_1 := \frac{\alpha_n(1-\beta)+\beta}{\beta}$ and $\lambda_2 := \frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$.

Proof of Lemma 2 This is a standard result an illustrated in a more general model in Bolton and Dewatripont (e.g. 2004, p. 52ff).

Proof. Suppose the monopolist offers a **separating** contract. Observe that the participation constraint of type 1 is fulfilled if incentive compatibility for type 1 and the participation constraint of type 0 hold. I solve the relaxed problem and verify ex post that the solution also fulfills incentive compatibility for type 0 and type 1's participation constraint. In the relaxed problem, type 0's participation constraint and type 1's incentive compatibility constraint bind at the optimum: $p_0 = 0 \cdot s_0 = 0$ and $p_1 = 1s_1 - (1-0)s_0 = s_1 - s_0$. Otherwise profit could be increased by raising p_0 or p_1 respectively without violating any constraint. The maximization problem becomes

$$\max_{s_0, s_1} \beta(s_1 - s_0 - \frac{1}{2}s_1^2) + (1-\beta)(-\frac{1}{2}s_0^2)$$

Taking derivatives and observing that qualities cannot be negative gives

$$\begin{aligned} \beta(1 - s_1) = 0 \quad &\Rightarrow \quad s_1^* = 1 \\ -\beta - (1-\beta)s_0 < 0 \quad &\Rightarrow \quad s_0^* = 0 \end{aligned}$$

Prices are

$$p_1^* = 1 \quad \text{and } p_0^* = 0.$$

The derived values also fulfill the participation constraint of type 1 and the incentive compatibility constraint of type 0 and thus are a solution to the fully constrained problem.

The profit corresponding to the separating menu is

$$\Pi^S = \frac{\beta}{2} > 0.$$

It is easy to see, that profit decreases if some of type 0 and 1 buy the same product. In a separating equilibrium, profits made per unit on type 1 are positive while those on type 0 are zero. In any separating equilibrium, some of type 1 do not buy the high quality product but pool with type 0 on the non-participation option, resulting in zero profit on these types. Profits go down as compared to full separation.

Suppose there is full **pooling**, i.e. the same product (s, p) is bought by all consumers. Since all consumers participate, the most restrictive constraint is the participation constraint for the ignorant consumer which must bind at the optimum: $p = 0 \cdot s = 0$. Profit maximization gives $s^* = 0$ and $p^* = 0$. Thus, pooling on a product with positive quality does not occur but not offering any positive quality gives zero profit and cannot be optimal.

Therefore the only equilibrium is separating with products as derived above. □

Proof of Lemma 3

Proof. Suppose the monopolist offers a **separating** contract and that given this contract the preferred equilibrium of the monopolist is played. Due to separation $R_1 = 1$ and $R_0 = 0$. In analogy to the case without image motivation, by profit maximization type 0's participation constraint and type 1's incentive compatibility constraint bind: $p_0 = 0 \cdot s_0 + \lambda R_0 = 0$ and $p_1 = 1 \cdot s_1 - (1-0)s_0 + \lambda(R_1 - R_0) = s_1 - s_0 + \lambda$.

The maximization problem becomes

$$\max_{s_0, s_1} \beta(s_1 - s_0 + \lambda - \frac{1}{2}s_1^2) + (1-\beta)(-\frac{1}{2}s_0^2).$$

Taking derivatives and observing that quality cannot be negative gives

$$\beta(1 - s_1) = 0 \quad \Rightarrow \quad s_1^* = 1$$
$$-\beta - (1-\beta)s_0 < 0 \quad \Rightarrow \quad s_0^* = 0.$$

Prices are $p_1^* = 1 + \lambda$ and $p_0^* = 0$. It is easily seen that the participation constraint of type 1 and the incentive compatibility constraint of type 0 are fulfilled at these values. The profit corresponding to the separating menu is $\Pi^S = \frac{\beta}{2} + \beta\lambda > 0$. Profit decreases with imperfect separation since then consumers of type 1 do not buy, the image of non-participation becomes positive, and therefore those who do buy pay less.

Suppose there is full **pooling**, i.e. the same product $(s, p) \neq (0, 0)$ is bought by all consumers. The participation constraint of type 0 is the strictest and thus binds: $p = 0 \cdot s + \lambda(\beta 1 + (1-\beta)0 - R_0) = \lambda(\beta - R_0)$. Since the outside good is chosen only out of equilibrium, the consumption stage has a continuum of equilibria with associated images $R_0 = E[\sigma|(0,0)] \in [0, \beta]$. Obviously, the monopolist's profit from pooling is largest for $R_0 = 0$. In this case profit maximization gives $s^* = 0$ and $p^* = \beta\lambda$. The corresponding profit is $\Pi^P = \beta\lambda < \Pi^S$. Profits are just shifted upwards by $\lambda\beta$ as compared to the situation without image motivation. The equilibrium offer is separating. If non-participation is associated with higher image out of equilibrium, profits will be even lower and thus pooling is not optimal.[31] □

Proof of Lemma 1

Proof. Suppose the monopolist offers $\mathcal{M} \subset \mathbb{R}^2_{\geq 0}$. Denote by $(s, p)^*$ the product in $\mathcal{M}$ which maximizes $s - p$. Assume without loss of generality that the maximizer is unique.[32] Then type 10 buys this product. Note that unconcerned consumers who do value neither quality nor image, $\sigma = \rho = 0$ decide not to buy from the monopolist for any positive price. Thus, non-participation $(0, 0)$ always occurs in equilibrium and its image is restricted by Bayes' rule.

Let beliefs be such that $R(s, p) = 0$ for all $(s, p) \in \mathcal{M}$ with $(s, p) \neq (s, p)^*$ and $R((s, p)^*) > 0$. Then, $(s, p)^* = b_{\mathcal{M}}(10) = b_{\mathcal{M}}(11)$. Furthermore, $(0, 0) = b_{\mathcal{M}}(00)$.

Finally,

$$b_{\mathcal{M}}(01) = \begin{cases} (0,0) & \text{if } \lambda < R((s,p)^*)^{-1} p \\ \in \{(0,0), (s,p)^*\} & \text{if } \lambda = R((s,p)^*)^{-1} p \\ (s,p)^* & \text{if } \lambda > R((s,p)^*)^{-1} p \end{cases}$$

[31] Note that after the separating contract has been offered, there is another equilibrium in the consumer game. High type consumers could collectively deviate to buying the lower quality thereby realizing higher utility since then $R(0, 0) = \beta$. Since the monopolist would in this case make zero profits, offering this menu cannot be optimal for the monopolist so that I do not have to consider it further. The same argument applies to equilibria where only a fraction of consumers coordinates. I discuss contracts which are robust against consumer coordination in Appendix E.

[32] If there were two maximizers $(s, p) \neq (s', p')$, in the consumption stage two equilibria exist where consumers behave as if (s, p) or (s', p') was the unique maximizer of $s - p$ and ignore the other one. Possibly the consumption stage has mixed strategy equilibria in addition. Note, however, that the monopolist is always better off including only one of the two products in the menu, namely the one that yields a higher profit margin $p - \frac{1}{2}s^2$.

I distinguish two cases:

Case 1: Suppose $(s,p)^* \neq (0,0)$. Then, for $\lambda < \frac{\beta}{\beta+\alpha_n(1-\beta)}$ and for $\lambda > 1$, a pure strategy equilibrium in the consumer game exists. For $\lambda < \frac{\beta}{\beta+\alpha_n(1-\beta)}$, types 10 and 11 buy $(s,p)^*$ and type 00 and 01 do not buy. For $\lambda > 1$, types 10, 11, and 01 buy $(s,p)^*$ and type 00 does not buy. For $\frac{\beta}{\beta+\alpha_n(1-\beta)} \leq \lambda \leq 1$, a mixed strategy equilibrium exists, where types 10, 11 and fraction q of type 01 buy. Type 00 and fraction $(1-q)$ of type 01 do not buy. The mixing probability is given by $q = \frac{(\lambda-p)\beta}{p\alpha_n(1-\beta)}$.

Case 2: Suppose $(s,p)^* = (0,0)$. Then, the consumption stage has a pure strategy equilibrium in which no consumer buys but all choose $(0,0)$. □

Proof of Proposition 1

Proof. I first prove that the monopolist will offer at most two products different from the non-participation option. Remember that for expositional reasons the latter, $(0,0)$ is always part of the product menu $\mathcal{M}$. Second, I exclude all but four partitions of consumers on products as inconsistent with profit maximization in Lemma A2. Third, I derive the prices and qualities which maximize the monopolist's profit subject to the corresponding incentive compatibility and participation constraints *given* each of the four partitions in Lemmas A3 to A6. For ease of exposition I introduce the names for the equilibrium candidates already in Lemma A2. Later, these names refer only to the equilibrium candidates which remain in Proposition 1.

Lemma A1. *The monopolist offers at most 2 products and non-participation* $(0,0)$.

Proof. Suppose the monopolist offers $(0,0)$, (s_L,p_L), (s_H,p_H), where $(s_L,p_L) \neq (s_H,p_H)$ and both are different from non-participation. Suppose further there is a pure-strategy equilibrium in the consumer game, where type 00 takes $(0,0)$, type 10 and 01 take (s_L,p_L), and type 11 takes (s_H,p_H) and profit is maximal in the set of 2 product menus with voluntary participation. I show (by contradiction) that the monopolist cannot increase profits by offering a third (non-zero) product $(s',p') \notin \{(s_L,p_L),(s_H,p_H)\}$. By Corollary 1 a menu with 3 products and non-participation involves randomization of at least one consumer type and (partial) pooling. Type 00 always takes $(0,0)$.

(i) Suppose a single type $\sigma\rho \in \{01, 10, 11\}$ randomizes over (s',p') and his original choice. Type 01 alone would not buy (s',p') because it has zero image. Type 10 or 11 only randomizes if $s'-p' = s_i - p_i$ for $i = L, H$, respectively. But if (s',p') gives higher per unit profit, the original offer was not optimal.

(ii) Suppose types 11 and 10 buy (s', p'). Then, $R(s', p') = R(s_H, p_H) = 1$. For type 10 it must hold that $p_L - p' = s_L - s'$, for type 11 $p_H - p' = s_H - s'$. These imply $p_H = p_L + (s_H - s_L)$. The participation constraint of type 10, $p_L \leq s_L$, yields $p_H \leq s_H$ and $p' \leq s'$. At the profit maximum both bind and quality is $s' = s_H$. But then $p' = p_H$.

(iii) Suppose (s', p') is bought by types 11 and 01. Then $p' \leq R(s', p')$ and profit would increase if type 10 bought (s', p') too to increase the feasible price $R(s', p')$ (see Lemma A2). This does not maximize profits either as shown in Lemma A8.

(iv) Suppose types 10 and 01 buy (s', p') and thus $R(s', p') \in (0, 1)$. Assume that $R(s', p') > R(s_L, p_L)$. Then, incentive compatibility and profit maximization yield $s_L = \min\{\lambda(R(s_L, p_L) - R_0), 1\} \leq 1$ and $p_L = s_L$ as well as $s' = \min\{\lambda(R(s', p') - R(s_L, p_L)), 1\} \leq 1$ and $p' = s'$. Since costs are convex in s, profit from types 10 and 01 is concave in s and is highest if only one product is offered to types 01 and 10.

(v) Suppose (s', p') is bought by types $11, 10$ and 01. According to Lemma A8 the original menu $(0, 0)$, (s_L, p_L), (s_H, p_H) must yield higher profit.

The same arguments apply for offering several additional products. Since it is not profitable to introduce an additional product into the two-product menu, it is not profitable to offer even more products. □

Lemma A2. *If the monopolist maximizes profits, the equilibrium features one of the following four consumer partitions ($s, s_L, s_H > 0$ and $p, p_L, p_H > 0$):* ***Standard good*** *- types* 10 *and* 11 *buy* (s, p)*, others* $(0, 0)$*.* ***Mass market*** *- types* 01*,* 10*, and* 11 *buy* (s, p)*, others* $(0, 0)$*.* ***Image building*** *- types* 01 *and* 10 *buy* (s_L, p_L)*, type* 11 *buys* (s_H, p_H)*, others* $(0, 0)$*.* ***Exclusive good*** *- type* 11 *buys* (s, p)*, others* $(0, 0)$*.*

Proof. First, Lemma 2 states an equilibrium candidate which offers strictly positive profit under heterogeneous image concerns. Any other equilibrium candidate must offer strictly positive profit. Second, type 00 chooses $(0, 0)$ in any equilibrium since she values neither quality nor image. Further, it is always profitable to sell $s > 0$ to type 11. Thus, no equilibrium candidate can pool these two types. Third, type 01 does not buy if her image is zero but she only buys if she is pooled with type 10 or type 11.

Finally, in equilibrium type 01 and type 11 choose the same product *only* if type 10 chooses the same product. Suppose to the contrary that the monopolist offers (s_P, p_P) to types 01 and 11, a different product $(s_{10}, p_{10}))$ to type 10 and type 00 chooses $(0, 0)$. I consider two separate cases.

Case 1: $(s_{10}, p_{10}) = (0, 0)$. Then, $R(0, 0) = \frac{\beta(1-\alpha_s)}{(1-\beta)(1-\alpha_n)+\beta(1-\alpha_s)}$, whereas the product (s_P, p_P)–chosen by consumers of types 11 and 01–has $R(s_P, p_P) = \frac{\beta\alpha_s}{(1-\beta)\alpha_n+\beta\alpha_s}$. The maximum price s_P is determined by type 01's participation constraint, $\lambda R(s_P, p_P) - p_P \geq R(0,0)$. If this is fulfilled, type 11's participation constraint is automatically fulfilled. Thus, $p_P = \lambda(R(s_P, p_P) - R(0,0))$ and the optimal prize is independent of quality. Since quality is costly, the monopolist sets $s_P = 0$ and profit from pooling types 01 and 11 is at most $\Pi^* = (\beta\alpha_s + (1-\beta)\alpha_n)\lambda(\frac{\beta\alpha_s}{(1-\beta)\alpha_n+\beta\alpha_s} - \frac{\beta(1-\alpha_s)}{(1-\beta)(1-\alpha_n)+\beta(1-\alpha_s)})$. Selling instead only totype 11 allows to sell $(s,p) = (1, 1 + \lambda(1 - \frac{\beta(1-\alpha_s)}{1-\alpha_s\beta})$ and obtain profits $\Pi^E = \beta\alpha_s(1 + \lambda(1 - \frac{\beta(1-\alpha_s)}{1-\alpha_s\beta}) - \frac{1}{2})$. Profit from only selling to type 11 strictly dominates profits from the offer that pools type 01 and 11:

$$\begin{aligned}\Pi^E - \Pi^* &> \frac{\alpha_s\beta}{2} - \alpha_s\beta\lambda\frac{\beta(1-\alpha_s)}{1-\alpha_s\beta} + (\beta\alpha_s + (1-\beta)\alpha_n)\lambda\frac{\beta(1-\alpha_s)}{1-\alpha_s\beta} \\ &= \frac{\alpha_s\beta}{2} + (1-\beta)\alpha_n\lambda\frac{\beta(1-\alpha_s)}{1-\alpha_s\beta} > 0\end{aligned}$$

Case 2: Suppose $(s_{10}, p_{10})) \neq (0,0)$. Then, consumers obtain images $R(0,0) = 0, R(s_P, p_P) = \frac{\beta\alpha_s}{(1-\beta)\alpha_n+\beta\alpha_s}$, and $R(s_{10}, p_{10}) = 1$. Incentive compatibility for purely quality-concerned consumers requires $s_P - p_P = s_{01} - p_{01} \leq s_{10} - p_{10}$ which implies by $R(s_P, p_P) < 1$ that $s_P + \lambda R_P - p_P = s_{11} + \lambda R_{11} - p_{11} < s_{10} + \lambda - p_{10} = s_{10} + \lambda R_{10} - p_{10}$. This violates incentive compatibility for consumers of type 11. □

To further restrict the set of equilibrium candidates, the following four lemmas characterize the offers which–for a given partition–give the highest profit.

Lemma A3. *In* ***standard good****, the monopolist maximizes profits by offering*

$$(s,p) = \begin{cases} (1,1) & \text{if } \lambda \leq 1 \\ (\lambda, \lambda) & \text{if } \lambda > 1 \end{cases}$$

for $\lambda \leq 2$. If $\lambda > 2$ a standard good cannot be profitably sustained.

Proof. Denote the product offered by the monopolist by (s,p) with $s, p > 0$ and the image corresponding to it by R. Types 01 and 00 are not willing to pay for quality, do not buy, and obtain an image of zero $R(0,0) = 0$. Type 10 buys (s,p) if $s - p \geq 0$. Type 11 receive additional image utility and buys too. As profit increases in p, $s = p$. To prevent type 01 from buying (s,p), it has to fulfill $\lambda R(0,0) \geq \lambda R - p = \lambda R - s$. The monopolist chooses s to maximize $\beta(s - \frac{1}{2}s^2)$ such that $s \geq \lambda R = \lambda$. If the separation is sustained $R = 1$ and thus, $s = \max\{1, \lambda\}$. If image concern is more than twice as large as marginal utility from quality, $\lambda > 2$, a standard good menu is not feasible anymore. Hindering type 01 from buying would require a quality so high that profit is negative. $\square$

Lemma A4. *In* ***mass market****, the monopolist maximizes profits by offering*

$$(s,p) = \begin{cases} (\lambda R, \lambda R) & \text{if } \lambda \leq R^{-1} \\ (1,1) & \text{if } \lambda > R^{-1} \end{cases}.$$

Proof. Type 00 does not buy and receives image $R(0,0) = 0$. The remaining group has image $R = \frac{\beta}{\beta+\alpha_n(1-\beta)}$. Incentive compatibility for types 01 and 10 requires $p \leq \min\{\lambda R, s\}$. If these hold, incentive compatibility for type 11 follows. Since profit is increasing in price and a higher p does not violate any other constraint, $p = \min\{\lambda R, s\}$.

I show in two steps that profit maximization requires $s \leq \min\{\lambda R, 1\}$. Since profit is increasing in s for $s \leq 1$ this implies $s = \min\{\lambda R, 1\}$.

Step 1: Show that $s \leq \lambda R$. Suppose to the contrary $s > \lambda R$. Consider an alternative product $(s', p') = (\lambda R, \lambda R)$ which offers lower quality at the same price. Incentive compatibility is still fulfilled and profit increases by $\Delta\Pi = (\beta+\alpha_n(1-\beta))(-\frac{1}{2}(\lambda R)^2 + \frac{1}{2}s^2)$. Since $s > \lambda R$ by assumption, $\Delta\Pi > 0$ contradicting optimality.

Step 2: Show that $s \leq 1$. From step 1 we know $s \leq \lambda R$ and therefore $p = s$. I distinguish two cases depending on the size of λ. Suppose first $\lambda \leq R^{-1}$. In this case $\lambda R \leq 1$ and part 1 applies. Suppose now $\lambda > R^{-1}$. Then, $\lambda R > 1$. The monopolist chooses s to maximize $(\beta + \alpha_n(1-\beta))(s - \frac{1}{2}s^2)$ such that $s \leq \lambda R$. Since $\lambda R > 1$, the optimal high quality is unconstrained and thus $s = 1$. $\square$

Lemma A5. *In* ***image building****, the monopolist maximizes profits by offering*

$$(s_L, p_L) = \begin{cases} (\lambda R_L, \lambda R_L) & \text{if } \lambda \leq R_L^{-1} \\ (1,1) & \text{if } \lambda > R_L^{-1} \end{cases} \text{ and } (s_H, p_H) = \left(1, 1 + \lambda \frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta + \alpha_n(1-\beta)}\right)$$

Proof. Type 00 does not buy and $R(0,0) = 0$. The group of types 10 and 01 receives image $R_L = \frac{\beta(1-\alpha_s)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)}$ and type 11 gets image $R_H = 1$. Incentive compatibility for type 11 requires $s_H + \lambda R_H - p_H \geq s_L + \lambda R_L - p_L$ which is equivalent to

$$p_H \leq p_L + \lambda \frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta + \alpha_n(1-\beta)} + s_H - s_L \tag{6}$$

Participation of 10 and 01 requires $p_L \leq \min\{\lambda R_L, s_L\}$ and their buying the low product is incentive compatible if $s_L - p_L \geq s_H - p_H$ and $\lambda R_L - p_L \geq \lambda R_H - p_H$. Profit increases in p_H and all other constraints are relaxed if the price for high quality goes up. Thus, (6) binds and $p_H = p_L + \lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} + s_H - s_L$. Then, price is chosen as high as possible at $p_L = \min\{\lambda R_L, s_L\}$. I show in two steps that profit maximization requires $s_L \leq \min\{\lambda R_L, 1\}$. Since profit is increasing in s for $s \leq 1$ this implies $s_L = \min\{\lambda R_L, 1\}$.

Step 1: Show that $s_L \leq \lambda R_L$. Suppose instead that $s_L > \lambda R_L$. Consider an alternative product $(s', p') = (\lambda R_L, \lambda R_L)$ which offers lower quality at the same price. Adjust the price of the high quality product by the same amount if necessary to ensure incentive compatibility. Profit increases by at least $\Delta\Pi = (\beta(1-\alpha_s) + (1-\beta)\alpha_n)(-\frac{1}{2}(\lambda R_L)^2 + \frac{1}{2}(s_L)^2)$. Since $s_L > \lambda R_L$, $\Delta\Pi > 0$. Any change in price and quality for type 11 (ignored here) increases profits further. Thus, the original product offer was not optimal.

Step 2: Show that $s_L \leq 1$. By step 1 $s_L \leq \lambda R_L$ and therefore $p_L = s_L$. I distinguish two cases depending on λ and show that $s_L = 1 < \lambda R_L$ is optimal if $\lambda > R_L^{-1}$ and $s_L = \lambda R_L$ otherwise. Suppose first that $\lambda \leq R_L^{-1}$. Then, $\lambda R_L \leq 1$ and by step 1 the claim is true. Suppose now $\lambda > R_L^{-1}$. Then, $\lambda R_L > 1$. Thus, I have $p_L = s_L$ and $p_H = \lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} + s_H$.

Using these values, the monopolist chooses s_L, s_H to maximize

$$(\beta(1-\alpha_s) + (1-\beta)\alpha_n)(s_L - \frac{1}{2}s_L^2) + \beta\alpha_s(\lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta + \alpha_n(1-\beta)} + s_H - \frac{1}{2}s_H^2).$$

This yields $s_L = s_H = 1$ and $p_L = 1 < 1 + \lambda\frac{\alpha_n(1-\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} = p_H$. □

Lemma A6. *In* ***exclusive market****, the monopolist maximizes profits by offering*

$$(s, p) = (1, 1 + \lambda\frac{1-\beta}{1-\alpha_s\beta}).$$

Proof. If we require 00, 01, and 10 to make the same choice, it must be that none of them buys since 00 will never buy. The group's image is positive, $R(0,0) = \frac{(1-\alpha_s)\beta}{1-\alpha_s\beta} < 1$. Type 11 has image $R_H = 1$. Incentive compatibility for 11 requires $p_H \leq s_H + \lambda(R_H - R_L) = s_H + \lambda\frac{1-\beta}{1-\alpha_s\beta}$. For 10 not to prefer 11's product requires $s_H \leq p_H$ and for 01 incentive compatibility requires $p_H \geq \lambda(R_H - R_L)$. Both are relaxed if p_H increases and profit goes up. Thus, $p_H = s_H + \lambda(R_H - R_L)$.

The profit maximization problem of the monopolist becomes

$$\max_{s_H}\Pi = \beta\alpha_s(s_H + \lambda\frac{1-\beta}{1-\alpha_s\beta} - \frac{1}{2}s_H^2)$$

The profit maximizing choice is $s_1^* = 1$ and $p_1 = 1 + \lambda\frac{1-\beta}{1-\alpha_s\beta}$. □

Lemmas A2, A3, A4, A5, and A6 together constitute the proof of Proposition 1. □

Proof of Proposition 2

Proof. I first characterize the profit functions associated with each equilibrium candidate, then exclude mass market from consideration, and finally compare profits across the remaining equilibrium candidates to identify which maximizes profit.

Lemma A7. *(i) Profit in standard good (Π^S) is constant for $\lambda < 1$ and decreasing and concave for $\lambda \geq 1$. (ii) Profit in image building (Π^I) is increasing and concave for $\lambda < \frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$ and linearly increasing for $\lambda > \frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$. (iii) Profit in exclusive good (Π^E) is linearly increasing.*

Proof. Lemmas A3, A5, and A6 yield the following profit functions:

$$\Pi^S = \begin{cases} \frac{\beta}{2} & \text{if } \lambda \leq 1 \\ \beta\left(\lambda - \frac{\lambda^2}{2}\right) & \text{otherwise} \end{cases} \tag{7}$$

$$\Pi^I = \begin{cases} \frac{\beta\left(\alpha_n(1-\beta)(\alpha_s+2\lambda)+(1-\alpha_s)\beta\left(\alpha_s(1-\lambda)^2+(2-\lambda)\lambda\right)\right)}{2\alpha_n+2(1-\alpha_n-\alpha_s)\beta} & \text{if } \lambda \leq \lambda_2 \\ \frac{1}{2}(\beta+\alpha_n(1-\beta)) + \frac{\alpha_n\alpha_s(1-\beta)\beta\lambda}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} & \text{otherwise} \end{cases} \tag{8}$$

$$\Pi^E = \alpha_s\beta\left(\frac{1}{2} + \frac{(1-(1-\alpha_s)\beta-\alpha_s\beta)\lambda}{1-\alpha_s\beta}\right) \tag{9}$$

From these I derive

$$\frac{\partial \Pi^S}{\partial \lambda} = \begin{cases} 0 & \text{if } \lambda \leq 1 \\ \beta(1-\lambda) < 0 & \text{if } \lambda \geq 1 \end{cases} \qquad \frac{\partial^2 \Pi^S}{\partial \lambda^2} = \begin{cases} 0 & \text{if } \lambda \leq 1 \\ -\beta < 0 & \text{if } \lambda \geq 1 \end{cases}$$

$$\frac{\partial \Pi^I}{\partial \lambda} = \begin{cases} \frac{\beta(\alpha_n(1-\beta)+(1-\alpha_s)^2\beta(1-\lambda))}{\alpha_n+(1-\alpha_n-\alpha_s)\beta} > 0 & \text{if } \lambda \leq \lambda_2 \\ \frac{\alpha_n\alpha_s(1-\beta)\beta}{\alpha_n+(1-\alpha_n-\alpha_s)\beta} > 0 & \text{if } \lambda \geq \lambda_2 \end{cases} \qquad \frac{\partial^2 \Pi^I}{\partial \lambda^2} = \begin{cases} \frac{(1-\alpha_s)^2\beta^2}{-\alpha_n-(1-\alpha_n-\alpha_s)\beta} < 0 & \text{if } \lambda \leq \lambda_2 \\ 0 & \text{if } \lambda \geq \lambda_2 \end{cases}$$

$$\frac{\partial \Pi^E}{\partial \lambda} = \frac{\alpha_s(1-\beta)\beta}{1-\alpha_s\beta} > 0 \qquad \frac{\partial^2 \Pi^E}{\partial \lambda^2} = 0$$

□

Lemma A8. *Offering a mass market product, i.e. a product which attracts all but the ignorant consumers, is never optimal for the monopolist.*

Proof. Profit from the image building menu Π^I is given in equation 8. From Lemma A4, I compute profit in the mass market as

$$\Pi^M = \begin{cases} \frac{1}{2}\beta\lambda\left(2 - \frac{\beta\lambda}{\beta+\alpha_n(1-\beta)}\right) & \text{if } \lambda \le \lambda_1 \\ \frac{1}{2}(\alpha_n(1-\beta)+\beta) & \text{otherwise} \end{cases} \tag{10}$$

Suppose $\lambda \le \lambda_1$. Rearranging terms in the profit functions (see Lemma A7) yields

$$\Pi^I - \Pi^M > 0 \Leftrightarrow \lambda^2 \frac{\alpha_s\beta^2(\alpha_n(2-\alpha_s)(1-\beta)+\beta-\alpha_s\beta)}{2(\alpha_n(1-\beta)+\beta)((1-\alpha_s)\beta+\alpha_n(1-\beta))} - \lambda\frac{(1-\alpha_s)\alpha_s\beta^2}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} + \frac{\alpha_s\beta}{2} > 0$$

The discriminant of the quadratic expression in λ is negative since $\alpha_s, \alpha_n, \beta \in (0,1)$ by Assumption 2. Thus, the expression does not have a real root. Since the coefficient of the quadratic term is positive, $\Pi^I > \Pi^M$ for all $\lambda \ge 0$.

Suppose $\lambda_1 < \lambda \le \lambda_2$.

$$\begin{aligned} &\Pi^I - \Pi^M > 0 \\ &\Leftrightarrow -\lambda^2\frac{((1-\alpha_s)\beta)^2}{2((1-\alpha_s)\beta+\alpha_n(1-\beta))} + \lambda\frac{((1-\alpha_s)\beta)^2+(1-\alpha_s)\beta\alpha_n(1-\beta)+\alpha_n(1-\beta)\alpha_s\beta}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} - \frac{(1-\alpha_s)\beta+\alpha_n(1-\beta)}{2} > 0 \end{aligned}$$

The left-hand side corresponds to a parabolic function in λ which opens downwards and has two roots, which enclose the interval $(\lambda_1, \lambda_2]$. Thus, for $\lambda_1 < \lambda \le \lambda_2$, it takes only positive values and $\Pi^I > \Pi^M$.

Suppose $\lambda > \lambda_2$. In this case, $\Pi^I - \Pi^M = \frac{\alpha_n\alpha_s(1-\beta)\beta\lambda}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} > 0$. □

Derivation of $\tilde{\lambda}_m$:

For $\lambda \ge 1$, Π^S is decreasing in λ, Π^M is increasing in λ, and at $\lambda = 1$ $\Pi^M > \Pi^S$ (equations 7 and 10). By Lemma A8 Π^M is never maximal and therefore $\tilde{\lambda}_m < 1$.

Suppose $\lambda < 1$. Rearranging terms gives

$$\Pi^S \ge \Pi^I \Leftrightarrow \lambda^2 - \lambda\frac{2(\alpha_n(1-\beta)+(1-\alpha_s)^2\beta)}{(1-\alpha_s)^2\beta} + \frac{\alpha_n+(1-\alpha_s-\alpha_n)\beta}{(1-\alpha_s)\beta} \ge 0$$

Tis expression has two roots $\lambda^{(1),(2)} = 1 + \frac{\alpha_n(1-\beta)}{(1-\alpha_s)^2\beta} \pm \frac{\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}}{(1-\alpha_s)^2\beta}$ and it is easy to see that $\lambda^{(1)} < 1 < \lambda^{(2)}$ so that we have have

$$\Pi^S \ge \Pi^I \text{ if } \lambda \le \lambda^{(1)} = 1 + \frac{\alpha_n(1-\beta)}{(1-\alpha_s)^2\beta} - \frac{\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}}{(1-\alpha_s)^2\beta} =: \lambda_{SI} \tag{11}$$

Using the respective profit functions from equations 7 and 9 I obtain

$$\Pi^S \geq \Pi^E \text{ if } \lambda \leq \frac{(1-\alpha_s)(1-\alpha_s\beta)}{2\alpha_s(1-\beta)} =: \lambda_{SE} \tag{12}$$

Standard good is optimal if and only if it gives higher profit than image building and exclusive good, $\tilde{\lambda}_m := \min\{\lambda_{SE}, \lambda_{SI}\}$. Using the definitions in (11) and (12) I compute

$$\lambda_{SE} \leq \lambda_{SI} \quad \Leftrightarrow \quad \alpha_s > \tfrac{1}{3} \text{ and } \beta < \tfrac{3\alpha_s - 1}{\alpha_s + \alpha_s^2} \text{ and } \alpha_n \leq \tfrac{\beta(1+\alpha_s(\beta+\alpha_s\beta-3))^2}{4\alpha_s(1-\beta)^2} \tag{13}$$

and thus have

$$\tilde{\lambda}_m := \begin{cases} \frac{(1-\alpha_s)(1-\alpha_s\beta)}{2\alpha_s(1-\beta)} & \text{if 13 holds} \\ 1 + \frac{\alpha_n(1-\beta)}{(1-\alpha_s)^2\beta} - \frac{\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}}{(1-\alpha_s)^2\beta} & \text{otherwise} \end{cases}$$

Derivation of $\tilde{\tilde{\lambda}}_m$:

Suppose $\lambda \leq \lambda_2$.

$$\Pi^I \geq \Pi^E \Leftrightarrow \lambda^2 - \lambda 2\frac{\beta(1-\alpha_s) + (1-\beta)\alpha_n - \beta\alpha_s(1-\beta\alpha_s)}{\beta(1-\alpha_s)(1-\beta\alpha_s)} \leq 0 \tag{14}$$

The expression has two real roots $\lambda^{(1)} = 0$ and $\lambda^{(2)} = 2\frac{\beta(1-\alpha_s)+(1-\beta)\alpha_n-\beta\alpha_s(1-\beta\alpha_s)}{\beta(1-\alpha_s)(1-\beta\alpha_s)}$ and it is $\Pi^I > \Pi^E$ if $\lambda \in [0, \min\{\lambda^{(2)}, \lambda_2\}]$. Define for later use

$$\lambda_{\text{IE,low}} := \lambda^{(2)} = 2\frac{\beta(1-\alpha_s) + (1-\beta)\alpha_n - \beta\alpha_s(1-\beta\alpha_s)}{\beta(1-\alpha_s)(1-\beta\alpha_s)} \tag{15}$$

Suppose now $\lambda \geq \lambda_2$. Rearranging terms yields

$$\Pi^I \geq \Pi^E \Leftrightarrow \lambda \leq \frac{1}{2}\frac{(\beta(1-\alpha_s) + (1-\beta)\alpha_n)^2(1-\beta\alpha_s)}{(1-\alpha_s)\beta^2\alpha_s(1-\beta)(1-\alpha_n)} =: \lambda_{\text{IE,high}} \tag{16}$$

Π^I is concave in λ for $\lambda \leq \lambda_2$, linear thereafter and Π^E is linear in λ for all values of λ (Lemma A7). Furthermore, we see that $\Pi^E|_{\lambda=0} < \Pi^I|_{\lambda=0}$. Thus, Π^I crosses Π^E only once and from above. Therefore, the region of λ where image building is optimal, is an interval.[33] With $\lambda_{\text{IE,low}}$ and $\lambda_{\text{IE,high}}$ as defined in equations 15 and 16 we have

$$\begin{aligned}(17)\qquad & \lambda_{\text{IE,high}} \geq \lambda_2 \Rightarrow \lambda_{\text{IE,low}} \geq \lambda_2, \text{ and } \lambda_{\text{IE,low}} \leq \lambda_2 \Rightarrow \lambda_{\text{IE,high}} \leq \lambda_2 \\ & \text{and } \lambda_{SE} \leq \lambda_{SI} \Rightarrow \lambda_{\text{IE,low}} \leq \lambda_{SI}\end{aligned}$$

Using (13) and (17), I define

$$(18)\qquad \tilde{\tilde{\lambda}}_m = \begin{cases} \lambda_{SE} & \text{if (13) holds} \\ \lambda_{\text{IE,low}} & \text{if } \lambda_{\text{IE,low}} \leq \lambda_2 \text{ and } \neg(13) \text{ holds} \\ \lambda_{\text{IE,high}} & \text{if } \lambda_{\text{IE,high}} \geq \lambda_2 \text{ and } \neg(13) \text{ hold} \end{cases}$$

□

Proof of Corollary 3:

Proof. Suppose $\alpha_s > \frac{1}{3}$ and $\beta < \frac{3\alpha_s - 1}{\alpha_s + \alpha_s^2}$ and $\alpha_n < \frac{\beta(1+\alpha_s(\beta+\alpha_s\beta-3))^2}{4\alpha_s(1-\beta)^2}$ so that by Proposition 2 image building is never optimal. The proof is by contradiction.

Since $\frac{\beta(1+\alpha_s(\beta+\alpha_s\beta-3))^2}{4\alpha_s(1-\beta)^2}$ is increasing in β, we have $\alpha_n < \frac{(1+\alpha_s)(3\alpha_s-1)^3}{16\alpha_s}$. Suppose $\alpha_n \geq \alpha_s$. The above implies $\frac{(1+\alpha_s)(3\alpha_s-1)^3}{16\alpha_s} \geq \alpha_s \Leftrightarrow 27\alpha_s^4 - 34\alpha_s^2 + 8\alpha_s - 1 \geq 0$. However, if $\alpha_s > \frac{1}{3}$ then $27\alpha_s^4 - 34\alpha_s^2 + 8\alpha_s - 1 = 27\alpha_s^2(\alpha_s^2 - 1) - 7\alpha_s(\alpha_s - 1) - 1 < 0$. □

Proof of Lemma 4

Proof. First note that there cannot be a partially pooling equilibrium at another product since purely quality-concerned consumers will always defect to buying $(1, \frac{1}{2})$.

Also note that for $\lambda < \frac{1}{2}\frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$, purely image-concerned consumers must be indifferent between buying $(1, \frac{1}{2})$ and choosing $(0, 0)$. In equilibrium only a fraction q of the purely image-concerned consumers buy $(1, \frac{1}{2})$. The associated image is then $R(1, \frac{1}{2}, q) = \frac{\beta}{q(1-\beta)\alpha_n+\beta}$. The indifference condition for purely image-concerned consumers (image utility equals price) pins down its participation probability q and thereby the associated image uniquely:

$$(19)\qquad \lambda\frac{\beta}{q(1-\beta)\alpha_n + \beta} = \frac{1}{2} \quad \Leftrightarrow \quad q = (2\lambda - 1)\frac{\beta\alpha_s}{(2-\beta)\alpha_n}$$

[33] The interval is empty if and only if Π^I crosses Π^E before it crosses Π^S ($\lambda_{SE} \leq \lambda_{SI}$, cf. Corollary 3).

The value q increases monotonically in λ over $[\frac{1}{2}, \frac{1}{2}\frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}]$; the decrease in image through increased q exactly balances the increase in the marginal value of image λ.

Images associated with all other products must be such that no consumer type wants to switch. This is ensured for instance by beliefs $\mu(s', p') = 0$ for all $(s', p') \neq (1, \frac{1}{2})$. $\square$

Proof of Lemma 5

Proof. Suppose two products $(1, \frac{1}{2})$ and $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ constitute a partially separating equilibrium: type 11 buys $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$, type 10 buys $(1, \frac{1}{2})$, type 00 chooses $(0, 0)$. Type 01 buys $(1, \frac{1}{2})$ with probability q and chooses $(0, 0)$ with probability $1-q$, where q is given in equation 5. Images are $R(0,0) = 0$, $R(1, \frac{1}{2}) = \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}$, and $R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) = 1$. Suppose out-of-equilibrium beliefs are $\mu(s, p) = 0$ for all other products.

Clearly, type 10 prefers $(1, \frac{1}{2})$ over any other product independent of beliefs.

Type 01 indeed prefers $(1, \frac{1}{2})$ over $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ in the proposed equilibrium if

$$
\begin{aligned}
(20)\quad U_{01}(1, \frac{1}{2}, R(1, \frac{1}{2})) &> U_{01}(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}, R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})) \\
\Leftrightarrow \lambda \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n} - \frac{1}{2} &> \lambda - \frac{(1+\varepsilon)^2}{2} \\
\Leftrightarrow \varepsilon > \underline{\varepsilon} &:= \sqrt{1 + 2\lambda \frac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}} - 1
\end{aligned}
$$

For $\lambda < \frac{1}{2}\frac{(1-\alpha_s)\beta+q\alpha_n(1-\beta)}{(1-\alpha_s)\beta}$, participation of type 01 is partial since the image of the low quality product under full participation is too low to compensate for the price of $\frac{1}{2}$. The participation probability q of type 01 is given in Equation 5 in the main text.

Consumer type 11 prefers $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ over $(1, \frac{1}{2})$ if

$$
\begin{aligned}
(21)\quad U_{11}(1, \frac{1}{2}, R(1, \frac{1}{2})) &< U_{11}(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}, R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})) \\
\Leftrightarrow 1 + \lambda \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n} - \frac{1}{2} &< 1 + \varepsilon + \lambda - \frac{(1+\varepsilon)^2}{2} \\
\Leftrightarrow \varepsilon < \bar{\varepsilon} &:= \sqrt{2\lambda \frac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}}
\end{aligned}
$$

It follows from (20) and (21) that there is a continuum of separating equilibria $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ such that $\varepsilon \in [\underline{\varepsilon}, \bar{\varepsilon}]$. For ε too low, type 01 prefers $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ and separation breaks down (Condition 20). For ε too large the price needed to recover the production cost exceeds consumer's willingness to pay (Condition 21).

The following beliefs sustain $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ as an equilibrium:

$$\mu(s,p) = \begin{cases} 1 & \text{if } (s,p) = (1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) \\ \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n} & \text{if } (s,p) = (1, \frac{1}{2}) \\ 0 & \text{else.} \end{cases}$$

□

Proof of Proposition 3

Proof. The first claim is trivial. For $\lambda \leq \frac{1}{2}$, type 01 does not want to buy. Thus, $R(1, \frac{1}{2}) = 1$ and type 11 does need to separate to obtain a better image. Thus, the pooling equilibrium **standard good** is unique. For the second part, suppose $\lambda > \frac{1}{2}$. I first show that among the separating equilibria there is a unique equilibrium which is consistent with the Intuitive Criterion (formally, the model is not a proper signaling game but can be regarded as one, see Footnote 19). In this separating equilibrium $\varepsilon = \underline{\varepsilon}$. Then, I show that no pooling equilibrium is consistent with the Intuitive Criterion.

(i) The proof is by contradiction. Assume there is a separating equilibrium as derived in Lemma 5 with $\varepsilon > \underline{\varepsilon}$. Sustaining this equilibrium would require the belief on $(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2})$ to be sufficiently low. A necessary condition for "sufficiently low" is $\mu(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2}) < 1$. However, type 00 would do worse by buying $(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2})$ instead of choosing $(0,0)$ for any belief. Type 01 cannot profit from deviating to $(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2})$ for any belief $R(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2}) \in [0,1]$ by definition of $\underline{\varepsilon}$ (see the proof of Lemma 5, in particular Equation 21). Also type 10 is better off buying $(1, \frac{1}{2})$ than anything else, independent of beliefs. Only type 11 can strictly profit from deviating from $(1+\varepsilon, \frac{1+\varepsilon}{2})$ to $(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2})$. Thus, the only belief consistent with the Intuitive Criterion is $\mu(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2}) = 1$ for which type 11 is better off buying $(1+\underline{\varepsilon}, \frac{1+\underline{\varepsilon}}{2})$ than $(1+\varepsilon, \frac{1+\varepsilon}{2})$.

The same argument goes through for all potentially separating equilibria, where $s = 1+\varepsilon$ and $p > \frac{1+\underline{\varepsilon}}{2}$. The only separating equilibrium, which remains is $(1, \frac{1}{2})$ and $(1+\underline{\varepsilon}, \frac{(1+\underline{\varepsilon})^2}{2})$ with participation behavior and beliefs as defined in Lemma 5.

(ii) Consider a pooling equilibrium where type 01 buys $(1, \frac{1}{2})$ with probability q as defined in Equation 4 and with probability $1-q$ type 01 choose $(0,0)$ so that $R(1, \frac{1}{2}) = \frac{\beta}{q(1-\beta)\alpha_n+\beta}$. I show in the following that there always exists $\varepsilon > 0$ such that type 11 profits from deviating to product $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ if he beliefs this to be associated with

$R = 1$, while type 01 cannot profit from deviating for any belief. But then, according to the Intuitive Criterion, $R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) = 1$ since for $R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) < 1$ we would assign positive probability to a type who would never gain from choosing this product.

Choose $\varepsilon > 0$ such that $\frac{\varepsilon}{2} < \lambda(1 - \frac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}) < \varepsilon + \frac{\varepsilon}{2}$. Then, for the product $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ the following holds:

(a) For the most favorable belief $R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) = 1$, type 11 gains from separating:

$$U_{11}(1, \tfrac{1}{2}, R(1, \tfrac{1}{2})) < U_{11}(1+\varepsilon, \tfrac{(1+\varepsilon)^2}{2}, R = 1) \Leftrightarrow \tfrac{\varepsilon}{2} < \lambda(1 - \tfrac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n})$$

(b) Type 01 cannot gain from deviating to $(1+\varepsilon, \frac{(1+\varepsilon)^2}{2})$ even for the most favorable belief $R(1+\varepsilon, \frac{(1+\varepsilon)^2}{2}) = 1$:

$$U_{01}(1+\varepsilon, \tfrac{(1+\varepsilon)^2}{2}, \mu = 1) < U_{01}(1, \tfrac{1}{2}, R(1, \tfrac{1}{2})) \Leftrightarrow \lambda(1 - \tfrac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}) < \varepsilon + \tfrac{\varepsilon}{2}$$

□

Proof of Lemma 6

Proof. According to Propositions 4 and 5, the equilibrium in the competitive setup is unique for $\lambda < \frac{1}{2}$. Thus, the respective equilibrium, the standard good, where consumers with $\sigma = 1$ buy quality $s = 1$ at price $p = \frac{1}{2}$ and consumers with $\sigma = 0$ choose the outside option $(0, 0)$ is also the welfare maximizing equilibrium in the competitive market for $\lambda < \frac{1}{2}$.

For $\lambda > \frac{1}{2}$, the standard good cannot be sustained as in equilibrium anymore. A continuum of partially separating equilibria (purely image-concerned and purely quality interested buyers buy the same product and those who value both characteristics separate by buying another product) and pooling equilibria (consumers who value at least one of the tow characteristics quality and image buy the same product, no other product is sold) coexist (see main text). Among the partially separating equilibria, the welfare maximizing equilibrium allocates quality $s = \min\{1, \sqrt{2\lambda R_L^{-1}}\}$ to consumers who care about either quality or image and quality $s = 1$ to consumers who value image and quality. Separation is ensured through setting prices and beliefs appropriately. For simplicity, I assume in the following, that beliefs on all products (s, p) not bought in equilibrium are zero, $\mu(s, p) = 0$. In any partially separating equilibrium with participation probability q for purely image-concerned consumers, beliefs are $\mu(s_l, p_l) = \frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}$ and $\mu(s_h, p_h) = 1$.

Since for a given partition of consumers, prices do not affect welfare, I can use the finding from monopoly to exclude the pooling equilibria (with full and partial participation of purely image-concerned consumers) from consideration. They never give higher welfare than the best partially separating equilibrium (again, this might feature partial participation of purely image-concerned consumers).

The participation probability of consumers who only care for quality is determined by the value of image. For $\lambda \leq \frac{1}{2}$, no purely image-concerned consumer wants to participate, for $\lambda > \frac{1}{2}\frac{\beta(1-\alpha_s)+(1-\beta)\alpha_n}{\beta(1-\alpha_s)}$, all purely image-concerned consumers prefer to participate. For intermediate values of λ, the indifference condition of these consumer types pins down the participation probability as $q = (2\lambda - 1)\frac{\beta}{(1-\beta)\alpha_n}$. □

Proof of Corollary 6

Proof. From Lemma 6 I compute welfare in a competitive market as

$$W^{\text{standard}} = \beta\left(\frac{1}{2} + \alpha_s\lambda\right) \tag{22}$$

for the standard good,

$$W^{\text{sep-part}} = \beta\left(\frac{1}{2} + \alpha_s\lambda\right) \tag{23}$$

in the case with partial participation and

$$W^{\text{sep-all}} = \frac{1}{2}(\beta - \alpha_n(1-\beta)) + \lambda\frac{\beta(\alpha_n(1-\beta) + (1-\alpha_s)\alpha_s\beta)}{\alpha_n(1-\beta) + \beta(1-\alpha_s)} \tag{24}$$

with full participation.

Using the equilibrium results from Propositions 1 and 2, I compute welfare in monopoly as

$$
\begin{aligned}
(25) \quad W^{\text{standard good}} &= \begin{cases} \beta\left(\frac{1}{2}+\alpha_s\lambda\right) & \text{if } \lambda \leq 1 \\ \frac{1}{2}\beta(2+2\alpha_s-\lambda)\lambda & \text{if } 1<\lambda<2 \\ \text{n.a.} & \text{otherwise} \end{cases} \\
(26) \quad W^{\text{mass market}} &= \begin{cases} \frac{1}{2}\lambda\frac{\beta(2\alpha_n(1-\beta)+\beta(2+2\alpha_s-\lambda))}{\beta+\alpha_n(1-\beta)} & \text{if } \lambda \leq \lambda_1 \\ \frac{1}{2}(\beta-\alpha_n(1-\beta))+\lambda\frac{\beta(\alpha_n(1-\beta)+\alpha_s\beta)}{\beta+\alpha_n(1-\beta)} & \text{otherwise} \end{cases} \\
(27) \quad W^{\text{image building}} &= \begin{cases} \lambda\beta+\frac{1}{2}(\alpha_s\beta-\frac{(1-\alpha_s)^2\beta^2\lambda^2}{(1-\alpha_s)\beta+\alpha_n(1-\beta)}) & \text{if } \lambda \leq \lambda_2 \\ \frac{1}{2}(\beta-\alpha_n(1-\beta))+\lambda\frac{\beta(\alpha_n(1-\beta)+(1-\alpha_s)\alpha_s\beta)}{(1-\alpha_s)\beta+\alpha_n(1-\beta)} & \text{otherwise} \end{cases} \\
(28) \quad W^{\text{exclusive good}} &= \frac{1}{2}\alpha_s\beta+\lambda(\alpha_s\beta+\frac{\alpha_n(1-\alpha_s)(1-\beta)\beta}{1-\alpha_s\beta})
\end{aligned}
$$

Comparing these yields the result. □

Proof of Lemma 7

Proof. Suppose the monopolist has to obey a MQS of $\underline{s} = 1$. Product offers in the standard good and the exclusive good are unaffected by the MQS. For the mass market (see Lemma A4) the monopolist then chooses $s = \max\{1, \min\{1, \lambda R\}\} = 1$. Prices are adjusted such that incentive compatibility is fulfilled. The optimal product offer is

$$
(s,p) = \begin{cases} (1, \lambda R) & \text{if } \lambda \leq R^{-1} \\ (1,1) & \text{if } \lambda > R^{-1} \end{cases}
$$

For the image building menu (see Lemma A5) the monopolist cannot decrease quality below 1 and chooses $s_L = \max\{1, \min\{1, \lambda R_L\}\} = 1$. Incentive compatibility requires that the price for the high quality product is adjusted upwards. For $\lambda < R^{-1}$, the price for the low quality product lies below its quality since otherwise the purely image-concerned consumer would not buy. This yields optimal product offers as

$$
(s_L,p_L) = \begin{cases} (1, \lambda R_L) & \text{if } \lambda \leq R_L^{-1} \\ (1,1) & \text{if } \lambda > R_L^{-1} \end{cases} \quad (s_H,p_H) = \begin{cases} (1, \lambda) & \text{if } \lambda \leq R_L^{-1} \\ (1, 1+\lambda(1-R_L)) & \text{if } \lambda > R_L^{-1} \end{cases}
$$

From this I compute profits for each consumer partition. For any set of parameters, the equilibrium with regulation is given by the offer which maximizes profits. Then, I compute consumer surplus for each equilibrium, and also welfare as the sum of consumers surplus and profit. I compare consumer surplus and welfare with regulation with results from Section 5. The proof is completed by Examples 5 and 6:

Example 5. *Suppose* $\alpha_n = \frac{3}{4}, \alpha_s = \frac{1}{48}, \beta = \frac{13}{64}, \lambda = 3$. *With and without regulation, the monopolist offers an image building menu. The introduction of the MQS* $\underline{s} = 1$ *decreases profits from* 0.38484 *to* 0.20898 *but increases consumer surplus from* 0.00317 *to* 0.05414. *The former effect is stronger: Welfare is* 0.38801 *without regulation and only* 0.26312 *with the MQS.*

Example 6. *Suppose* $\alpha_n = \frac{3}{4096}, \alpha_s = \frac{1}{224}, \beta = \frac{1}{4096}, \lambda = 2$. *The monopolist offers an image building menu without regulation and an exclusive good in the presence of the MQS* $\underline{s} = 1$. *Consumer surplus decreases from* 5.43230×10^{-7} *without regulation to* 3.56475×10^{-7} *with the MQS. Profit also decreases. Welfare decreases from* 0.00037 *without regulation to* 3.08073×10^{-6} *with regulation.*

□

Proof of Corollary 7

Proof. Any one-product equilibrium features $s = 1$ and is unaffected. Suppose we are in a two-product equilibrium. By Proposition 3 the product chosen by type 11 in this equilibrium is characterized by $\tilde{s} = \sqrt{1 + \frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}} > 1$. $MC(\tilde{s}) = \frac{1}{2} + \frac{\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}$ is just high enough to ensure that type 01 prefers to buy $(1, \frac{1}{2})$.

Choose $0 < \varepsilon < \sqrt{1 + \frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}} - 1$. For each product (s, p) set the tax to

$$t(s,p) = \begin{cases} 0 & \text{if } s \leq 1 \\ \lambda\frac{\alpha_n(1-\beta)}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} & \text{if } s > 1 \text{ and } s \neq 1+\varepsilon \\ \lambda\frac{\alpha_n(1-\beta)}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} - \varepsilon^2 & \text{if } s = 1+\varepsilon \end{cases} \tag{29}$$

Then, type 11 is best off choosing $(1+\varepsilon, MC(1+\varepsilon))$ and paying the associated tax. Assuming separation holds, her utility is then $U_{11}(1+\varepsilon, MC(1+\varepsilon), t) = \frac{1}{2} + \lambda\frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} + \frac{1}{2}\varepsilon^2$. This is greater than utility would be from choosing $(1, \frac{1}{2})$ which equals $\frac{1}{2} + \lambda\frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}$. Moreover, for any other quality level $s > 1$, $s - \frac{1}{2}s^2 < \frac{1}{2}$ and type 11 derives strictly lower utility $U_{11}(s, MC(s), t) = \frac{1}{2} + \lambda\frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} + s - \frac{1}{2}s^2 - \frac{1}{2}$ from choosing it than from choosing $(1, \frac{1}{2})$. Type 01 does not want to mimic type 11 since $U_{01}(1, \frac{1}{2}) = \lambda\frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} - \frac{1}{2} > \lambda\frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} - \frac{1}{2} + \frac{1}{2}\varepsilon^2 - \varepsilon = U_{01}(1+\varepsilon, MC(1+\varepsilon), t)$. Thus, separation indeed holds.

Since separation is unchanged, the allocation of image remains the same and welfare increases by the increased efficiency in production because the quality which type 11 chooses now $1+\varepsilon$ is smaller than $\tilde{s}$ by construction.

The tax income does not directly affect welfare but is a transit item since it is subtracted from surplus of type 11 consumers. Thus, it can be seen that there always exists a welfare improving tax scheme. However, not necessarily everyone is better off. The tax does not affect choices by types 00, 01, and 10 and thereby does not affect their surplus either. Type 11 is affected, though. If the functional excuse $\tilde{s}$ is relatively small, $\tilde{s} < 3$, type 11 is hurt by the luxury tax even though welfare increases. The reason is that the tax can be larger than the per unit increase in net surplus. Since taxes cancel out in welfare this implies an increase in total welfare but consumers of type 11 are still worse off so that the tax does not constitute a Pareto improvement.

In the absence of the tax, type 11 would choose $\tilde{s} = \sqrt{1 + \frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}} > 1$ at a price $p = MC(\tilde{s}) = \frac{1}{2} + \frac{\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}$ which yields utility $U_{11}(\tilde{s}, MC(\tilde{s})) = \tilde{s} + \lambda - \frac{1}{2}\tilde{s}^2$. Utility with taxation is higher if the following holds:

$$\frac{1}{2} + \lambda \frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} + \frac{1}{2}\varepsilon^2 > \tilde{s} + \lambda - \frac{1}{2}\tilde{s}^2$$

From the definition of $\tilde{s}$ we know that $\lambda - \frac{1}{2}\tilde{s}^2 = \lambda \frac{(1-\alpha_s)\beta}{\alpha_n(1-\beta)+(1-\alpha_s)\beta} - \frac{1}{2}$ so that the former is equivalent to $\varepsilon^2 > 2(\tilde{s}-1)$ which is only true if $\varepsilon > \sqrt{2(\tilde{s}-1)} > 0$. This requirement on ε can be fulfilled whenever

$$\sqrt{2(\tilde{s}-1)} < \tilde{s} - 1 \Rightarrow 2\tilde{s} - 2 < \tilde{s}^2 - 2\tilde{s} + 1 \Leftrightarrow \tilde{s}^2 - 4\tilde{s} + 3 > 0$$

Given $\tilde{s} > 1$ by definition, this inequality is fulfilled for all $\tilde{s} > 3$. Thus, a welfare-improving tax that also constitutes a Pareto improvement exists, whenever $\tilde{s} > 3$.

To ensure that consumer surplus remains unchanged but choices are unaffected or increases, a more complicated tax scheme has to be put in place which redistributes the tax income to all consumers in a lumpsum way. It is not clear that such a scheme always exists. $\square$

B. Results with constant unit cost are similar

Suppose the unit cost is constant in quality, $c(s) = c > 0$ and utility from obtaining quality s is equal to s. Suppose further that quality cannot exceed 1, e.g. because quality is the fraction of high quality inputs into the final good. I assume that producing quality is cheap enough relative to the value of image and the type distribution for it being profitable to sell to engage in product differentiation and where marginal utility from quality exceeds its marginal cost, i.e. $c < \max\{1, \lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}\}$.

As in the setup with quadratic costs of quality, there are four possible sortings in the coordination game among consumers. Optimal products which sustain these equilibria are presented in Table 3.

menu	group	products: (quality,price)			
Image motivation		$\lambda \leq 1$	$1 < \lambda \leq \lambda_1$	$\lambda_1 < \lambda \leq \lambda_2$	$\lambda_2 < \lambda$
standard good	00,01	(0,0)	-		
	10,11	(1,1)	-		
mass market	00	(0,0)		(0,0)	
	01,10,11	$(1, \lambda\frac{\beta}{\beta+(1-\beta)\alpha_n})$		(1,1)	
image building	00	(0,0)			(0,0)
	01,10	$(\lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}, \lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n})$			(1,1)
	11	$(1{,}1 + \lambda\frac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n})$			$(1{,}1 + \lambda\frac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n})$
exclusive good	00,01,10	(0,0)			
	11	$(1{,}1 + \lambda\frac{1-\beta}{1-\beta\alpha_s})$			

Table 3: Characterization of possible menus with constant unit cost

I derive the optimal products as follows:

Standard good (sg): If $\lambda < 1$, type 01 does not want to buy at the monopoly price $p = 1$ even for maximal image $R = 1$. If $\lambda > 1$, however, separation requires: $\lambda R(s_{sg}, p_{sg}) < p_{sg}$ and $s_{sg} \geq p_{sg}$. Since profit is increasing in p_{sg} and thus in s_{sg}, set $s_{sg} = 1$ and $p_{sg} = s_{sg}$. Separation is then sustainable if and only if $\lambda R(s_{sg}, p_{sg}) < 1 \Leftrightarrow \lambda < 1$.

Mass market (mm): Denote the product for the mass market by (s_{mm}, p_{mm}). Types 10 and 01 buy if $p \leq \min\{s, \lambda R(s_{mm}, p_{mm})\}$. It is $R(s_{mm}, p_{mm}) = \frac{\alpha_{11}+\alpha_{10}}{\alpha_{01}+\beta}$. Then, since there is no separation, $s_{mm} = 1$. Note that for $\lambda > \lambda_1$, $\lambda\frac{\beta}{\beta+(1-\beta)\alpha_n} > 1$ and thus price is not bound by valuation of type 01 for image anymore, and therefore $p = 1$.

Image building: Denote by (s_H, p_H) and (s_I, p_I) the high and the lower quality product in this menu. Images are given through the sorting. To gain the most from separation, high quality must be set at its maximum, $s_H = 1$, and price is set at the highest value which is still incentive compatible, $p_H = p_L + (s_H - s_L) + \lambda(R(s_H, p_H) - R(s_I - p_I)) = 1 + \lambda\frac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}$. For the lower quality product, the monopolist sets price such as to keep the type with lower willingness to pay just indifferent between buying and not buying, $s_L = \min\{s_L, \lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}\}$. Thus, he will set quality such as not to exceed the value of the associated image, $s_L = \min\{1, \lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}\}$. To summarize:

$$s_L = p_L = \begin{cases} \lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n} & \text{if } \lambda < \lambda_2 \\ 1 & \text{else.} \end{cases}$$

To maximize profits, the monopolist does not want to increase the quality of the lower quality product even though marginal cost are constant. The reason is that providing $s_L > \lambda R_L$ tightens the upper bound on the high quality product's price more than necessary and thereby reduces profits.

Exclusive good (eg): To sustain a sorting where only type 11 buys, the price has to be high enough, $p_{eg} \geq \max\{\lambda, s_{eg}\}$. Furthermore for type 11 to buy, $p_{eg} \leq s_{eg} + \lambda\frac{1-\beta}{1-\beta\alpha_s}$. To maximize profits, the monopolist sets $s_{eg} = 1$, and $p_{eg} = 1 + \lambda\frac{1-\beta}{1-\beta\alpha_s}$.

Given these four menus, I compute profits as summarized in Table 4 and identify which of those gives the highest profit for given type distribution and value of image.

menu	profit			
Image motivation	$\lambda \leq 1$	$v < \lambda \leq \lambda_1$	$1\lambda_1 < \lambda \leq \lambda_2$	$\lambda_2 < \lambda$
standard good	$\beta(1-c)$	-		
mass market	$((1-\beta)\alpha_n+\beta)(\lambda\frac{\beta}{\beta+(1-\beta)\alpha_n}-c)$		$((1-\beta)\alpha_n+\beta)(1-c)$	
image building	$((1-\beta)\alpha_n+\beta(1-\alpha_s))(\lambda\frac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}-c)$ $+\beta\alpha_s(1+\lambda\frac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}-c)$			$((1-\beta)\alpha_n+\beta(1-\alpha_s))(1-c)$ $+\beta\alpha_s(1+\lambda\frac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}-c)$
exclusive good	$\beta\alpha_s(1+\lambda\frac{1-\beta}{1-\beta\alpha_s}-c)$			

Table 4: Profits with constant unit cost

Note first, that mass market never maximizes profits and I can restrict attention to the remaining three types of offers.

$$\Pi^M - \Pi^E = \begin{cases} \frac{\alpha_s\beta(\alpha_n+\beta-(\alpha_n+\alpha_s+\lambda(1-\alpha_s))\beta)}{-\alpha_n-(1-\alpha_n-\alpha_s)\beta} < 0 & \text{if } \lambda < \lambda_1 \\ \frac{-\alpha_n^2(1-\beta)^2+\alpha_n(\lambda-2(1-\alpha_s))(1-\beta)\beta-(1-\alpha_s)^2(1-\lambda)\beta^2}{-\alpha_n-(1-\alpha_n-\alpha_s)\beta} < 0 & \text{if } \lambda_1 < \lambda < \lambda_2 \\ \frac{\alpha_n\alpha_s\lambda(1-\beta)\beta}{-\alpha_n-(1-\alpha_n-\alpha_s)\beta} < 0 & \text{if } \lambda > \lambda_2 \end{cases}$$

It is straightforward to see that indeed for small λ, standard good is optimal, i.e. there exists $\tilde{\lambda} > 0$ such that for $\lambda < \tilde{\lambda}$ standard good maximizes profits. It is equally easy to see that there exists $\tilde{\tilde{\lambda}}$ large enough such that exclusive good maximizes profits.

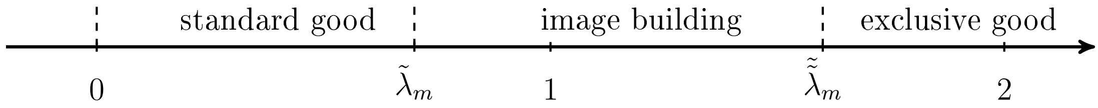

Figure 9: Equilibrium in monopoly with constant unit cost $c(s) = c < \bar{c}$.

When we look at the profit functions for the different menus, we find

$$\begin{aligned}
\frac{\partial \Pi^S}{\partial \lambda} &= 0 \\
\frac{\partial \Pi^E}{\partial \lambda} &= \frac{\beta \alpha_s (1-\beta)}{1-\beta\alpha_s} \\
\frac{\partial \Pi^I}{\partial \lambda} &= \begin{cases} \beta(1-\alpha_s) + \frac{\beta\alpha_s(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n} & \text{if } \lambda < \lambda_2 \\ \frac{\beta\alpha_s(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n} & \text{if } \lambda > \lambda_2 \end{cases}
\end{aligned}$$

It is

$$\frac{\partial \Pi^E}{\partial \lambda} > \frac{\partial \Pi^S}{\partial \lambda} \text{ and } \frac{\partial \Pi^I}{\partial \lambda} > \frac{\partial \Pi^S}{\partial \lambda}$$

and

$$\frac{\partial \Pi^I}{\partial \lambda}|_{\lambda > \lambda_2} < \frac{\partial \Pi^E}{\partial \lambda} \Leftrightarrow \alpha_n < 1$$

Finally, the slope of Π^I decreases at $\lambda = \lambda_2$.

I conclude that, if there is λ such that image building is optimal, then there exists an interval $[\tilde{\lambda}, \tilde{\tilde{\lambda}}]$ such that image building is optimal for all $\lambda \in [\tilde{\lambda}, \tilde{\tilde{\lambda}}]$.[34]

If I define now $\tilde{\lambda}$ and $\tilde{\tilde{\lambda}}$ as the values of image for which image building gives the same profit as does standard good ($\tilde{\lambda}$) and image building gives the same profit as does exclusive good ($\tilde{\tilde{\lambda}}$), the profit maximizing equilibrium takes the same form as in the case with quadratic costs which is illustrated in Figure 9.

For $\lambda < \tilde{\lambda}$, the monopolist offers a standard good, for $\tilde{\lambda} < \lambda < \tilde{\tilde{\lambda}}$ he offers an image building menu and for $\lambda > \tilde{\tilde{\lambda}}$, he offers the exclusive good.

So far, I have ignored the possibility of randomization. From the main text and Appendix D we know that with quadratic cost, there is only one type of randomization which is profitable for certain parameter constellations. Type 10 could mix between buying the lower quality product in a two-product menu and not buying at all. In analogy to the analysis with quadratic unit costs, one can derive precise conditions for the optimality of randomization. However, this would go beyond the scope of this robustness check.

[34] $c < \bar{c}$. Having cost $c < \bar{c} = \frac{(1-\alpha_s)^2\beta(\alpha_n(1-\beta)+\beta(1-\alpha_s\beta)^2)}{\alpha_n^2\alpha_s(1-\beta)^3+(1-\alpha_s)^3\beta^2(1-\alpha_s\beta)+\alpha_n(1-\alpha_s)(1-\beta)\beta(1+\alpha_s(1-2\beta))}$ ensures that image building is profitable for lower values than is the exclusive good, i.e. $\tilde{\lambda} < \tilde{\tilde{\lambda}}$.

Proposition B1 shows that there are parameters such that randomization by type 10 is not profitable with constant marginal cost of quality. Note that the proposition derives sufficient conditions and their not being fulfilled does not imply that randomization is optimal.

Proposition B1. *Suppose marginal cost of quality is constant. For each set of parameters, $\alpha_s, \alpha_n, \beta, \lambda$, such that $\beta\alpha_s < \alpha_n(1-\beta) + \beta(1-\alpha_s)$, there exists $\hat{c} > 0$ such that for $c \leq \hat{c}$ a two-product mechanism where type 10 randomizes between buying the lower quality from the monopolist and not buying at all gives lower profit than a deterministic mechanism where type 10 buys the low quality product with certainty.*

Proof. Suppose an image building menu is offered and denote the high quality product by (s_H, p_H), the low quality product by (s_L, p_L). Suppose a fraction q of type 10 consumers buys (s_L, p_L) and the remaining fraction of $(1-q)$ of type 10 consumers does not buy but obtains $(0,0)$. I compare the gain in profit from selling this menu with partial participation over the one where all type 10 consumers participate.

$$\begin{aligned}
\Delta\Pi &= \Pi_I^{\text{rand}} - \Pi_I^{\text{det}} \\
&= \alpha_s\beta\lambda\left(\tfrac{(1-\beta)\alpha_n}{(1-\beta)\alpha_n+\beta(1-\alpha_s)} - \tfrac{(1-\beta)\alpha_n}{(1-\beta)\alpha_n+q\beta(1-\alpha_s)}\right) \\
&\quad - (1-q)\beta(1-\alpha_s)\left(\lambda\tfrac{(1-\beta)\alpha_n}{(1-\beta)\alpha_n+\beta(1-\alpha_s)} - c\right) \\
&\quad - ((1-\beta)\alpha_n + \beta(1-\alpha_s))\lambda\left(\tfrac{\beta(1-\alpha_s)}{(1-\beta)\alpha_n+\beta(1-\alpha_s)} - \tfrac{q\beta(1-\alpha_s)}{(1-\beta)\alpha_n+q\beta(1-\alpha_s)}\right) \\
&= (1-q)\left(c - \lambda\tfrac{(1-\beta)\alpha_n((1-\beta)\alpha_n+\beta(1-\alpha_s)-\beta\alpha_s)}{((1-\beta)\alpha_n+\beta(1-\alpha_s))((1-\beta)\alpha_n+q\beta(1-\alpha_s))}\right)
\end{aligned}$$

Then,

$$\begin{aligned}
& \Delta\Pi < 0 \\
(30) \qquad \Leftrightarrow \quad & c < \lambda\frac{(1-\beta)\alpha_n((1-\beta)\alpha_n+\beta(1-\alpha_s)-\beta\alpha_s)}{((1-\beta)\alpha_n+\beta(1-\alpha_s))((1-\beta)\alpha_n+q\beta(1-\alpha_s))} =: \hat{c}
\end{aligned}$$

For $c \leq \hat{c}$, profit with randomization is lower than with deterministic participation. Furthermore, the term is decreasing in q, such that no randomization is profitable starting from $q = 1$. The intuition behind this finding is that for costs low enough, the cost saving from selling to fewer consumers does outweigh the loss from selling to them. We also learn from this special case with constant cost, that if randomization is profitable with quadratic cost, this is related to the fact that underproducing quality for the low quality product (i.e. $s_L < 1$) is not efficient and thereby dropping some of this consumers in exchange for higher prices from those served at efficient levels, may pay off.

The threshold $\hat{c}$ from (30) is positive as long as the fraction of image and quality-concerned consumers is small enough, i.e.

$$\beta\alpha_s < \alpha_n(1-\beta) + \beta(1-\alpha_s) \Rightarrow \hat{c} > 0$$

□

C. The equilibrium is in pure strategies

In this section, I prove that inducing randomization which is consistent with Assumption 1 is not profitable.

Proposition C2. *Under Assumption 1 any product menu which induces a mixed strategy-equilibrium in the consumption stage does not maximize monopolist profits. Thus, Proposition 2 characterizes the equilibrium of the complete game.*

For the proof, I identify equilibrium candidates which involve mixed strategies subject to Assumption 1. For each of them I show that the monopolist makes higher profit by offering a menu which induces consumers to play pure strategies.

Proof. By Lemma A1, the monopolist offers at most two products and the non-participation option. In the following, I prove that randomization in one-product menus is not profitable (Lemma C9). Then, I show that in two-product menus, randomization between products is not profitable either (Lemma C10). Finally, I show, that randomization by type 01 or 11 in two-product menus is also not profitable (Lemmas C11 and C12). Note that randomization by type 10 has been excluded through Assumption 1.

During the proof I will refer to Proposition 1, Proposition 2 (main text), Lemma A8 (in Appendix A), and Lemma A5 (in Appendix A). I am brief here and refer to the corresponding statements and proofs for the details.

Lemma C9. *Suppose the monopolist maximizes profits by offering one product* $(s, p) \neq (0, 0)$*. Then, the offer induces a pure-strategy equilibrium in the consumer game.*

Proof. Suppose the monopolist offers $(s, p) \neq (0, 0)$. Since otherwise profit is zero, at least some consumers of type 10 or type 11 buy (s, p) and $p > \frac{1}{2}s^2$.

(i) Suppose consumer type 11 buys (s,p) with probability q and $(0,0)$ with probability $1-q$. For given price and quality, profit increases in q since $p-\frac{1}{2}s^2>0$. Further, the image associated with (s,p) (with $(0,0)$) increases (decreases) in q. Thus, the price which can be maximally charged increases in q. Therefore, the monopolist maximizes profit for $q=1$. The same argument holds for type 10.

(ii) Suppose consumer type 01 buys (s,p) with probability q and $(0,0)$ with probability $1-q$. Without loss of generality assume that type 11 and 10 buy (s,p) with probability 1 and type 00 chooses $(0,0)$. Then, $R(s,p)=\frac{\beta}{q\alpha_n(1-\beta)+\beta}$ and $R(0,0)=0$. Indifference requires

$$\lambda R(s,p)=p \Leftrightarrow q=\frac{\beta(\lambda-p)}{\alpha_n(1-\beta)p}$$

By the same arguments as in Lemma A5, I obtain the profit maximizing product as

$$(s,p)=\begin{cases}(\frac{\beta\lambda}{\beta+\alpha_n q(1-\beta)},\frac{\beta\lambda}{\beta+\alpha_n q(1-\beta)}) & \text{if } \lambda<R(s,p)^{-1}\\ (1,1) & \text{else.}\end{cases}$$

The corresponding profit is increasing in q

$$\Pi=\begin{cases}\frac{1}{2}\beta\lambda\left(2+\frac{\beta\lambda}{\alpha_n q(-1+\beta)-\beta}\right) & \text{if } \lambda<R(s,p)^{-1}\\ \frac{1}{2}(\beta+\alpha_n(q-q\beta)) & \text{else.}\end{cases} \quad \text{and} \quad \frac{\partial\Pi}{\partial q}>0$$

□

Suppose the monopolist offers a menu which maximizes profits within the set of offers that induce a pure-strategy equilibrium in the consumption stage. According to Proposition 1, the offer takes the form of an "image building" menu where types 00 choose $(0,0)$, types 10 and 01 buy (s_L,p_L), and type 11 buys (s_H,p_H) and $s_L\leq s_H$. To simplify notation, define $\Delta R=R(s_H,p_H)-R(s_L,p_L)$.

Furthermore, the following set of conditions will be helpful in subsequent derivations:

$$
\begin{array}{ll}
(\mathrm{IC}_{10}) & s_H - p_H \leq s_L - p_L \\
(\mathrm{IC}_{01}) & \lambda R(s_H, p_H) - p_H \leq \lambda R(s_L, p_L) - p_L \\
(\mathrm{PC}_{01}) & \lambda R(s_L, p_L) - p_L \geq \lambda R(0,0) \\
(\mathrm{PC}_{10}) & s_L - p_L \geq 0 \\
(\mathrm{IC}_{11}) & s_H + \lambda R(s_H, p_H) - p_H \geq s_L + \lambda R(s_L, p_L) - p_L \\
(\mathrm{PC}_{11}) & s_H + \lambda R(s_H, p_H) - p_H \geq \lambda R(0,0)
\end{array}
$$

The images $R(s_H, p_H)$, $R(s_L, p_L)$, and $R(0,0)$ will be stated separately in each case. Additional conditions will be detailed where necessary. It is easily verified that PC_{11} is automatically fulfilled whenever the other constraints hold.

Lemma C10. *Suppose the monopolist maximizes profits by offering two products $(s_L, p_L) \neq (s_H, p_H)$, $(s_i, p_i) \neq (0,0)$ for $i = L, H$. Then, consumers do not randomize over (s_L, p_L) and (s_H, p_H).*

Proof. **(i)** Suppose type 10 buys (s_H, p_H) with probability q and (s_L, p_L) with probability $1-q$. Suppose that type 01 buys (s_L, p_L) and type 11 buys (s_H, p_H). Then $R(s_H, p_H) = 1$, $R(s_L, p_L) = \frac{(1-q)(1-\alpha_s)\beta}{(1-q)(1-\alpha_s)\beta + \alpha_n(1-\beta)}$, and $R(0,0) = 0$ and IC_{01}, IC_{11}, PC_{01}, and PC_{10} have to hold. Additionally, IC_{10} has to hold with equality to keep type 10 indifferent between the two products. From the two participation constraints PC_{10} and PC_{01} I obtain $p_L = \min\{s_L, \lambda R(s_L, p_L)\}$. By the same arguments as in Lemma A5 this implies $s_L = \min\{1, \lambda R(s_L, p_L)\}$, and $s_L = p_L$. Then, from IC_{10} follows $s_H = p_H$. Using this in IC_{01} I obtain

$$
s_H - s_L \geq \lambda \Delta R \tag{31}
$$

If unconstrained, the monopolist would like to sell $s_L = s_H = 1$. Thus, (31) binds at the optimum and $s_H = s_L + \lambda \Delta R$. The corresponding profit is

$$
\begin{aligned}
\Pi &= (q(1-\alpha_s)\beta + \alpha_s\beta)(s_L + \lambda\Delta R - \tfrac{1}{2}(s_L + \lambda\Delta R)^2) \\
&\quad + ((1-q)(1-\alpha_s)\beta + \alpha_n(1-\beta))(s_L - \tfrac{1}{2}s_L^2)
\end{aligned}
$$

with optimal quality choices

$$
\begin{aligned}
s_L &= \max\{0, 1 - \frac{q(1-\alpha_s)\beta + \alpha_s\beta}{\beta + \alpha_n(1-\beta)}\lambda\Delta R\} < 1 \\
s_H &= \begin{cases} \lambda\Delta R & \text{if } s_L = 0 \\ 1 + \frac{(1-q)(1-\alpha_s)\beta + \alpha_n(1-\beta)}{\beta + \alpha_n(1-\beta)}\lambda\Delta R & \text{if } s_L > 0 \end{cases}
\end{aligned}
$$

For $s_L = p_L = 0$, types 11 and 10 buy $s_H = p_H = 1$ and type 01 pools with type 00 on the outside option $(0,0)$; no randomization takes place $q = 1$. For $\lambda < (\Delta R)^{-1}\frac{\alpha_n(1-\beta)+\beta}{q(1-\alpha_s)\beta+\alpha_s\beta}$, I obtain $s_L > 0$ and profit is

$$
\begin{aligned}
\text{(32)} \qquad \Pi &= \frac{1}{2}(\alpha_n(1-\beta) + \beta) \\
&\quad - \frac{\alpha_n^2(1-\beta)^2(q(1-\alpha_s)\beta + \alpha_s\beta)\lambda^2}{2(\alpha_n(1-\beta) + (1-q)(1-\alpha_s)\beta)(\alpha_n(1-\beta)+\beta)}
\end{aligned}
$$

Profit from (32) is maximal at $q = 0$; at the optimum, no randomization takes place.

(ii) Suppose type 01 buys (s_H, p_H) with probability q and (s_L, p_L) with probability $1-q$. Suppose further that type 10 buys (s_L, p_L) and type 11 buys (s_H, p_H). Then $R(s_H, p_H) = \frac{\alpha_s\beta}{q\alpha_n(1-\beta)+\alpha_s\beta}$, $R(s_L, p_L) = \frac{(1-\alpha_s)\beta}{(1-q)\alpha_n(1-\beta)+(1-\alpha_s)\beta}$, and $R(0,0) = 0$. Conditions IC_{10}, IC_{11}, PC_{01}, and PC_{10} have to hold. Additionally, IC_{01} has to hold with equality for type 01 to remain indifferent: $p_H = p_L + \lambda\Delta R$.

Note that this menu is only feasible as long as

$$
R(s_H, p_H) \geq R(s_L, p_L) \Leftrightarrow q \leq \frac{\alpha_s\beta}{\alpha_s\beta + (1-\alpha_s)\beta}
$$

In analogy to the proof of Lemma A5, I find

$$
p_L = \min\{\lambda R(s_L, p_L), s_L\} \text{ and } s_L = \min\{\lambda R(s_L, p_L), 1\}
$$

I distinguish two cases:

Case 1: Suppose $\lambda < R(s_L, p_L)^{-1}$. Then, $s_L = \lambda R(s_L, p_L) = p_L$. From IC_{01} I obtain $p_H = \lambda R(s_H, p_H)$ and from IC_{10} $s_H \leq \lambda R(s_H, p_H)$. Profit is increasing in s_H for $s_H \leq 1$. Thus, we obtain $s_H = \min\{1, \lambda R(s_H, p_H)\}$. I plug in the derived values into the profit

function and simplify profits:
(33)

$$\Pi = \begin{cases} \beta\lambda + \frac{\left(q\alpha_n(1-\beta)((1-\alpha_s)\beta-\alpha_s\beta)\beta+\alpha_s\beta\left((1-\alpha_s)^2\beta^2+(\alpha_n(1-\beta)+(1-\alpha_s)\beta)\alpha_s\beta\right)\right)\lambda^2}{2((-1+q)\alpha_n(1-\beta)-(1-\alpha_s)\beta)(q\alpha_n(1-\beta)+\alpha_s\beta)} \\ \quad \text{if } \lambda < R(s_H,p_H)^{-1} \\ \frac{1}{2}\left(-q\alpha_n(1-\beta)+\alpha_s\beta(-1+2\lambda)+(1-\alpha_s)\beta\lambda\left(2-\frac{(1-\alpha_s)\beta\lambda}{(1-q)\alpha_n(1-\beta)+(1-\alpha_s)\beta}\right)\right) \\ \quad \text{if } R(s_H,p_H)^{-1} < \lambda < R(s_L,p_L)^{-1} \end{cases}$$

I maximize profit according to (33) with respect to the probability q that type 01 buys (s_H, p_H) and obtain

$$q^* = \begin{cases} \alpha_s \text{ if } \lambda < R(s_H,p_H)^{-1} \\ \frac{1}{2}\left(1+\frac{(1-\alpha_s)\beta\left(\alpha_n(1-\beta)+(1-\alpha_s)\beta+(1-\alpha_s)\beta\lambda^2\right)}{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)\beta)} - \sqrt{\frac{((\alpha_n(1-\beta)+(1-\alpha_s)^2\beta)^2+(1-\alpha_s)^2\beta^2\lambda^2)^2}{\alpha_n^2(1-\beta)^2(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2}}\right) \\ \quad \text{if } R(s_H,p_H)^{-1} < \lambda < R(s_L,p_L)^{-1} \end{cases}$$

Profit at q^* is

$$\Pi = \begin{cases} \frac{1}{2}\beta\lambda\left(2-\frac{\beta\lambda}{\alpha_n(1-\beta)+\beta}\right) \\ \quad \text{if } \lambda < R(s_H,p_H)^{-1} \\ \alpha_s\beta\left(-\frac{1}{2}+\lambda\right)+\frac{1}{2}(1-\alpha_s)\beta\lambda\left(2-\frac{(1-\alpha_s)\beta\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}\right) \\ \quad \text{if } R(s_H,p_H)^{-1} < \lambda < R(s_L,p_L)^{-1} \end{cases}$$

and never exceeds profit from a deterministic image building menu as derived in Lemmas A5 and A7 and stated in equation 7.

Case 2: Suppose $\lambda \geq R(s_L,p_L)^{-1}$. Since $R(s_L,p_L) < R(s_H,p_H)$ this implies $\lambda > R(s_H,p_H)^{-1}$. Due to the quadratic cost function profit is decreasing in qualities s_i for $s_i > 1, i = L, H$. Therefore, the monopolist sets $s_L = s_H = 1$. This yields $p_L = 1$ and $p_H = 1 + \lambda\Delta R$. Profit is then

$$\Pi = \frac{1}{2}(\alpha_n(1-\beta)+\beta) + \frac{\alpha_n(1-\beta)(-\alpha_s\beta+q\beta)\lambda}{(-1+q)\alpha_n(1-\beta)-(1-\alpha_s)\beta}$$

This profit is maximal at $q = 0$ and the monopolist does not profit from randomization.

(iii) It is easy to see that profits do not increase either if type 11 randomizes between the high and the low quality product. Suppose type 11 is indifferent between (s_L, p_L) and (s_H, p_H). If a fraction $1-q$ of type 11 buys (s_L, p_L) this increases the associated image. However, if the monopolist increases p_L in response to the image increase, types 10 stop buying (s_L, p_L) unless he also increases s_L. But an increase in s_L makes the low quality product more attractive to type 11, thereby breaking the indifference of type 11.[35] Therefore, p_L and s_L remain unchanged. Having type 11 buy the low quality decreases profits since $p_H - \frac{1}{2}s_H^2 > p_L - \frac{1}{2}s_L^2$ due to the image-premium charged from type 11. $\square$

Lemma C11. *Suppose the monopolist maximizes profits by offering two products $(s_L, p_L) \neq (s_H, p_H)$, $(s_i, p_i) \neq (0,0)$ for $i = L, H$. Then, consumer type* 01 *does not randomize over (s_L, p_L) and* $(0,0)$.

Proof. Let q denote the probability that type 01 buys (s_L, p_L) and with $(1-q)$ he takes $(0,0)$. Suppose only type 11 buys (s_H, p_H). Then $R(s_L, p_L) = \frac{(1-\alpha_s)\beta}{(1-\alpha_s)\beta + q\alpha_n(1-\beta)}$ and $R(s_H, p_H) = 1$.

For type 01 to mix between (s_L, p_L) and $(0,0)$, PC_{01} has to bind. Together with PC_{10} this gives $s_L \geq \lambda R(s_L, p_L) = p_L$. Since quality is costly to produce the monopolist sets $s_L = \lambda R(s_L, p_L)$.

Using this in IC_{11} yields

$$p_H \leq p_L + s_H - s_L + \lambda \Delta R = s_H + \lambda \Delta R. \tag{34}$$

Under profit maximization constraint 34 binds. The monopolist maximizes profits by setting $s_H = 1$ and

$$(s_L, p_L) = (\lambda R(s_L, p_L), \lambda R(s_L, p_L)) \quad \text{and} \quad (s_H, p_H) = (1, 1 + \lambda \Delta R).$$

The corresponding profit increases in q:

$$\begin{aligned}
\Pi &= \frac{\alpha_s \beta}{2} + \frac{q\alpha_n(1-\beta)\alpha_s\beta\lambda}{(1-\alpha_s)\beta + q\alpha_n(1-\beta)} \\
&\quad + (q\alpha_n(1-\beta) + (1-\alpha_s)\beta)\left(\frac{(1-\alpha_s)\beta\lambda}{(1-\alpha_s)\beta + q\alpha_n(1-\beta)} - \frac{(1-\alpha_s)^2\beta^2\lambda^2}{2(q\alpha_n(1-\beta) + (1-\alpha_s)\beta)^2}\right) \\
\frac{\partial \Pi}{\partial q} &= \frac{\alpha_n(1-\alpha_s)(1-\beta)\beta^2(2\alpha_s + (1-\alpha_s)\lambda)\lambda}{2(\alpha_n q(1-\beta) + (1-\alpha_s)\beta)^2} > 0.
\end{aligned}$$

$\square$

[35] The monopolist can increase s_H to sustain indifference but this does quite obviously not increase profits either.

Lemma C12. *Suppose the monopolist maximizes profits by offering two products* $(s_L, p_L) \neq (s_H, p_H)$*,* $(s_i, p_i) \neq (0,0)$ *for* $i = L, H$*. Then, consumer type* 11 *does not randomize over any product and* $(0,0)$*.*

Proof. Let q denote the probability of type 11 buying (s_H, p_H) and by $(1-q)$ the probability of her choosing $(0,0)$. Denote by $\gamma_{10}^i, \gamma_{01}^i$ the fractions of the population which are of type 10 and 01, respectively, and buy product i for $i \in \{L, H\}$. The required indifference in PC_{11} implies

$$\begin{aligned}
p_H &= \lambda(R(s_H, p_H) - R(0,0)) + s_H \\
&= \lambda(1 - \frac{(1-q)\alpha_s\beta}{(1-q)\alpha_s\beta + (1-\beta)\alpha_n(1-\gamma_{01}^L - \gamma_{01}^H) + (1-\alpha_s)\beta(1-\gamma_{10}^L - \gamma_{10}^H)}) + s_H
\end{aligned}$$

The price p_H increases in q and so do per-unit profits from sales of (s_H, p_H). Furthermore, profits from selling (s_L, p_L) also increase in q since analogous to Lemma A5:

$$\begin{aligned}
p_L &= s_L \\
&= \min\{1, \lambda(\tfrac{(1-\alpha_s)\beta\gamma_{10}^L}{(1-\alpha_s)\beta\gamma_{10}^L + (1-\beta)\alpha_n\gamma_{01}^L} - \tfrac{(1-q)\alpha_s\beta}{(1-q)\alpha_s\beta + (1-\beta)\alpha_n(1-\gamma_{01}^L-\gamma_{01}^H) + (1-\alpha_s)\beta(1-\gamma_{10}^L-\gamma_{10}^H)})\}
\end{aligned}$$

and thus p_L and s_L increase in q. Finally, at the margin type 11 buying (s_H, p_H) contributes $p_H - \frac{1}{2}s_H^2 > 0$ to profits so that the monopolist looses from type 11 not buying directly. □

Thus, I have shown that randomization of types 01 or 11 is not profitable. By Assumption 1 type 10 does not randomize. This completes the proof. □

D. Results are similar if Assumption 1 is relaxed

In this Section, I relax Assumption 1, derive the optimal product offer in the generalized model, and illustrate that the result from the main text remain qualitatively unchanged.

First, I prove the generalization of Lemma C9.

Lemma D13. *Suppose the monopolist maximizes profits by offering one product* $(s, p) \neq (0,0)$*. Then type 10 does not randomize between* (s, p) *and* $(0,0)$*.*

Proof. Let q denote the probability of type 10 buying the high quality product and $1-q$ the probability that type 10 chooses $(0,0)$. Suppose $q \in (0,1)$. Type 10 finds it profitable to randomize in this way if and only if $s = p$. The profit maximizing quality choice is then

$s = 1$ and profits from sales of (s,p) are $(q(1-\alpha_s)\beta+\alpha_s\beta)(s_H - \frac{1}{2}s_H^2) = \frac{1}{2}(q(1-\alpha_s)\beta+\alpha_s\beta)$ and increasing in q. Thus, $q \in \{0,1\}$ and type 10 does not randomize. □

The next lemma characterizes a possibly profitable 2-product menu where type 10 randomizes between the lower quality product and not participating. I call this **image building with randomization** because of its similarity to the image building menu.

Lemma D14. *There exists a stochastic mechanism where two products with positive quality are offered and type* 10 *randomizes over buying the lower quality product and not participating and a set of parameters such that this mechanism maximizes monopoly profits.*

Proof. Suppose a menu with two positive quality products $(s_L, p_L), (s_H, p_H)$ is offered and that type 10 randomizes over buying the lower of the two qualities, s_L, and not buying at all. Denote by q the probability that type 10 buys the lower quality product; $1 - q$ is the probability that type 10 does not buy.

When type 10 does not always participate, the image of non-participation increases whereas the image associated with the lower quality product decreases. The proposed structure is only feasible as long as the image associated with the lower quality product is greater than the image associated with not buying since only the difference between the two, multiplied by the value of image λ is the price which can be charged for this product.

The image of the lower quality product is higher than the one for non-participation as long as

$$R(s_L, p_L) \geq R(0,0) \Leftrightarrow q \geq \alpha_n$$

Thus, for $\alpha_n = 1$ the only admissible menu of this type has $q = 1$ and randomization of type 10 does not have to be considered.

Analogous to the derivation of the pure strategy image building menu, I derive that the products with randomization take the following form:

$$s_H = 1 \text{ and } s_L = \begin{cases} \lambda\left(\frac{(1-\alpha_s)q\beta}{\alpha_n(1-\beta)+(1-\alpha_s)q\beta} - \frac{(1-\alpha_s)(1-q)\beta}{1-\alpha_n(1-\beta)-\alpha_s\beta-(1-\alpha_s)q\beta}\right) \\ \text{if } \lambda < (R_L - R(0))^{-1} \\ 1 \text{ else} \end{cases}$$

$$p_H = 1 + \lambda\frac{\alpha_n(1-\beta)}{q(1-\alpha_s)\beta + \alpha_n(1-\beta)} \text{ and } p_L = s_L$$

Suppose this menu is feasible, i.e. $q \geq \alpha_n$. Profit from image building with randomization is then

(35)

$$\Pi_{I\text{rand}} = \begin{cases} \frac{\alpha_s\beta}{2} + \frac{\alpha_n\alpha_s(1-\beta)\beta\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)q\beta} \\ +(\alpha_n(1-\beta)+(1-\alpha_s)q\beta)\{\left(\frac{(1-\alpha_s)q\beta}{\alpha_n(1-\beta)+(1-\alpha_s)q\beta} - \frac{(1-\alpha_s)(1-q)\beta}{1-\alpha_n(1-\beta)-\alpha_s\beta-(1-\alpha_s)q\beta}\right)\lambda \\ -\frac{1}{2}\left(\frac{(1-\alpha_s)q\beta}{\alpha_n(1-\beta)+(1-\alpha_s)q\beta} - \frac{(1-\alpha_s)(1-q)\beta}{1-\alpha_n(1-\beta)-\alpha_s\beta-(1-\alpha_s)q\beta}\right)^2\lambda^2\} \\ \quad \text{if } \lambda < (R_L - R(0))^{-1} \\ \\ \frac{1}{2}(\alpha_n(1-\beta)+\alpha_s\beta+(1-\alpha_s)q\beta) + \frac{\alpha_n\alpha_s(1-\beta)\beta\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)q\beta} \\ \quad \text{else} \end{cases}$$

I conclude the proof by an example in which image building with randomization gives higher profit than any pure strategy mechanism.

Example 7. ***Profitable randomization:*** *Suppose we have* $\alpha_{10} = \frac{1}{32}, \alpha_{01} = \frac{379}{4096}, \alpha_{11} = \frac{1}{16}, \lambda = \frac{21}{4}, q = \frac{3}{4}$. *Plugging in reveals that the relevant constraints on*λ *and* q *are satisfied. I have shown before that for* λ *large enough, as is the case here, neither the standard good nor the mass market have to be considered (see Lemma A8 and Proposition 2).*

Profits corresponding to the example are $\Pi_{Irand} = \frac{1365977}{3891200} = 0.351043, \Pi_{Idet} = \frac{468531}{1384448} = 0.338424, \Pi_E = \frac{223}{640} = 0.348438$ *with* Π_{Irand} *being the largest.*

□

Corollary D1. *Inducing partial participation of type* 10 *allows to sell two different quality levels for higher values of image motivation than under full participation.*

Proof. In general, the threshold above which both qualities are equal to one is $(R_L - R(0))^{-1}$. Since partial participation decreases R_L and increases $R(0)$, the threshold increases (as long as the participation probability is admissible, see above). □

It is instructive that we find an example in the case where $s_L = 1 = p_L < \lambda R_L$ in the deterministic image building. In this case, the value of image is so large that the purely image-concerned consumer 01 earns a rent when buying the lower quality product. Having type 10 only partially participate reduces the image associated with the lower quality product. This lowers not only the rent to type 01 but also the rent which has to be left to type 11. By inducing type 10 to only partially participate, the monopolist can increase the price charged on the higher quality product without having to adjust price and quality of the lower quality product. Thus, when participation changes at the margin, profit on those still buying goes up.

Suppose such a mixed-strategy image building menu is optimal. The structure of this menu is the same as in the pure strategy image building apart from the fact that some type 10 consumers do not buy anything and image as well as quality of the lower quality product deteriorate. While average and aggregate quality change, this type of equilibrium does not give fundamentally different insights than what we learn from the pure strategy equilibria. Qualitatively, the only profitable randomization induces an image building menu but does not change the intuition of the results.

The following proposition characterizes the equilibrium without Assumption 1. The result is illustrated in Figure 10

Proposition D3. *Suppose $\alpha_n, \alpha_s, \beta$ and $q \in (\alpha_n, 1)$ are such that profit from* ***image building with randomization*** *is strictly higher than profit from any other menu for some $\lambda > 0$. If such q exists, there are $\hat{\lambda}(q) < \tilde{\lambda}_m < \hat{\hat{\lambda}}(q)$ such that image building with randomization gives highest profits for all $\lambda \in [\hat{\lambda}(q), \hat{\hat{\lambda}}(q)]$.*

Proof. Profit from image building with randomization is given in 35 where

$$(R_L - R(0))^{-1} = \frac{(1-\alpha_n(1-\beta) - \alpha_s(1-q)\beta - q\beta)(\alpha_n(1-\beta) + (1-\alpha_s)q\beta)}{(1-\alpha_s)(1-\alpha_n)(1-\beta)\beta}$$

is the inverse of the image premium from buying low quality instead of not buying at all.

It is easily verified that the profit function from image building with mixing is continuous, increasing, and concave in λ for $\lambda \leq (R_L - R(0))^{-1}$ and linearly increasing for $\lambda > (R_L - R(0))^{-1}$.

I have shown in Lemma 3.2 that profit from image building in pure strategies is continuous, increasing, and concave in λ for $\lambda \leq \lambda_2$ and linearly increasing for $\lambda > \lambda_2$.

Both menus give the same profit for $\lambda = 0$, $\Pi^I|_{\lambda=0} = \Pi^{\text{mix}}|_{\lambda=0}$. Furthermore, if $\tilde{\lambda}_m > \lambda_2$ the slope from profit with mixing is always greater than the slope from profit with image building:

$$\frac{\partial \Pi^I}{\partial \lambda}|_{\lambda=\tilde{\lambda}_m} < \frac{\partial \Pi^{\text{mix}}}{\partial \lambda}|_{\lambda=\tilde{\lambda}_m}$$

Moreover, the slope from profit with mixing is lower than the slope from profit with exclusive good when evaluated at $\lambda = (R_L - R(0))^{-1}$.

This can be seen relatively easily by assuming that $\lambda \geq (R_L - R(0))^{-1}$ such that also three profit functions are linear. Profit from exclusive good and deterministic image

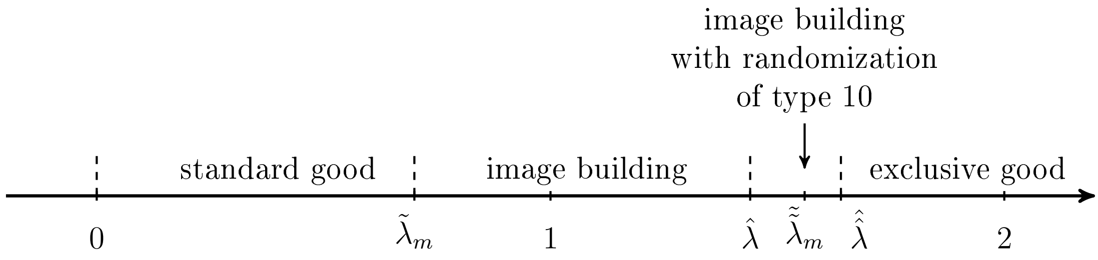

Figure 10: Equilibrium in monopoly without Assumption 1.

building are linear for any $\lambda > \lambda_2$ and $\lambda_2 < (R_L - R(0))^{-1}$. Since, profit from mixing is linear for $\lambda > (R_L - R(0))^{-1}$, concave for smaller λ, and continuous in λ, the slope for any smaller λ is only greater such that the first inequality still holds.

The case where $\tilde{\lambda}_m < \lambda_2$ is more complicated since then only profit from exclusive good is linear. However, we know that profit from mixing and profit from image building are concave and that at $\lambda = 0$, both give the same profit. Furthermore, one can show that for $\lambda < \lambda_2$ the following holds:

$$\frac{\partial^2 \Pi^{\text{mix}}}{\partial \lambda^2} \geq \frac{\partial^2 \Pi^I}{\partial \lambda^2}$$

Since $\frac{\partial^2 \Pi^{\text{mix}}}{\partial \lambda^2} < 0$ and $\frac{\partial^2 \Pi^I}{\partial \lambda^2} < 0$ this means that the slope of profit from image building is decreasing faster than the slope from profit with mixing. From this we know that if for some $\lambda > 0$ profit from mixing is higher than profit from image building and $\frac{\partial \Pi^I}{\partial \lambda}|_\lambda < \frac{\partial \Pi^{\text{mix}}}{\partial \lambda}|_\lambda$, then mixing will give higher profit than image building for all $\lambda' > \lambda$ subject to the assumption that $\lambda' < \lambda_2$.

Since for $\lambda = 0$ profits are equal, this implies that profit from mixing and profit from deterministic image building cross at most once for $\lambda < \lambda_2$ with profit from image building with randomization coming from below (and additionally the two menus give the same profit for $\lambda = 0$).

Combining the two insights for $\lambda < \lambda_2$ and $\lambda > \lambda_2$, I have shown that if mixing is best for some $\lambda > 0$, then there exist $q \in (\alpha_n, 1)$ and $\hat{\lambda}(q) < \hat{\hat{\lambda}}(q)$ such that mixing with an induced participation probability q for type 10 maximizes profit for $\lambda \in [\hat{\lambda}(q), \hat{\hat{\lambda}}(q)]$.

In the first part, I have shown that the slope of mixing for $\lambda > \tilde{\lambda}_m$ is lower than the slope of exclusive good profits. Thus, if profits haven't intersected before, they will not do so later. Thus, I have also shown that $\hat{\lambda}(q) < \tilde{\tilde{\lambda}}_m < \hat{\hat{\lambda}}(q)$. $\square$

E. Results are similar if consumers coordinate at consumption stage

So far I have assumed that consumers play the equilibrium which is preferred by the monopolist. In this subsection I analyze how the results change, when instead, in case of multiplicity of equilibria in the consumption game, the equilibrium is played which consumers prefer. This amounts to selecting a coalition proof Nash equilibrium in the consumption stage. In the end, I show that even if I compare this type of monopoly equilibrium with the "best-welfare" competitive equilibrium as derived in Lemma 6, monopoly yields higher welfare than competition for generic parameters.

If the monopolist offers a standard good, the equilibrium in the consumption game is unique. For the mass market good the equilibrium is also unique.

If the monopolist offers two products as derived above for the image building menu, the ensuing subgame among consumers has two equilibria. One, where consumers sort onto the two products as intended by the monopolist, and a second one, where consumer types 01, 10, and 11 all buy the lower quality product and nobody buys the high quality product. In this equilibrium, types 01 and 11 are better off than in the separating equilibrium, while profits to the monopolist are lower. The separating menu can however be adapted such that this second equilibrium is not attractive anymore, by leaving an appropriately higher rent to type 11. The new relevant constraint is the following non-deviation constraint:

$$p_{11} = s_H - s_L + p_L + \lambda(R(s_H)|_{sep} - R(s_L)|_{pool})$$

With the optimal quality choices, the optimal low quality price and plugging in for images this becomes

$$p_{11} = 1 + \lambda \frac{\alpha_n(1-\beta)}{\beta + \alpha_n(1-\beta)}.$$

If the monopolist offers an exclusive good, the consumption stage again has two equilibria. Instead of actually buying the exclusive good, types 11 could collectively deviate from the monopolist's plan and not buy at all. This would increase the image associated with not buying such that types 11 and 01 are better off than if the exclusive good was bought by type 11. If this occurs, however, the monopolist would have preferred to offer a product which is immune to such deviations. This requires that the following constraint holds:

$$p_{11} = s_H + \lambda(R(s_H)|_{sep} - R(s_L)|_{pool}) = 1 + \lambda(1-\beta)$$

If consumers play their preferred equilibrium in both cases where there is multiplicity, the monopolist adjusts its behavior and in equilibrium never offers the ambiguous products but the deviation-proof versions.

Using the above products I compute the following profits for image building and exclusive good. To avoid confusion between the two different types of equilibria, I add a superscript 'alt' for the values derived under the alternative assumption that consumers coordinate against the monopolist.

$$\Pi^{I,\text{alt}} = \begin{cases} \frac{1}{2}\beta\left(\alpha_s + 2\lambda - \frac{2\alpha_s\beta\lambda}{\alpha_n+\beta-\alpha_n\beta} + \frac{(-1+\alpha_s)^2\beta\lambda^2}{-\alpha_n+(-1+\alpha_n+\alpha_s)\beta}\right) & \text{if } \lambda \leq \lambda_2 \\ \frac{1}{2}(\alpha_n(1-\beta)+(1-\alpha_s)\beta) + \alpha_s\beta\left(\frac{1}{2} + \frac{\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta+\alpha_s\beta}\right) & \text{if } \lambda > \lambda_2 \end{cases}$$

$$\Pi^{E,\text{alt}} = \alpha_s\beta\left(\frac{1}{2} + (1-(1-\alpha_s)\beta - \alpha_s\beta)\lambda\right)$$

Note that profits in standard good and mass market are unchanged as the respective products are unchanged. These are stated in Equations 7 and 10.

Results for the overall equilibrium are qualitatively the same as derived above. I proceed as follows.

First, computer-aided computations show that image building gives always at least the same profit as mass market, $\Pi^I \geq \Pi^M$, and therefore mass market does not have to be considered further.

Second, I identify for which values of λ, the standard good maximizes profits.

$$\Pi^S > \Pi^{I,\text{alt}} \Leftrightarrow \lambda < \lambda_{SI}^{\text{alt}}$$

where

$$(36)\lambda_{SI}^{\text{alt}} := \frac{(\alpha_n(1-\beta)+\beta(1-\alpha_s)^2}{(1-\alpha_s)^2(\beta+\alpha_n(1-\beta)} - \frac{\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)\beta)(\alpha_n^2(1-\beta)^2+\alpha_n(2-(3-\alpha_s)\alpha_s^2)(1-\beta)\beta+(1-\alpha_s)^2(1+2\alpha_s)\beta^2)}}{(1-\alpha_s)^2(\alpha_n(1-\beta)+\beta)\beta}$$

and

$$\Pi^S > \Pi^{E,\text{alt}} \Leftrightarrow \lambda < \frac{1-\alpha_s}{2\alpha_s(1-\beta)} =: \lambda_{SE}^{\text{alt}} \tag{37}$$

One can show that $\lambda^{\text{alt}}_{SI} < 1$ but $\lambda^{\text{alt}}_{SE}$ may be smaller or greater than one. The threshold $\tilde{\lambda}^{\text{alt}}$ is defined as the minimum of the two

$$\tilde{\lambda}^{\text{alt}} := \min\{\lambda^{\text{alt}}_{SE}, \lambda^{\text{alt}}_{SI}\} \tag{38}$$

A sufficient condition for image building determining the threshold is that image concerns are more prevalent for those not intrinsically interested in quality, $\alpha_n > \alpha_s$.

Next, I derive the value of image for which exclusive good gives higher profit than image building. Since image building is determined piecewise, two cases have to be considered

$$\Pi^{E,\text{alt}} > \Pi^{I,\text{alt}} \text{ if } \begin{cases} \lambda > \lambda^{\text{alt}}_{\text{IE,low}} & \text{if } \lambda < \lambda_2 \\ \lambda > \lambda^{\text{alt}}_{\text{IE,high}} & \text{if } \lambda > \lambda_2 \end{cases}$$

where

$$\lambda^{\text{alt}}_{\text{IE,low}} := \frac{2(\alpha_n(1-\beta)+(1-\alpha_s)\beta)(\alpha_n(1-\alpha_s(1-\beta))(1-\beta)-(1-\alpha_s(2-\beta))\beta)}{(1-\alpha_s)^2(\alpha_n(1-\beta)+\beta)\beta} \tag{39}$$

and

$$\lambda^{\text{alt}}_{\text{IE,high}} := \frac{(\alpha_n(1-\beta)+\beta)(\alpha_n(1-\beta)+(1-\alpha_s)\beta)}{2(1-\alpha_n)\alpha_s(1-\beta)\beta^2} \tag{40}$$

One can show that

$$\lambda^{\text{alt}}_{\text{IE,low}} < \lambda_2 \Rightarrow \lambda^{\text{alt}}_{\text{IE,high}} < \lambda_2 \text{ and } \lambda^{\text{alt}}_{\text{IE,high}} > \lambda_2 \Rightarrow \lambda^{\text{alt}}_{\text{IE,low}} > \lambda_2$$

by noting that the profit functions for image building is continuous and weakly concave whereas the profit function for exclusive good is linearly increasing. Thus, if image building maximizes profit for some λ, it maximizes profit for an interval of values for λ. If image building is not optimal for any value of λ, the threshold to exclusive good is given by $\lambda^{\text{alt}}_{SE}$. Using the definitions from Equations 37, 38, 39, and 40 I obtain

$$\tilde{\tilde{\lambda}}^{\text{alt}} := \begin{cases} \lambda^{\text{alt}}_{SE} & \text{if } \tilde{\lambda}^{\text{alt}} = \lambda^{\text{alt}}_{SE} \\ \lambda^{\text{alt}}_{\text{IE,low}} & \text{if } \lambda < \lambda_2 \text{ and } \tilde{\lambda}^{\text{alt}} = \lambda^{\text{alt}}_{SI} \\ \lambda^{\text{alt}}_{\text{IE,high}} & \text{if } \lambda > \lambda_2 \text{ and } \tilde{\lambda}^{\text{alt}} = \lambda^{\text{alt}}_{SI} \end{cases} \tag{41}$$

Qualitatively, the equilibrium is exactly what I have shown by focussing on the equilibrium preferred by the monopolist.

Whereas there are clearly parameters such that consumers are better off in this equilibrium than in the alternative, the opposite happens too. There are parameters such that consumers are worse off than if the equilibrium was played that the monopolist preferred. The intuition is that consumers also profit from image building but their colluding against the monopolist makes it less profitable for the monopolist to implement the image building menu. The following numerical example illustrated the case.

Example 8. *Suppose the parameters take the following values: $\beta = 0.00170898$, $\alpha_n = 0.00012207$, $\alpha_s = 0.314941$, and $\lambda = 1.28931$. Then, the thresholds derived above are $\tilde{\lambda}^{alt} = \lambda_{SI}^{alt} = 0.67984 < 1.08887 = \lambda_{SE}^{alt}$, $\tilde{\tilde{\lambda}}^{alt} = \lambda_{IE,high}^{alt} = 1.28879 > 1.10409 = \lambda_2$. Thus, if consumers coordinated against the monopolist would offer an exclusive good. Corresponding consumer surplus is $CS^{E,alt} = 1.369983^{-6}$. If instead, consumers follows the prescriptions by the monopolist, the thresholds are $\tilde{\lambda} = \lambda_{SI} = 0.67984 < 1.08887 = \lambda_{SE}$, $\tilde{\tilde{\lambda}} = \lambda_{IE,high} = 1.32751 > 1.10409 = \lambda_2$. If unconstrained by consumers's coordination, the monopolist would still offer an image building menu. Consumer surplus would be $CS^I = 0.000629$.*

Finally, using the computations on the "best welfare" competitive equilibrium, one can show that there still exist parameter constellations such that monopoly gives higher welfare than competition.

Example 9. *Suppose the following values: $\alpha_s = 0.0625$, $\alpha_n = 0.109375$, $\beta = 0.0546875$, $\lambda = 1$. Then, $\tilde{\lambda}^{alt} = \lambda_{SI}^{alt} = 0.522462 < 7.93388 = \lambda_{SE}^{alt}$, $\tilde{\tilde{\lambda}}^{alt} = \lambda_{IE,high}^{alt} = 77.6802$, and $\lambda_2 = 3.01667$. Monopoly implements an image building menu which yields welfare $W^{I,alt} = 0.047899$. The "best welfare" equilibrium in competition is a partially separating equilibrium with partial participation and yields only welfare $W^{sep\text{-}part} = 0.030762$.*

Example 10. *Suppose the following parameter values $\alpha_s = 0.852661$, $\alpha_n = 0.335938$, $\beta = 0.486328$, $\lambda = 1.70703$. Then, $\tilde{\lambda}^{alt} = \tilde{\tilde{\lambda}}^{alt} = \lambda_{SE}^{alt} = 0.1682 < 0.201117 = \lambda_{SI}^{alt}$. Monopoly implements and exclusive good and yields welfare $W^{E,alt} = 0.951257$. Competition in the "best welfare" equilibrium yields a partially separating equilibrium with full participation of purely image-concerned consumers ($\lambda > 1.70411 = \frac{1}{2}R_L^{-1}$) and thereby only lower welfare of $W^{sep\text{-}all} = 0.951172$.*

F. Formal comparative statics

First, I discuss comparative statics for prices and qualities in monopoly. Second, I investigate the implications for total provision of quality in monopoly, which depends on the qualities sold to consumers as well as on the fractions of consumers who buy a given quality. Third, I analyze how the prevalence of different monopoly equilibria is affected by changes in the preference distribution. Finally, I discuss additional comparative statics in a competitive market.

In Proposition 1, I have derived qualities and prices for each possible equilibrium. Using Proposition 2 one can then read off equilibrium qualities and prices corresponding to any preference distribution for any value of image. Obviously, price and quality in the standard good are independent of the preference distribution. In image building and exclusive good we observe the following.

Corollary F2. ***(Products)***
Suppose (s_L, p_L) and (s_H, p_H) are an image building menu with $p_H > p_L$.

(i) If $\lambda < \frac{\alpha_n(1-\beta)+\beta}{\beta}$, s_L, p_L, p_H, and $p_H - p_L$ increase in β. Otherwise, only p_H and $p_H - p_L$ increase in β.

(ii) If $\lambda < \frac{\alpha_n(1-\beta)+(1-\alpha_s)\beta}{(1-\alpha_s)\beta}$, s_L and p_L decrease, and $s_H - s_L$, p_H, and $p_H - p_L$ increase in α_s and α_n. Otherwise, only p_H and $p_H - p_L$ increase α_s and α_n.

Suppose (s, p) is an exclusive good offer. Then, p increases in β and α_s, and is independent of α_n. Quality s is independent of preferences.

Proof. These results are directly read of from the products defined in Table 2. □

Increases in image concerns, whether for the intrinsically concerned or the unconcerned induce quality reductions and price increases. Whereas this increases profits, it makes individual consumers worse off. Increases in the share of intrinsically concerned consumers β yield increases in both quality (as long as it still below $s = 1$) and prices. The effects in product qualities also affect the total provision of quality. The following is directly read off from the derivatives of total quality (see Figure 5).

Corollary F3. ***(Total quality)***

(i) Total provision of quality S in monopoly (weakly) increases in β and α_n.

(ii) In exclusive good, S increases in α_s.

(iii) In image building, S increases in α_s if $\lambda < 1$, weakly decreases in α_s otherwise.

Proof. Total quality is computed from the equilibrium offers (see Proposition 2) as

$$S = \begin{cases} \beta & \text{if } \lambda \leq \tilde{\lambda}_m \quad \text{(standard good)} \\ \beta\lambda - (\lambda - 1)\beta\alpha_s & \text{if } \tilde{\lambda}_m < \lambda \leq \min\{\lambda_2, \tilde{\tilde{\lambda}}_m\} \quad \text{(image building)} \\ \beta + (1-\beta)\alpha_n & \text{if } \lambda_2 < \lambda \leq \tilde{\tilde{\lambda}}_m \\ \beta\alpha_s & \text{if } \lambda > \tilde{\tilde{\lambda}}_m \quad \text{(exclusive good)} \end{cases}$$

From this we read off

$$\frac{\partial S}{\partial \beta} = \begin{cases} 1 & \text{if } \lambda \leq \tilde{\lambda}_m \\ \lambda(1-\alpha_s) + \alpha_s & \text{if } \tilde{\lambda}_m < \lambda \leq \min\{\lambda_2, \tilde{\tilde{\lambda}}_m\} \\ 1 - \alpha_n & \text{if } \lambda_2 < \lambda \leq \tilde{\tilde{\lambda}}_m \\ \alpha_s & \text{if } \lambda > \tilde{\tilde{\lambda}}_m \end{cases}$$

$$\frac{\partial S}{\partial \alpha_n} = \begin{cases} 1 - \beta & \text{if } \lambda_2 < \lambda \leq \tilde{\tilde{\lambda}}_m \\ 0 & \text{otherwise} \end{cases}$$

$$\frac{\partial S}{\partial \alpha_s} = \begin{cases} 0 & \text{if } \lambda \leq \tilde{\lambda}_m \text{ or } \lambda_2 < \lambda \leq \tilde{\tilde{\lambda}}_m \\ -(\lambda - 1) & \text{if } \tilde{\lambda}_m < \lambda \leq \min\{\lambda_2, \tilde{\tilde{\lambda}}_m\} \\ \beta & \text{if } \lambda > \tilde{\tilde{\lambda}}_m \end{cases}$$

All derivatives are positive or zero except for $\frac{\partial S}{\partial \alpha_s}$, which is negative if $\lambda \leq 1$ and image building is the equilibrium. □

Intuitively, for $\lambda < 1$, the contribution to total quality of selling the high quality product is greater than the contribution of the low quality product. For $\lambda > 1$, however, the quality of the low quality product is high enough such that the participation weighted contribution to total quality outweighs the contribution through the high quality product. Since increases in α_s decrease purchases as well as quality of this product, total quality decreases.

Having established comparative statics on total quality I now discuss how the prevalence of different types of equilibrium is affected by changes in the preference distribution. Figure 4 has illustrated the equilibrium thresholds depending on the fraction of intrinsically motivated consumers for a specific example. The following proposition is more general.

Proposition F4. ***(Equilibrium thresholds)*** *Monopoly offers (i) standard good more often if β increases, (ii) standard good less often if α_s or α_n increases, (iii) image building more often if α_n increases, and (iv) exclusive good less often if α_n increases. The sign of the effects of a change in α_s or β on the relative prevalence of image building and exclusive good is ambiguous.*

If the share of consumers increases who experience utility from quality directly, the undistorted standard good is offered more often. However, if instead the fraction of consumers increases who have a signaling desire and buy a product only for its image, the standard good becomes less attractive to the producer. Simultaneously, distortions in quality provision in form of either image building or the exclusive good become more prevalent.

Proof. Suppose image building does not occur. Then, $\tilde{\lambda}_m = \tilde{\tilde{\lambda}}_m = \lambda_{SE} = \frac{(1-\alpha_s)(1-\alpha_s\beta)}{2\alpha_s(1-\beta)}$ as defined in Equation 12. The derivatives are

$$\frac{\partial\tilde{\lambda}_m}{\partial\beta} = \frac{(1-\alpha_s)^2}{2\alpha_s(1-\beta)^2} > 0, \quad \frac{\partial\tilde{\lambda}_m}{\partial\alpha_s} = -\frac{1-\alpha_s^2\beta}{2\alpha_s^2(1-\beta)} < 0, \quad \frac{\partial\tilde{\lambda}_m}{\partial\alpha_n} = 0$$

Suppose image building does occur, $\tilde{\lambda}_m < \tilde{\tilde{\lambda}}_m$ For $\tilde{\lambda}_m$ and $\tilde{\tilde{\lambda}}_m$ as defined in equations 14 and 18 we find

$$\begin{aligned}
\frac{\partial\tilde{\lambda}_m}{\partial\beta} &= \frac{\alpha_n\left(2\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta-2\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}\right)}{2(1-\alpha_s)^2\beta^2\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}} > 0\\
\frac{\partial\tilde{\lambda}_m}{\partial\alpha_s} &= -\frac{\alpha_n(1-\beta)\left(4\alpha_n(1-\beta)+(1-\alpha_s)^2(3+\alpha_s)\beta-4\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}\right)}{2(1-\alpha_s)^3\beta\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}} < 0\\
\frac{\partial\tilde{\lambda}_m}{\partial\alpha_n} &= -\frac{(1-\beta)\left(2\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta-2\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}\right)}{2(1-\alpha_s)^2\beta\sqrt{\alpha_n(1-\beta)(\alpha_n(1-\beta)+(1-\alpha_s)^2(1+\alpha_s)\beta)}} < 0
\end{aligned}$$

Independent of whether $\tilde{\tilde{\lambda}}_m = \lambda_{\text{IE,low}}$ or $\tilde{\tilde{\lambda}}_m = \lambda_{\text{IE,high}}$, $\tilde{\tilde{\lambda}}_m$ increases in α_n.

$$\frac{\partial\tilde{\tilde{\lambda}}_m}{\partial\alpha_n} = \begin{cases} 2\left(\frac{1}{\beta-\alpha_s\beta} - \frac{1}{1-\alpha_s\beta}\right) & \text{if } \tilde{\tilde{\lambda}}_m = \lambda_{\text{IE,low}} \\ \frac{(1-\alpha_s\beta)(2-\alpha_n(1-\beta)-(1+\alpha_s)\beta)(\alpha_n+(1-\alpha_n-\alpha_s)\beta)}{2(1-\alpha_n)^2(1-\alpha_s)\alpha_s(1-\beta)\beta^2} & \text{if } \tilde{\tilde{\lambda}}_m = \lambda_{\text{IE,high}} \end{cases}$$

and therefore

$$\frac{\partial\tilde{\tilde{\lambda}}_m}{\partial\alpha_n} > 0$$

The signs of the derivatives of $\tilde{\tilde{\lambda}}_m$ with respect to α_s and β are ambiguous. I consider the different formula for $\tilde{\tilde{\lambda}}_m$ one after the other.

Case 1: $\tilde{\tilde{\lambda}} = \lambda_{IE,low}$

$$
\begin{aligned}
\frac{\partial \lambda_{\text{IE,low}}}{\partial \beta} &> 0 \quad \text{if } \frac{\alpha_s \beta^2 - \alpha_s^2 \beta^2}{1 - 2\alpha_s \beta + \alpha_s \beta^2} > \alpha_n \\
\frac{\partial \lambda_{\text{IE,low}}}{\partial \alpha_s} &> 0 \quad \text{if } \alpha_n > \frac{\beta - \alpha_s^2 \beta^2}{1 + \beta - 2\alpha_s \beta}
\end{aligned}
$$

Case 2: $\tilde{\tilde{\lambda}} = \lambda_{IE,high}$

$$
\begin{aligned}
\frac{\partial \lambda_{\text{IE,high}}}{\partial \beta} &= \frac{(\alpha_n + (1-\alpha_n-\alpha_s)\beta)\big((1-\alpha_s)^2\beta^2 + \alpha_n(1-\beta)(2-\beta-\alpha_s\beta)\big)}{2(1-\alpha_n)(1-\alpha_s)\alpha_s(1-\beta)^2\beta^3} \\
\frac{\partial \lambda_{\text{IE,high}}}{\partial \alpha_s} &= -\frac{(\alpha_n + (1-\alpha_n-\alpha_s)\beta)\Big((1-\alpha_s)\beta\big(1-\alpha_s^2\beta\big) + \alpha_n(1-\beta)(1-\alpha_s(2-\alpha_s\beta))\Big)}{2(1-\alpha_n)(1-\alpha_s)^2\alpha_s^2(1-\beta)\beta^2}
\end{aligned}
$$

$$
\frac{\partial \lambda_{\text{IE,high}}}{\partial \beta} > 0
$$

if $\left(\alpha_n < \frac{1-2\alpha_s+\alpha_s^2}{1+\alpha_s} \text{ and } \frac{3\alpha_n+\alpha_n\alpha_s}{2(-1+\alpha_n+2\alpha_s+\alpha_n\alpha_s-\alpha_s^2)} + \frac{1}{2}\sqrt{\frac{8\alpha_n+\alpha_n^2-16\alpha_n\alpha_s-2\alpha_n^2\alpha_s+8\alpha_n\alpha_s^2+\alpha_n^2\alpha_s^2}{(-1+\alpha_n+2\alpha_s+\alpha_n\alpha_s-\alpha_s^2)^2}} < \beta\right)$

or $\left(\alpha_n = \frac{1-2\alpha_s+\alpha_s^2}{1+\alpha_s} \text{ and } \frac{2}{3+\alpha_s} < \beta\right)$

or $\left(\frac{1-2\alpha_s+\alpha_s^2}{1+\alpha_s} < \alpha_n \text{ and } \frac{3\alpha_n+\alpha_n\alpha_s}{2(-1+\alpha_n+2\alpha_s+\alpha_n\alpha_s-\alpha_s^2)} - \frac{1}{2}\sqrt{\frac{8\alpha_n+\alpha_n^2-16\alpha_n\alpha_s-2\alpha_n^2\alpha_s+8\alpha_n\alpha_s^2+\alpha_n^2\alpha_s^2}{(-1+\alpha_n+2\alpha_s+\alpha_n\alpha_s-\alpha_s^2)^2}} < \beta\right)$

$$
\frac{\partial \lambda_{\text{IE,high}}}{\partial \alpha_s} > 0
$$

if $\frac{1}{2} < \alpha_s$ and $\beta < \frac{1-2\alpha_s}{-2\alpha_s+\alpha_s^2}$ and $\frac{\beta-\alpha_s\beta-\alpha_s^2\beta^2+\alpha_s^3\beta^2}{-1+2\alpha_s+\beta-2\alpha_s\beta-\alpha_s^2\beta+\alpha_s^2\beta^2} < \alpha_n$

□

Corollary F4. *Suppose competition yields a functional excuse equilibrium, where consumers who value image and quality buy (s, p). Then, s decreases in β and increases in α_s and α_n. Total provision of quality increases in α_s and α_n and is non-monotone in β.*

Proof. From Proposition 3 we know that in functional excuse

$$
(s, p) = \left(\sqrt{1 + \frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta) + (1-\alpha_s)\beta}}, \frac{1}{2} + \frac{\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta) + (1-\alpha_s)\beta} \right)
$$

if purely image concerned consumers buy $(1, \frac{1}{2})$ with probability one. From this I derive

$$
\begin{aligned}
\frac{\partial s}{\partial \beta} &= \frac{-\frac{2\alpha_n(1-\alpha_n-\alpha_s)(1-\beta)\lambda}{(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2} - \frac{2\alpha_n\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}{2\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}} < 0 \\
\frac{\partial s}{\partial \alpha_s} &= \frac{\alpha_n(1-\beta)\beta\lambda}{(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}} > 0 \\
\frac{\partial s}{\partial \alpha_n} &= \frac{-\frac{2\alpha_n(1-\beta)^2\lambda}{(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2} + \frac{2(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}{2\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}} > 0
\end{aligned}
$$

With the separating products $(1, \frac{1}{2})$ and (s, p) as defined above, total quality provision in functional excuse is computed as

$$
S_{\text{total}} = \alpha_n(1-\beta) + (1-\alpha_s)\beta + \alpha_s\beta\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}
$$

From this I obtain

$$
\begin{aligned}
\frac{\partial S_{\text{total}}}{\partial \beta} &= 1-\alpha_n-\alpha_s+\frac{\alpha_n(-1+\alpha_s)\alpha_s\beta\lambda}{(\alpha_n+\beta-(\alpha_n+\alpha_s)\beta)^2\sqrt{1+\frac{2\alpha_n(-1+\beta)\lambda}{-\alpha_n+(-1+\alpha_n+\alpha_s)\beta}}} \\
&\quad +\alpha_s\sqrt{1+\frac{2\alpha_n(-1+\beta)\lambda}{-\alpha_n+(-1+\alpha_n+\alpha_s)\beta}} \lesseqgtr 0 \\
\frac{\partial S_{\text{total}}}{\partial \alpha_s} &= \frac{\alpha_n\alpha_s(1-\beta)\beta^2\lambda}{(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}} \\
&\quad +\beta\left(\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}-1\right) > 0 \\
\frac{\partial S_{\text{total}}}{\partial \alpha_n} &= 1-\beta+\frac{\alpha_s\beta\left(-\frac{2\alpha_n(1-\beta)^2\lambda}{(\alpha_n(1-\beta)+(1-\alpha_s)\beta)^2}+\frac{2(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}\right)}{2\sqrt{1+\frac{2\alpha_n(1-\beta)\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}}} > 0
\end{aligned}
$$

□

G. Focus on coalition-proof equilibria in a competitive market

In Section 4 in the main text, I have considered equilibria consistent with a refinement analogous to the Intuitive Criterion. Sometimes, equilibria do not survive this refinement even though they are desirable from a welfare-maximizing point of view. To give an alternative picture, in this section, I derive the equilibria which would obtain if I instead let consumers coordinate their actions in the sense that in an equilibrium no group of consumers could do better by deviating collectively to another action.[36]

Proposition G5. *Suppose consumer coordinate before choosing a product. There are $\tilde{\lambda}_c, \tilde{\tilde{\lambda}}_c$ such that for all $\lambda \neq \tilde{\lambda}_c, \tilde{\tilde{\lambda}}_c$, the coalition-proof equilibrium is unique. All products are sold at marginal cost and the equilibrium is*

(i) the standard good if $\lambda < \frac{1}{2}$.

(ii) partial mainstreaming if $\frac{1}{2} < \lambda < \tilde{\lambda}_c$.

(iii) functional excuse if $\tilde{\lambda}_c \leq \lambda \leq \tilde{\tilde{\lambda}}_c$.

(iv) full mainstreaming if $\tilde{\tilde{\lambda}}_c < \lambda$.

For $\lambda = \tilde{\lambda}_c$ ($\lambda = \tilde{\tilde{\lambda}}_c$), the equilibrium is not unique; partial (full) mainstreaming and functional excuse coexist.

Proof. From the proof of Proposition 3 I use the first part to exclude all but one separating equilibrium. In the following, I trade off the remaining separating equilibrium against the (partially) pooling equilibria.

Suppose $\frac{1}{2} < \lambda < \frac{1}{2}\lambda_2$, i.e. type 01 participates with probability $q(\lambda) = (2\lambda - 1)\frac{\beta\alpha_s}{(1-\beta)\alpha_n}$ under pooling (see Equation 19). Then,

$$\begin{aligned}
& U_{11}(1, \frac{1}{2})|_{\text{pool}} > U_{11}(s', p')|_{\text{sep}} \\
\Leftrightarrow\quad & 1 + \lambda\tfrac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n} - \tfrac{1}{2} > \sqrt{1 + 2\lambda\tfrac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n}} + \lambda - \tfrac{1}{2} - \lambda\tfrac{q(1-\beta)\alpha_n}{\beta(1-\alpha_s)+q(1-\beta)\alpha_n} \\
\Leftrightarrow\quad & \lambda < \tilde{\lambda}_c
\end{aligned} \tag{42}$$

and

$$\begin{aligned}
\tilde{\lambda}_c = & \tfrac{3((1-\alpha_s)\beta)^2+5((1-\alpha_s)\beta)(\alpha_n(1-\beta))+2(\alpha_n(1-\beta))^2}{2((1-\alpha_s)\beta)^2} \\
& - \sqrt{\tfrac{((1-\alpha_s)\beta)^4+5((1-\alpha_s)\beta)^3(\alpha_n(1-\beta))+8((1-\alpha_s)\beta)^2(\alpha_n(1-\beta))^2+5(1-\alpha_s)\beta(\alpha_n(1-\beta))^3+(\alpha_n(1-\beta))^4}{((1-\alpha_s)\beta)^4}}
\end{aligned} \tag{43}$$

It is verified that $\frac{1}{2} < \tilde{\lambda}_c < \frac{1}{2}\lambda_2$.

[36] These equilibria are coalition-proof. See e.g. Bernheim et al. (1987).

Suppose now that $\frac{1}{2}\lambda_2 < \lambda$, i.e. type 01 fully participates in pooling.

$$
\begin{aligned}
& U_{11}(1,\frac{1}{2})|_{\text{pool}} > U_{11}(s',p')|_{\text{sep}} \\
\Leftrightarrow \quad & 1+\lambda\tfrac{\beta(1-\alpha_s)}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}-\tfrac{1}{2} > \sqrt{1+2\lambda\tfrac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n}}+\lambda-\tfrac{1}{2}-\lambda\tfrac{(1-\beta)\alpha_n}{\beta(1-\alpha_s)+(1-\beta)\alpha_n} \\
(44)\Leftrightarrow \quad & \lambda > \tilde{\tilde{\lambda}}_c
\end{aligned}
$$

and

$$
\begin{aligned}
(45)\quad \tilde{\tilde{\lambda}}_c = \quad & \max\{\tfrac{1}{2}\lambda_2, \tfrac{2(\alpha_s\beta)((1-\alpha_s)\beta))^2+2((1-\alpha_s)\beta))^3+4(\alpha_s\beta)((1-\alpha_s)\beta))(\alpha_n(1-\beta))}{(\alpha_s\beta)^2(\alpha_n(1-\beta))} \\
& +\tfrac{6((1-\alpha_s)\beta))^2(\alpha_n(1-\beta))+2(\alpha_s\beta)(\alpha_n(1-\beta))^2+6((1-\alpha_s)\beta))(\alpha_n(1-\beta))^2+2(\alpha_n(1-\beta))^3}{(\alpha_s\beta)^2(\alpha_n(1-\beta))}\}
\end{aligned}
$$

The threshold $\tilde{\tilde{\lambda}}_c$ is given by $\frac{1}{2}\lambda_2$ when the fraction of intrinsically motivated consumers who value image α_s is large, namely if

$$
\alpha_s \quad > \quad -\tfrac{2\left(\alpha_n^2+3\alpha_n\beta-2\alpha_n^2\beta+2\beta^2-3\alpha_n\beta^2+\alpha_n^2\beta^2\right)}{\beta(-3\alpha_n-4\beta+3\alpha_n\beta)}-2\sqrt{-\tfrac{\alpha_n(-1+\beta)(\beta+\alpha_n(1-\beta))^3}{(3\alpha_n(-1+\beta)-4\beta)^2\beta^2}}
$$

Using the definitions from (43) and (45), Inequalities 42 and 44 are reversed for $\lambda < \tilde{\lambda}_c$ and $\lambda > \tilde{\tilde{\lambda}}_c$. In this case, only the pooling equilibrium survives. At the thresholds, type 11 is indifferent between the two types of equilibrium, so that none of the two can be eliminated. □

If the intensity of image motivation is small the equilibrium resembles the monopolistic **standard good** case: the efficient quality level $s = 1$ is sold to all consumers who care about quality. Those who do not value quality pick the outside option. This can be thought of as a conventional good without any quality component. If the value of image increases, purely image-concerned consumers are attracted by the same product and separation is not yet worthwhile. In **partial mainstreaming** only the efficient quality level $s = 1$ is sold. Unconcerned consumers do not buy. Also, consumers who only value image randomize with non-participation since otherwise the image would deteriorate so much as to make purchase unattractive. The participation probability of the image-concerned type is $q_{pool} = (2\lambda-1)\frac{(\alpha_s\beta)+((1-\alpha_s)\beta))}{(\alpha_n(1-\beta))}$.

If image motivation becomes even more intense, also under competition product differentiation within the quality segment occurs. Consumers who value both quality and image are willing to buy overly high quality since utility is realized from both image and quality; they use a **functional excuse** to separate from other consumers and obtain higher image. Product differentiation now features an upward distortion in quality: The lower quality product has the efficient quality level $s = 1$ and is bought by consumer who value either image or quality.[37] The high quality is chosen such that the product is not attractive for the purely image-concerned consumers due to its high marginal cost.[38] Recall from Proposition 2 that a monopolist in contrast achieves differentiation by depressing quality for the lower quality product leading to lower average quality. If the intensity of image motivation becomes very large, however, the upward distortion in quality becomes too expensive. In **full mainstreaming** only the efficient quality level $s = 1$ is sold and only unconcerned consumers do not buy. The mainstreaming of the efficient quality resembles the mass market described under monopoly. It differs in so far as the product is priced at marginal cost here, whereas the monopoly charges the monopoly price.

At the two thresholds, both types of equilibria coexist. They differ only in the purchasing choice of consumers who value both quality and image. Even though these are indifferent between the two equilibria at the two thresholds, in equilibrium no mixing can occur. Suppose we start from the pooling equilibrium and a positive mass of consumers who value both quality and image switches to product (s', p'). The image of the pooling product deteriorates such that it becomes strictly optimal for all other consumer of the same type to buy (s', p') too. The separating equilibrium is not sensitive to such deviations and, therefore, is in this sense more stable than the pooling equilibrium.

H. Welfare without image in monopoly

Suppose we consider the concern for image a behavioral bias and are interested in welfare without utility from image.

Using the menus for the different equilibrium candidates as derived in Section A, I compute welfare without utility from image as

[37] The participation probability of purely image-concerned types is 0 for $\lambda < \frac{1}{2}$, $q_{sep}(\lambda) = (2\lambda - 1)\frac{((1-\alpha_s)\beta))}{(\alpha_n(1-\beta))}$ for $\frac{1}{2} \leq \lambda < \frac{1}{2}\frac{(1-\alpha_s)\beta+\alpha_n(1-\beta)}{((1-\alpha_s)\beta))}$, and 1 otherwise.

[38] Note that this result is driven buy the additivity of utility from image and quality. The convex cost of quality production exceeds the value of quality for every quality level above the efficient one and only consumers who in addition realize image utility are willing to pay the price.

$$
(46) \qquad W^S = \begin{cases} \frac{1}{2}\beta & \text{if } \lambda \leq 1 \\ \beta\left(\lambda - \frac{\lambda^2}{2}\right) & \text{if } 1 < \lambda \leq 2 \\ \text{n.a.} & \text{if } \lambda > 2 \end{cases}
$$

$$
(47) \qquad W^M = \begin{cases} -\frac{\alpha_n(1-\beta)\beta^2\lambda^2}{2(\alpha_n(1-\beta)+(1-\alpha_s)\beta+\alpha_s\beta)^2} + \frac{\beta^2\lambda}{\alpha_n(1-\beta)+(1-\alpha_s)\beta+\alpha_s\beta} & \\ \quad -\frac{\beta^3\lambda^2}{2(\alpha_n(1-\beta)+(1-\alpha_s)\beta+\alpha_s\beta)^2} & \text{if } \lambda \leq \lambda_1 \\ -\frac{1}{2}\alpha_n(1-\beta) + \frac{1}{2}\beta & \text{if } \lambda > \lambda_1 \end{cases}
$$

$$
(48) \qquad W^I = \begin{cases} \frac{\alpha_s\beta}{2} + \frac{(1-\alpha_s)^2\beta^2}{\alpha_n(1-\beta)+(1-\alpha_s)\beta}(\lambda - \frac{1}{2}\lambda^2) & \text{if } \lambda \leq \lambda_2 \\ -\frac{1}{2}\alpha_n(1-\beta) + \frac{\beta}{2} & \text{if } \lambda > \lambda_2 \end{cases}
$$

$$
(49) \qquad W^E = \frac{\alpha_s\beta}{2}
$$

By construction of the menus it is clear that the mass market cannot give higher welfare when I exclude image utility than does the image building menu. Thus, I can concentrate on the remaining three equilibrium candidates.

It is also easily seen, that for $\lambda \leq 1$, standard good gives higher welfare than image building and than exclusive good.

Consider now $1 < \lambda \leq \lambda_2$. Using the welfare formula from equations 46, 47, 48, and 49 I find

$$
W^I > W^S \Leftrightarrow \lambda > 1 + \sqrt{\frac{\alpha_n(1-\alpha_s)(1-\beta)}{\alpha_n(1-\beta)+\alpha_s\beta(1-\alpha_s)}}
$$
$$
W^E > W^I \Leftrightarrow \beta < \frac{\alpha_n}{1+\alpha_n-\alpha_s} \text{ and } \lambda > 2
$$

For $\lambda > \lambda_2$, I find

$$
W^I > W^S \Leftrightarrow \beta \leq \frac{\alpha_n}{1+\alpha_n-2\alpha_s+\alpha_s^2} \text{ or } \lambda > 1 + \sqrt{\frac{\alpha_n(1-\beta)}{\beta}}
$$
$$
W^E > W^I \Leftrightarrow \beta < \frac{\alpha_n}{1+\alpha_n-\alpha_s}
$$

From these derivations I conclude that even if I exclude image utility from welfare, the main result remains similar. For low value of image, standard good is optimal, for intermediate values of image welfare is maximized by an image building menu, and exclusive good maximizes welfare only if the fraction of intrinsically motivated consumers is small enough and image is at least twice as valuable as quality ($\lambda \geq 2$).

Note that even though I exclude image utility from welfare here, it does still influence the results. In particular, to enforce the standard good allocation, the monopolist has to produce inefficiently high quality. Therefore, there are parameters such that selling to purely image-concerned consumers in the image-building menu is better in terms of welfare than trying to exclude them.

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