Taxes and the Division of Social Status

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July 20, 2023

Abstract

This paper presents a novel perspective on the taxation of conspicuous consumption, highlighting its potential to achieve a more equitable distribution of welfare by compressing the status distribution. By curbing the conspicuous consumption of the affluent, the government reduces the informativeness of status signaling, leading to an increased share of the social status surplus for the less wealthy. This "status channel" serves as a complement to traditional monetary channels of redistribution. The findings emphasize the importance of incorporating the status dimension in policy design and shed new light on the benefits of taxing conspicuous consumption in pursuit of societal equity.

Keywords: optimal taxation, signaling, status, redistribution

JEL classification: H21, D63, D82

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1 Introduction

Consumers frequently allocate their expenditures towards visible goods in order to signal their affluence and social standing. This notion has a longstanding history within the realm of social sciences, dating back to ancient times. Plato, for instance, eloquently expressed this idea in The Republic, stating, "Since then, as philosophers prove, appearance tyrannizes over truth and is lord of happiness, to appearance I must devote myself" (Plato, Rep. 3.414b [Jowett 1888]). Adam Smith, in his seminal work from 1776, also acknowledged this concept and provided an illustration of how consumption norms are influenced by social expectations.[1]

The term "conspicuous consumption" was coined by Veblen (1899) to describe the extravagant expenditure on visible goods that serve as status symbols. Hirsch (1976) further introduced the concept of "positional goods," referring to goods valued for their relative rather than absolute properties. Building upon these foundational insights, the recent economic literature has developed the theory of conspicuous consumption. Notably, Frank (1997, 2005) emphasized the significance of positional goods and the welfare costs incurred due to the negative externalities they generate. Bagwell and Bernheim (1996) and Hopkins and Kornienko (2004) made influential contributions to the analysis of signaling games involving conspicuous consumption. Other studies have delved into the determinants, effects, and ramifications of conspicuous consumption within various economic domains, including income inequality, social welfare, taxation, saving behavior, and environmental sustainability.

Empirical studies have provided compelling evidence regarding the significance

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[1]Smith remarked that "in the present times, through the greater part of Europe, a creditable day-laborer would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful degree of poverty which, it is presumed, nobody can well fall into without extreme bad conduct. Custom, in the same manner, has rendered leather shoes a necessary of life in England. The poorest creditable person of either sex would be ashamed to appear in public without them" (Smith 1776, 5.2.148).

of consumption visibility and its impact on consumer behavior. Heffetz (2011), utilizing survey data from the United States, constructed a visibility index for various consumption categories and discovered that it could account for as much as one-third of the variation in income elasticities across these categories. Furthermore, experimental findings bolster the role of visibility in signaling social status. For instance, Bursztyn et al. (2017) demonstrated that consumers in Indonesia displayed a willingness to pay a premium for Platinum credit cards that were more visibly prestigious compared to Gold cards. Butera et al. (2022) revealed that donors to the Red Cross exhibited a positive and widespread desire for public recognition of their contributions, indicating a demand for acknowledgment.[2]

Given the prevalence and importance of conspicuous consumption in modern societies, a natural question is how to design optimal consumption taxes that take into account the status motives of consumers. Most of the existing literature has focused on corrective (Pigouvian) taxes that can internalize the positional externalities generated by conspicuous consumption. The literature has also shown that such taxes can improve equity, as they are progressive (since status goods are mainly consumed by the wealthy) and can fund transfers to the poor.[3] However, a novel aspect that has been overlooked by the literature is that taxes on conspicuous consumption affect the information transmission among consumers, and, ultimately, the allocation of a potentially large social status surplus.

To further illustrate the point, consider the scenario of implementing mandatory uniform dress codes in schools. In the absence of regulation, affluent students may engage in conspicuous consumption by donning expensive brand-name apparel,

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[2]Notably, if charitable acts are driven by status concerns rather than altruism, they can be perceived as a form of conspicuous consumption serving signaling purposes, as argued by Glazer and Konrad (1996).

[3]Some papers that address the policy implications of conspicuous consumption are Ng (1987), Corneo and Jeanne (1997), Ireland (2001), Bilancini and Boncinelli (2012), Truyts (2012), and Friedrichsen et al. (2020).

using it as a means to signal their elevated social status, at the expense of their less affluent peers in a zero-sum status competition. To address this issue, regulations can be introduced to enforce a uniform dress code, which would result in an equitable distribution of social status within a pooling equilibrium. Alternatively, the government could offer students the choice to opt out of the dress code by paying a fee. The tax revenues generated from this fee, under the resulting separating equilibrium, while maintaining an inequitable distribution of social status, can nonetheless be utilized to provide additional tutoring or school materials that benefit all students. Under this policy framework, wealthy students would still have the option to differentiate themselves, albeit to a lesser extent than in the laissez-faire regime, while the proposed fee/compensation scheme could potentially enhance the welfare of less affluent students.

Another example of a status contest is the choice of cars by consumers. Without regulation, wealthy consumers may buy expensive and luxurious cars to signal their high income and gain enhanced social status at the expense of less wealthy consumers. Regulation can address this issue by imposing a uniform car standard, which leads to an equal allocation of social status in a pooling equilibrium. For example, in East Germany, the car market was dominated by two models, the Trabant and the Wartburg, which were produced by state-owned enterprises. Alternatively, the government can allow consumers to buy more expensive cars by paying a luxury tax. The tax revenues can fund public goods or transfers for the benefit of all consumers. Under this policy regime, wealthy consumers would still choose to buy more expensive cars, but less so than in the laissez-faire regime, and the welfare of less wealthy consumers could be improved through the proposed tax/transfer scheme.

In both of the aforementioned examples, the suggested tax/transfer schemes

serve a dual purpose: they mitigate the income disparity between the affluent and less affluent individuals, while simultaneously reducing the status disparity by diminishing the informativeness of signaling. As a result, a novel channel of status redistribution emerges, which complements the conventional monetary redistribution channel. By implementing these policies, the government not only addresses the economic imbalance but also curtails the effectiveness of conspicuous consumption as a means of signaling social status. This approach allows for a more comprehensive redistribution of both wealth and status, ultimately contributing to a more equitable society.

This paper develops a simple framework to analyze the role of commodity taxation in pursuing re-distributive goals, trading-off between the two aforementioned monetary and status channels of re-distribution. We view conspicuous consumption as a rent-seeking activity that aims to extract a higher fraction of the social surplus from status. The effectiveness of status signaling, and thus the likelihood of being recognized as high-status, hinges on the diversity of conspicuous goods consumed. We employ an extension of Spence's (1973) classic signaling game, which allows for noisy signals. The game structure implies that, under a separating equilibrium, the consumption signals are not fully informative due to their limited visibility. Commodity taxation reduces the diversity of goods consumed by the rich, making status signals less reliable. This, in turn, enhances the relative status of the poor, who obtain a larger fraction of the social surplus from status. However, this novel mechanism of redistribution through status must be balanced against traditional mechanisms of redistribution through the income channel.

We address the challenge of formulating an optimal government policy aimed at redistributing welfare through a combination of monetary and status-based mechanisms. We explore a range of potential strategies, spanning from exclusively relying

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on monetary redistribution by utilizing conspicuous consumption as a taxable base, to entirely suppressing the signaling of social status, thereby forgoing any tax revenue derived from conspicuous consumption. Our main contribution lies in recognizing the status channel and that the evaluation of a high marginal tax's equity benefits should extend beyond its revenue-generating capacity alone. Drawing parallels to the impact of high marginal income tax rates, which can have favorable pre-distributive effects (Bozio et al. 2020), we demonstrate that imposing increased commodity tax rates can facilitate a more equitable distribution of welfare, even when their contribution to government revenue is relatively modest.

The rest of the paper proceeds as follows. Section 2 introduces the main elements of our model and section 3 describes the two-stage signaling game (between the government and private agents). Finally, section 4 offers a concluding discussion.

2 Model

In the considered economy, there are two types of agents denoted by $j = 1, 2$, characterized by their differing wealth endowments. The wealthy type is represented by the endowment w^2, while the poor type possesses an endowment of w^1, where $w^2 > w^1 > 0$. The population size of each type is normalized to one for simplicity. It is important to note that the individual wealth endowments remain private information, undisclosed to both the government and other agents.

Each agent allocates their endowment across $n + 1$ consumption goods. The numeraire good, denoted by y, generates intrinsic utility from consumption and remains unobserved by both the government and other agents. Additionally, there are n binary signaling goods, denoted by x_i with $i = 1, \ldots, n$, which are utilized for status-signaling purposes. These signaling goods have a binary nature, meaning an

agent can choose to either consume or not consume each signaling good ($x_i \in {0, 1}$).

The utility of an agent of type j is given by the following expression:

$$U^j(y^j, x_1^1, \ldots, x_n^1, x_1^2, \ldots, x_n^2) = y^j + \mathbf{P}[\tilde{w}^j = w^2 | x_1^1, \ldots, x_n^1, x_1^2, \ldots, x_n^2] \cdot B. \quad (1)$$

The utility of an agent consists of two main factors. The first factor accounts for the inherent satisfaction obtained from consuming the numeraire good, denoted by y. The second factor captures the utility derived from social status, which is determined by two components. The first component, $\mathbf{P}$, represents the conditional probability that an agent of type j is perceived as having a high wealth endowment, given the consumption choices of both types of individuals. The perceived wealth endowment is denoted by $\tilde{w}^j$. The second component, $B > 0$, represents the additional satisfaction derived from social status associated with being perceived as a wealthy type.

The vector x_i^j represents the consumption choices made by agents of type $j = 1, 2$ with respect to the pure signaling goods x_i ($i = 1, \ldots, n$). It is important to note that these signaling goods are considered "pure" because neither type derives direct utility from consuming them. Our assumption simplifies the analysis for tractability, but the qualitative features of the analysis would remain unchanged even if intrinsic utility was derived from these signaling goods, as long as wasteful signaling is measured relative to a nonzero reference level (which may differ across types).

The formulation of the utility function in equation (1) is chosen to focus specifically on pure strategies when analyzing the perfect Bayesian equilibrium of the signaling game. It assumes that all agents of the same type will select the same consumption bundle along the equilibrium path. The formation of perceptions occurs through Bayesian updating, conditioned on the vector x chosen by both types on this path.

It is important to note that in our context, a low level of utility experienced by poor agents is not solely a result of being deprived and consuming a smaller quantity

of the numeraire good. It is also influenced by the status channel, specifically by being perceived as poor. Consequently, type-1 agents with lower wealth endowments have an incentive to imitate their wealthier counterparts, behaving as if they were type-2 agents. This, in turn, prompts wealthy type-2 agents to credibly signal their larger endowments by allocating their resources towards conspicuous consumption, which does not provide them with intrinsic utility.

The budget constraints faced by the two types of agents are given by equation (2):

$$y^j + \sum_{i=1}^{n} p_i^j \cdot x_i^j = w^j, \quad j = 1, 2, \tag{2}$$

where p_i^j represents the price paid by type $j = 1, 2$ when purchasing a unit of good $i = 1, \ldots, n$. Specifically, we assume that $p_i^2 = \theta/n$ and $p_i^1 = 1/n$, where $0 < \theta < 1$.

The fact that the per-unit prices incurred by type 2 are lower than those incurred by type 1 can be interpreted in several ways. First, it aligns with the canonical signaling model of Spence (1973), where the cost of acquiring the signal may be lower for type 2. Second, the lower costs incurred by type 2 can reflect, in simplified form, the diminishing marginal utility from the consumption of the numeraire good y, assumed to be constant for tractability. This implies that the effective prices of x decrease with respect to the wealth endowment. Third, the lower costs incurred by type 2 may reflect heterogeneity in preferences, where type 2 derives either direct utility or higher direct utility from the consumption of x. In this case, the effective price incurred by type 2 would be lower than that incurred by type 1.

To illustrate this, consider the scenario where $n = 1$ (and let $x_1^j \equiv x^j$ for simplicity). If the utility derived by type 2 is given by $u^2(y^2, x^1, x^2) = y^2 + \frac{1}{n}(1 - \theta)x^2 + \mathbf{P}[\tilde{w}^2 = w^2 | x^1, x^2] \cdot B$, assuming both types incur the same prices per unit of x (given by $1/n$) implies that the budget constraint faced by type 2 is $w^2 = y^2 + \frac{1}{n}x^2$. By substituting y^2 from the budget constraint into the utility function, we obtain an expression identical

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to the utility function in equation (1).

We now delve into the role of visibility within the status-generation process, drawing from the literature on noisy signaling (e.g., Matthews and Mirman 1983).[4] We plausibly assume that engaging in conspicuous consumption is not perfectly observed by the target population, introducing an element of noise in the signaling mechanism. This characteristic is fundamental to our model and will have significant implications for the subsequent policy analysis.

In particular, within a separating equilibrium framework, each individual faces a trade-off between allocating more resources towards the numeraire good, y, or investing more in signaling activities. The latter enhances the probability of being perceived as a high type, leading to a higher expected level of social status. This trade-off arises due to the imperfect observability of signals. With perfectly observed signals, no such trade-off would exist under a fully revealing separating equilibrium.

This trade-off provides the government with an opportunity to redistribute resources through the status channel. By controlling the level of noise, which is endogenously determined within the equilibrium, the government can influence the signaling process and thereby engage in redistribution through the status channel. This complements the traditional income channel of redistribution, allowing for a multi-faceted approach to achieving desired distributional outcomes.

For the sake of tractability, we adopt a relatively simple structure for the stochastic process that determines the level of noise in our model. However, it is important to note that the qualitative findings of our analysis remain robust to alternative specifications of the stochastic process.

Specifically, we assume that from a point of view of an observer, the visibility of

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[4]The paper by Matthews and Mirman (1983) is widely regarded as a seminal work in the literature on noisy signals. It introduced the concept of noisy signals in the context of a classical model of limit pricing. More recently, de Haan et al. (2011) conducted theoretical analysis and provided experimental evidence on the behavioral implications of different levels of noise in signaling games.

each signaling good x_i ($i = 1, \ldots, n$) purchased by an agent that engages in signaling is determined by a binary random variable denoted as z. The random variable z takes the value of 1 ("visible") with a probability of $0 < q/n < 1$, and the value of 0 ("non-visible") with the complementary probability of $0 < 1 - q/n < 1$. The realization of z is assumed to be independent across different signaling goods. It is worth noting that we invoke symmetry across goods for simplicity in our analysis. However, we discuss a generalization allowing for asymmetry across goods in the Online Appendix B.

A straightforward interpretation of the stochastic process generating the noise draws on the literature of informative advertising, following the seminal studies of Butters (1977) and Grossman and Shapiro (1984). According to this approach, the consumption of each signaling good by an individual is seen as an advertisement that is sent to the target population and received with some probability. Suppose for instance that over a period of time (say a year) there are n social events. The number of individuals attending a single social event is given by $q/n \cdot B$ in the target population of size B. That is, a fraction q/n of the target population is exposed to any single event. Suppose that the target population is randomly assigned across events, and further suppose that the probability that any individual in the target population is attending a given event, q/n, is independent of the probability of attending another one. Now consider an individual who is engaging in signaling by renting a luxury car for the event he is attending. By showing up with a luxury car one exposes himself as a wealthy individual. The individual may choose to rent a car for a subset of the events (possibly none or all as special cases). Willing to 'impress' as many individuals as possible from the target population, the independence property implies that different individuals would attend different events, hence there is an incentive to rent the car for many events so as enhance the exposure. Assuming

that the signaling agent is renting a car and attending m events (not for the intrinsic benefit of attending the event but for a signaling motive), the probability of being perceived as a wealthy type is increasing with the likelihood of exposure, namely the likelihood that an individual of the target population will attend at least one of these events. The likelihood of exposure is increasing in the number of events attended by the signaling agent.

The benefit from social status can be simply captured by the perception of the observer, namely the probability that the signaling agent is perceived to be the wealthy type by the observer. If the observer is exposed, he believes with probability 1 that the agent is rich. Otherwise, if the observer is not exposed, he assigns a 1/2 probability based on the prior distribution of types in the population. The gain from status associated with this observer hence is given by applying the Law of Total Probability, accounting for the likelihood of exposure. Aggregating over the entire target population (of observers) yields the total benefit from social status.

3 The two-stage game

We analyze a two-stage game. In the first stage, the government imposes a uniform ad-valorem tax, denoted as $t \geq 0$, on all signaling goods. This tax affects the after-tax prices of each signaling good for types $j = 1, 2$. Specifically, the after-tax prices faced by types 1 and 2 are given by $p^1 = (1 + t) \cdot \frac{1}{n}$ and $p^2 = (1 + t) \cdot \frac{\theta}{n}$, respectively, with $p^1 > p^2$. The tax revenues generated are utilized to finance a universal lump-sum transfer denoted as T.

In the second stage, given the tax instruments implemented by the government, a signaling game unfolds. Each agent, based on their wealth endowment, decides how to allocate their resources among the consumption goods.

The tax instruments (t and T) set by the government in the first stage are chosen so as to maximize social welfare, subject to a balanced revenue constraint and taking into account the optimal choices of the consumers in the second stage of the game.

We will next proceed to analyze the second stage and then follow by solving the government constrained maximization program.

3.1   Stage II: The signaling game

Consider a separating equilibrium in which type 2 agents allocate their spending between the numeraire good, y, and a range of signaling goods ($0 \leq m \leq n$), whereas type 1 agents spend their entire wealth endowment solely on the numeraire good.[5]

Formally, the separating equilibrium can be characterized as the solution to the following constrained maximization program:

$$\max_{0 \leq m \leq n} w^2 - \theta \cdot (1+t) \cdot \frac{m}{n} + T + \left\{ \left[1 - (1 - \frac{q}{n})^m \right] + \frac{1}{2} \cdot (1 - \frac{q}{n})^m \right\} \cdot B \qquad (3)$$

subject to

$$w^1 - (1+t) \cdot \frac{m}{n} + T + \left\{ \left[1 - (1 - \frac{q}{n})^m \right] + \frac{1}{2} \cdot (1 - \frac{q}{n})^m \right\} \cdot B \leq w^1 + T + \frac{1}{2} \cdot (1 - \frac{q}{n})^m \cdot B.$$

$$(4)$$

It is important to note that in cases where none of the signals are observed, which occurs with a probability of $(1 - \frac{q}{n})^m$ based on the stochastic process outlined earlier, the social status surplus is evenly distributed between the two types, as per the prior symmetric distribution. However, in situations where at least one signal is observed, which occurs with a probability of $1 - (1 - \frac{q}{n})^m$, a Bayesian update leads to

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[5]In situations outside the equilibrium, where agents' beliefs cannot be formed based on Bayesian updating, it is assumed that an agent is perceived to be a low type with a probability of 1. In other words, when agents do not adhere to the equilibrium strategies and their behavior deviates from the expected pattern, they are assumed to be perceived as low types by default.

a posterior distribution that supports full separation. Consequently, the entire social status surplus is obtained by the high-type agents.

However, due to the presence of noisy signaling and partial observability, the low-type agents gain from 'the benefit of the doubt' and are able to derive a positive fraction of the surplus under the separating equilibrium. Furthermore, this 'benefit of the doubt' derived by the low-type agents diminishes as the intensity of signaling chosen by the high-type agents, m, increases.

These two qualitative features of the model are generic and do not hinge on the specific stochastic process invoked, which generates the noise.

The constraint (4) captures a standard incentive constraint known as the no-mimicking constraint. This constraint may or may not be binding in the optimal solution and states that the low-type agents weakly prefer to refrain from spending on the signaling goods.

Let $\alpha \equiv \frac{m}{n}$ denote the fraction of signaling goods on which the high types allocate their spending. Additionally, assume that both m and n are large. In this case, we can use the fact that $e = \lim_{h \to \infty} \left(1 + \frac{1}{h}\right)^h$ to reformulate the constrained maximization problem in (3) - (4) as follows:

Problem $\mathcal{P}1$

$$\max_{0 \leq \alpha \leq 1} V(\alpha) \equiv w^2 - \theta \cdot (1+t) \cdot \alpha + T + \left(1 - \frac{1}{2} \cdot e^{-q\alpha}\right) \cdot B \tag{5}$$

subject to

$$(IC) \quad (1 - e^{-q\alpha}) \cdot B \leq (1+t) \cdot \alpha. \tag{6}$$

Before delving into the formal analysis of the constrained maximization program in $\mathcal{P}1$, it is essential to highlight two important observations.

Firstly, it should be noted that the reformulated constrained maximization prob-

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lem in (5) - (6) implicitly interchanges the 'max' and 'limit' operators. In other words, it maximizes the limiting expression rather than taking the limit of the maximized expression. These procedures are equivalent if and only if the convergence of the limiting expression is uniform, rather than point-wise. In our analysis, we assume that α is chosen from a fixed finite partition of the unit interval $[0, 1]$. Under this assumption uniform convergence is guaranteed. However, as we can set the finite grid to be arbitrarily fine, we adopt the continuum approximation for the subsequent analysis.

Secondly, within $\mathcal{P}1$, we implicitly assume that type-1 agents have two choices: either refraining from spending on the signaling goods or mimicking the spending behavior of type-2 agents by choosing the same α. In principle, type-1 agents could opt to spend on a smaller subset of the signaling goods ($0 < \tilde{\alpha} < \alpha$). However, it can be shown that the constrained maximization program solved by type-1 agents, which involves maximizing their expected utility by choosing $\tilde{\alpha} \in [0, \alpha]$, given the separating equilibrium strategies outlined earlier, is strictly convex. As a result, we can focus on the two corner solutions: $\tilde{\alpha} = 0$ and $\tilde{\alpha} = \alpha$.[6] The incentive compatibility constraint (6) is hence well-defined. The formal details are provided in Online Appendix A.1.

Before proceeding to the analysis, we add some more structure to the model by invoking Assumption 1 that presents a set of parametric conditions which imply that in the laissez-faire ($t = 0$), the IC constraint is binding and the optimum is attained by an interior solution ($0 < \alpha < 1$).

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[6]It is worth noting that spending on a larger subset, $\alpha' > \alpha$, would be sub-optimal by virtue of our assumption regarding off-equilibrium beliefs (see footnote 5) and as the cost of acquiring the signal is higher for the low type.

Assumption 1.

$$e^{-q} < \frac{2\theta}{qB} < 1, \tag{7}$$

$$\ln qB - \ln 2\theta < qB - 2\theta, \tag{8}$$

$$(1 - e^{-q})B < 1. \tag{9}$$

The solution to problem $\mathcal{P}1$ is characterized by the following Proposition.

Proposition 1. *For $\theta < 1/2$, there exists a positive threshold value, denoted as t^*, such that the optimal solution to $\mathcal{P}1$ can be characterized as follows:*

$$\alpha(t) = \begin{cases} \alpha_2(t), & 0 \leq t < t^* \\ \frac{1}{q} \ln \frac{qB}{2\theta(1+t)}, & t^* \leq t < \frac{qB}{2\theta} - 1 \\ 0, & t \geq \frac{qB}{2\theta} - 1, \end{cases}$$

where $\alpha_2(t)$ is the strictly positive interior solution to the binding incentive compatibility constraint (6), and $\frac{1}{q} \ln \frac{qB}{2\theta(1+t)}$ represents the optimal solution to the unconstrained maximization of (5). Conversely, for $\theta \geq 1/2$, we have $\alpha(t) = 0$ for all $t \geq 0$.

Proof See Online Appendix A.2. □

Proposition 1 highlights that status signaling serves two purposes for type-2 agents. First, by increasing the number of status goods purchased, they can increase their expected utility from status. This property holds for sufficiently high tax rates where the incentive compatibility constraint is not binding, and the threat of mimicking by type-1 agents is not a concern. In this case, the choice of α achieves the optimal trade-off between status and non-status goods, given the noisy signaling environment. This is a non-standard property driven by the presence of noisy signaling.

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Second, spending on signaling goods serves to deter mimicking by low types and enables high types to distinguish themselves from their less wealthy counterparts. This property holds for sufficiently low tax rates where the incentive compatibility constraint is binding. By spending on signaling goods, high types can effectively separate themselves from low types and maintain their higher perceived social status.

Based on the characterization of the optimal solution to problem $\mathcal{P}1$, it can be observed that $\frac{d\alpha}{dt} \equiv \alpha'(t) < 0$ for all $t < \frac{qB}{2\theta} - 1$.[7] This means that as the tax rates on the signaling goods increase, type 2 individuals choose to spend their income on a smaller subset of the signaling goods, reducing the intensity of signaling.

We turn next to analyze the first stage of the game in which the government is setting its tax instruments. To render our analysis non-trivial, we will focus on the case where $\theta < 1/2$.

3.2 Stage I: Government problem

We now formulate the government program and characterize the optimal redistributive policy. The (binding) revenue constraint is formulated as follows:

$$\theta \cdot \alpha(t) \cdot t = 2T, \tag{10}$$

where $\alpha(t)$ denotes the optimal fraction of signaling goods on which type-2 spends in equilibrium, and is characterized by Proposition 1.

In a separating equilibrium, where type-1 agents refrain from engaging in signaling and spend their entire wealth endowment on the numeraire good y, their

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[7]See online appendix A.2. For the case where (IC) is slack, this follows immediately from (A8). When (IC) binds, it follows from Figure 4. Notice that we are focusing on the interior solution. Hence, when the red curve shifts upwards, the intersection point shifts to the left.

equilibrium utility is given by:

$$u^1 = w^1 + T + \frac{1}{2} \cdot e^{-q\alpha(t)} \cdot B = w^1 + \frac{1}{2} \cdot \theta \cdot \alpha(t) \cdot t + \frac{1}{2} \cdot e^{-q\alpha(t)} \cdot B. \qquad (11)$$

The second equality follows by substituting the expression for T from the revenue constraint in equation (10). We consider an egalitarian government that aims to maximize the well-being of type-1 agents. The social welfare measure is given by:

$$W = \delta \cdot \left[w^1 + \frac{1}{2} \cdot \theta \cdot \alpha(t) \cdot t \right] + (1 - \delta) \cdot \left[\frac{1}{2} \cdot e^{-q\alpha(t)} \cdot B \right]. \qquad (12)$$

The weight $\delta \in [0.5, 1]$ represents the importance assigned to consumption of the numeraire good, while $(1 - \delta)$ represents the weight assigned to social status.[8] By differentiating equation (12) with respect to t, we obtain the first-order condition (FOC) for the government maximization program.

$$\frac{\delta}{2} \left[\alpha(t) + t\alpha'(t) \right] \theta - \frac{1 - \delta}{2} qB\alpha'(t)e^{-q\alpha(t)} = 0, \qquad (13)$$

or equivalently,

$$\delta\theta \left(t + \frac{\alpha(t)}{\alpha'(t)} \right) - (1 - \delta) qBe^{-q\alpha(t)} = 0. \qquad (14)$$

By denoting η as the elasticity of α with respect to the after-tax price $(1 + t)$, defined as $\eta \equiv \frac{\alpha'(t) \cdot (1+t)}{\alpha(t)}$, equation (14) can be restated as follows:

$$\frac{t}{1 + t} = \frac{1 - \delta}{\delta\theta} \frac{qBe^{-q\alpha(t)}}{1 + t} + \frac{1}{|\eta|}. \qquad (15)$$

Equation (15) reveals that, except in the limiting case when $\delta = 1$, the optimal tax rate surpasses the Laffer rate $t/(1 + t) = |\eta|^{-1}$. When $\delta = 1$, signifying that

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[8]When $\delta = 0.5$, the welfare measure is non-paternalistic and aligns with the utility derived by type-1. However, for $\delta > 0.5$, the welfare measure becomes paternalistic, exhibiting a bias towards utility from consumption of the numeraire good. In particular, when $\delta = 1$, the welfare measure reflects a preference for "income maintenance," disregarding the utility derived from social status. For further discussion on the concept of status-laundering in social welfare functions, refer to Aronsson and Johansson-Stenman (2018).

the government disregards social status, the optimal tax rate follows the inverse-elasticity rule. In this scenario, revenue is maximized by taxing signaling goods (purchased solely by high types), and redistribution is exclusively achieved through the income channel by maximizing the demogrant value T. For $\delta \in [0.5, 1)$, which encompasses both non-paternalistic government ($\delta = 0.5$) and partially paternalistic government (with δ between 0.5 and 1), the optimal tax rate exceeds the Laffer rate. This divergence arises because revenue considerations are tempered by the desire to promote a more equitable distribution of social status, using t as an instrument.

To gain further insights into the optimal tax system, we can reformulate equation (15). By introducing λ as the Lagrange multiplier associated with the IC constraint (6), we can express the first-order condition for the high-type agent's optimal choice of α as follows:

$$- (1 + t)\,\theta + \frac{qB}{2} e^{-q\alpha} + \left(1 + t - qBe^{-q\alpha}\right)\lambda = 0. \tag{16}$$

Solving for $e^{-q\alpha}$ in (16), we obtain the expression:

$$e^{-q\alpha} = \frac{2\,(1 + t)\,(\theta - \lambda)}{(1 - 2\lambda)\,qB}. \tag{17}$$

Substituting the value of $e^{-q\alpha(t)}$ from (17) into (15), we can restate (15) as follows:

$$\frac{t}{1 + t} = 2\frac{1 - \delta}{\delta}\frac{1 - \lambda/\theta}{1 - 2\lambda} + \frac{1}{|\eta|}. \tag{18}$$

Recalling that t^* represents the positive threshold value for t that distinguishes the region where the IC constraint is binding ($t < t^*$) from the region where it is slack ($t > t^*$), Proposition 2 below characterizes the relationship between the elasticity $|\eta|$ and the tax rate.

Proposition 2. *The absolute value of the elasticity $|\eta|$ is endogenous to the tax rate t and is characterized as follows:*

(i) *For $t \in [0, t^*)$, we have that*

$$|\eta| = \frac{1 - 2\lambda}{1 - 2\theta},$$

which monotonically increases in t since λ decreases in t.

(ii) *As t approaches t^* from the left, $|\eta|$ drops discontinuously.*

(iii) *For $t \in [t^*, \frac{qB}{2\theta} - 1]$, we have that*

$$|\eta| = \left(\ln \frac{qB}{2\theta(1+t)} \right)^{-1},$$

which monotonically increases in t and tends to infinity at $t = t^{max} \equiv \frac{qB}{2\theta} - 1$.

Proof See Online Appendix A.3 □

Notice that according to (iii), the inverse elasticity is equal to $\ln \frac{qB}{2\theta(1+t)}$ and reflects the return on status signaling, given by the ratio between the expected benefit and the cost of signaling.[9] The features of the inverse elasticity $|\eta|^{-1}$ as a function of t are described graphically in Figure 1. The figure also shows that two different tax rates can be consistent with the same elasticity. For instance, defining $\hat{t} = -1 + \frac{qB}{2\theta} e^{2\theta - 1}$, we have that $\lim_{t \to t^{*-}} |\eta(t)| = |\eta(\hat{t})| = \frac{1}{1 - 2\theta}$.

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[9] To see this, consider a single signaling good x that is visible with probability q and has an associated cost θ, while the gains from status are denoted by B. If x is not purchased, the status surplus is split evenly between the two agents, and type 2 derives an expected net benefit of $B/2$. Alternatively, if type 2 purchases a unit of x which costs θ, the social status derived by type 2 is $qB + (1-q)B/2$, as x is only visible with probability q. The net benefit associated with spending on x is hence $[(qB + (1-q)B/2) - B/2] = qB/2$. Dividing by the cost θ yields $qB/2\theta$.
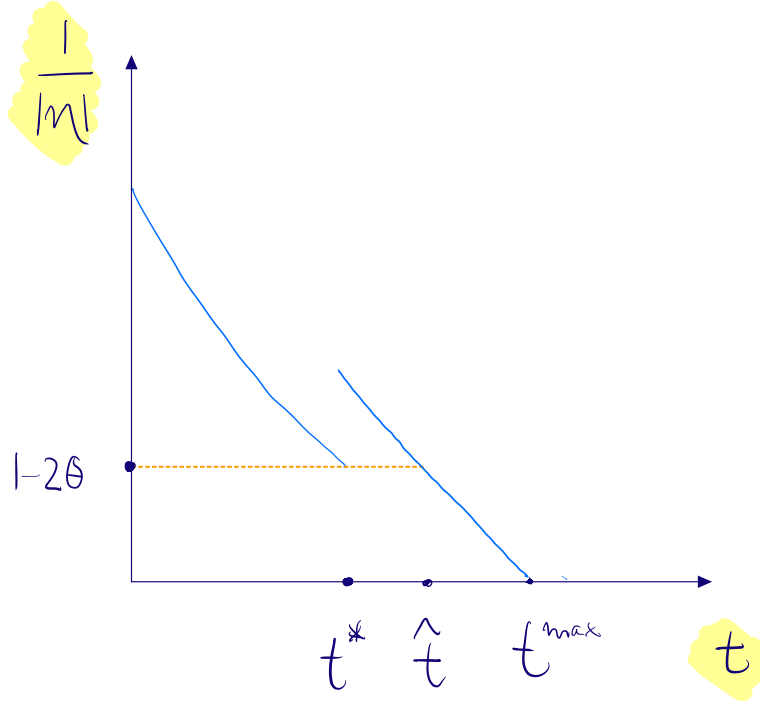
Figure 1: The shape of $|\eta|^{-1}$.

The reason why there is a discrete drop in $|\eta|$ at $t = t^*$ is that for $t < t^*$, the value of α (as a function of t) is dictated by the binding IC constraint $(1 + t)\,\alpha = (1 - e^{-q\alpha})\,B$, whereas for $t^* \leq t \leq t^{\max}$, we have that α is given by the unconstrained demand function $\alpha\,(t) = \frac{1}{q} \ln \frac{qB}{2\theta(1+t)}$. Although this does not disturb the continuity of $\alpha(t)$ at $t = t^*$, it implies a discontinuous drop in $\alpha'(t)$ at $t = t^*$. The intuition is that when the threat of mimicking by type-1 ceases to be a concern for type-2, the demand for α becomes less sensitive to changes in t.[10]

In Proposition 3, we provide a characterization of the optimal tax policy based on the analysis of the inverse elasticity $|\eta|^{-1}$ as a function of t. The characterization takes into account the first-order condition (18) for the government's problem, considering

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[10]To see this, notice that, given that the existence of t^* requires that $1 + t < qB$, we have that $\lim_{t \to t^{*-}} \alpha'(t) = -\frac{\alpha}{(1+t)(1+q\alpha)-qB} < -\frac{1}{(1+t)q} = \lim_{t \to t^{*+}} \alpha'(t)$ (i.e., $\lim_{t \to t^{*-}} |\alpha'(t)| = \frac{\alpha}{(1+t)(1+q\alpha)-qB} > \frac{1}{(1+t)q} = \lim_{t \to t^{*+}} |\alpha'(t)|$).

the potential existence of multiple solutions and distinguishing between local and global optima.

Proposition 3. *Let $\hat{\delta} \equiv \frac{2qB}{3qB - 2\theta}$ and $\widehat{\hat{\delta}} \equiv \frac{1}{1+\theta}$. The optimal tax policy is characterized as follows:*

i) For $\delta \in [\frac{1}{2}, \hat{\delta}]$, the optimal tax policy fully suppresses signaling, resulting in no tax revenues raised. Redistribution is exclusively achieved by promoting an egalitarian distribution of status. Any tax rate weakly larger than $\frac{qB}{2\theta} - 1$ is optimal.

(ii) For $\delta \in (\hat{\delta}, 1]$, signaling is not fully suppressed, and the optimal tax rate t^{opt} monotonically decreases with δ. Moreover, t^{opt} satisfies equation (19), namely,

$$\frac{t^{opt}}{1 + t^{opt}} = 2\frac{1 - \delta}{\delta}\frac{1 - \lambda/\theta}{1 - 2\lambda} + \frac{1}{|\eta|}, \tag{19}$$

where λ is necessarily equal to zero for $\delta \in (\hat{\delta}, \widehat{\hat{\delta}}]$.

Proof See Online Appendix A.4 □

Proposition 3 focuses on cases where the government assigns at least as much weight to consumption as it does to social status ($\delta \geq 1/2$), with the non-paternalistic case represented by $\delta = 1/2$. The proposition demonstrates that when δ is sufficiently large, the government does not suppress conspicuous consumption as it serves as a source of tax revenue that can be utilized for achieving an egalitarian distribution of consumption. However, as δ decreases, the proposition shows that the optimal approach is to suppress signaling and achieve redistribution primarily through the status channel. Notably, this optimal policy aligns with the non-paternalistic case when $\delta = 1/2$. [11]

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[11]The non-paternalistic optimum, where redistribution occurs exclusively through the status

In summary, Proposition 3 highlights the novel and potentially significant role of redistribution via the signaling channel, in addition to the traditional income channel, when individuals have concerns about social status and engage in conspicuous consumption to signal their wealth.

According to Equation (19) and for given values of δ and η, the upward adjustment on the Laffer rate, required for status-redistribution purposes, is smaller when the IC constraint is binding ($\lambda \neq 0$). This is because a binding IC constraint implies an upward distortion in the choice of α, compared to the choice made by a type-2 agent in the absence of a mimicking threat from type-1. The smaller adjustment is due to two factors. First, a marginal reduction in α delivers smaller gains in terms of status redistribution, as the effects diminish with larger values of α. Second, the base-broadening effect of the binding IC constraint makes it more effective to achieve redistributive goals through the traditional income channel.[12]

Figures 2-3 provide graphical illustrations of the two possible profiles of the optimal tax function $t(\delta)$, demonstrating the different adjustments to the Laffer rate depending on the binding or slack IC constraint.

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channel, is a result of the linearity of the signaling cost. In a more general setting, the optimal policy would involve redistribution through both channels, but the status channel would always require a tax rate higher than the Laffer rate.

[12]This observation is supported by the fact that the partial derivative $\frac{\partial}{\partial \lambda} \left(\frac{1 - \lambda/\theta}{1 - 2\lambda} \right) = \frac{2 - 1/\theta}{(1 - 2\lambda)^2} < 0$ (for $0 < \theta < 1/2$). The negative derivative indicates that as λ decreases (corresponding to a binding IC constraint), the adjustment on the Laffer rate decreases.
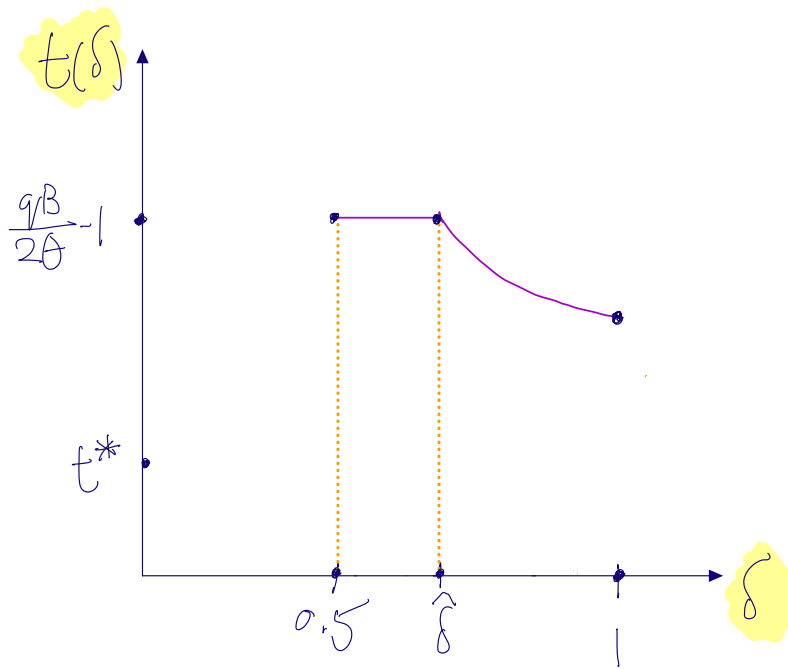
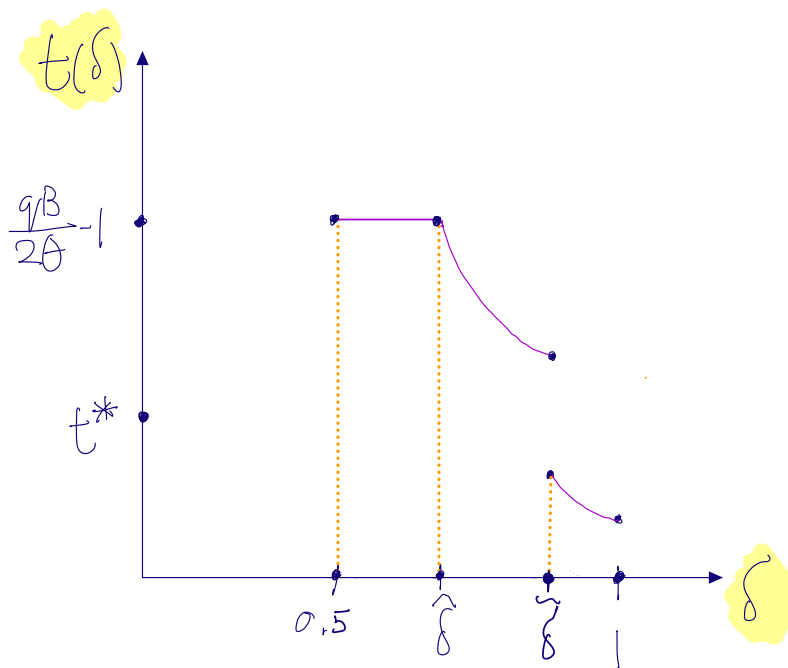Figure 2: Illustration of the shape of $t(\delta)$ when $t(1)$ is larger than t^*.

Figure 3: Illustration of the shape of $t(\delta)$ when $t(1)$ is smaller than t^*.

The two figures, Figure 2 and Figure 3, highlight a crucial difference in the behavior of the optimal tax function $t(\delta)$. In Figure 2, where $t(1) > t^*$, the function $t(\delta)$ is continuous within its domain $[0.5, 1]$. It starts with a constant optimal tax rate of $\frac{qB}{2\theta} - 1$ for δ in the range $[0.5, \hat{\delta}]$, where $\hat{\delta} \equiv \frac{2qB}{3qB-2\theta}$. Then, $t(\delta)$ decreases monotonically and continuously until it reaches its minimum for $\delta = 1$.

In contrast, in Figure 3, where $t(1) < t^*$, the optimal tax function $t(\delta)$ exhibits a point of discontinuity. Similar to Figure 2, there is an initial range where the optimal tax rate is constant. However, starting from $\delta = \hat{\delta}$, there is a continuous and monotonically decreasing region. But instead of extending all the way to $\delta = 1$, there is a threshold value denoted as $\widetilde{\delta}$ where a jump occurs. At this threshold, $t(\delta)$ jumps from a value strictly larger than t^* to a value strictly smaller than t^*. From there, the function continues its continuous decrease.

The presence of a discontinuous jump in the optimal tax function $t(\delta)$ indicates that as societies become more sensitive to status differences over time, a marginal reduction in δ (i.e., an increase in the weight assigned to the status component by the government) can trigger a regime change in taxation policy. This change shifts from a low-tax regime, where most redistribution occurs through the income channel, to a high-tax regime, where the focus of redistribution shifts to the status channel.

3.3 The efficiency-enhancing role of commodity taxation

So far, our focus has been on equity considerations. However, it is important to briefly discuss efficiency aspects in our model. As is typically the case with pure signaling, the resulting allocation in equilibrium is inefficient. In our setup, the status surplus is fixed at B, and engaging in signaling by type-2 agents is essentially a form of rent-seeking. The only Pareto efficient allocation is one where type-2 agents refrain from signaling and set $\alpha = 0$. This implies that a Pareto improvement can be attained

by reducing the intensity of signaling (a decrease in α) supplemented by a proper transfer from type-1 to type-2 agents (in units of the numeraire good, y, by virtue of the quasi-linearity of the utility function). In general, this can be achieved through a system of non-linear commodity taxes.

However, even in the linear regime considered in our model (ad-valorem taxes levied on the signaling goods accompanied by a universal lump-sum transfer), it is still possible to potentially attain a Pareto improvement. Under Assumption 1, the incentive constraint is binding when $t = 0$. Thus, although tax revenues are split between the two types, and hence cross-subsidization goes in the 'wrong' direction from type-2 to type-1 agents, the former may still become better off due to the reduction in the extent of (excessive) signaling, which is desirable in light of the binding incentive constraint.[13] The feasibility of attaining a Pareto improvement depends on the magnitude of the distortion associated with excessive consumption of signaling goods (due to the binding incentive constraint) and the degree of cross-subsidization needed to maintain the information rent associated with the low-type agents. With a sufficiently large distortion and a relatively moderate extent of cross-subsidization, a Pareto improvement becomes feasible.

It is important to notice the difference from the standard argument which supports a Pareto improvement in the presence of wasteful signaling when linear instruments are in place. In the traditional context, the information content is fixed, and a separating equilibrium requires that high types spend a sufficient amount of resources on the signal to induce no-mimicking. The expenditure could either be driven by 'burning money' which is wasteful, or be associated with higher tax payments, that could be diverted to consumption (through transfers). Thus, given that the tax parameters are common knowledge, paying taxes could serve as an instrumental

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[13]The argument bears similarity to the role played by a binding parental leave mandate in a labor market marred by adverse selection (see e.g., Bastani et al. 2019).

signal. Hence, it is always desirable to tax signals. In our context, in contrast, signals are not wasteful in the sense that consumption needs to be visible to acquire status. Thus, status is driven by the number of units (or variety) of signaling goods that are purchased rather than the resources spent on these goods. It may be the case, therefore, that the laissez-faire equilibrium is second-best efficient, that is linear instruments need not yield a Pareto improvement. [14]

4   Concluding discussion

In contemporary societies, conspicuous consumption is a widespread phenomenon driven by the pursuit of social status. Extensive scholarly research on status signaling and taxation argues that spending on conspicuous consumption, aimed at signaling one's social standing, essentially involves squandering resources. Therefore, by taxing conspicuous consumption and utilizing the tax revenues to redirect these resources towards goods that offer intrinsic value, the government can simultaneously maintain the informational content of signaling while curbing wasteful expenditure. This progressive reallocation scheme primarily affects affluent individuals engaged in signaling, thereby addressing both efficiency and equity objectives.

This study makes valuable contributions to the existing literature by offering two key insights, each pertaining to distinct dimensions: equity and efficiency.

On the equity front, we introduce a novel role for taxes imposed on conspicuous consumption as a means to enhance welfare by fostering a more equitable distribution of social status. This introduces an additional avenue for redistribution that expands beyond the existing focus on fully revealing separating equilibria. We argue that a continuum of possibilities should be considered, ranging from uninformative pooling

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[14]Ng (1987) and Truyts (2012) discuss the use of linear instruments, including confiscatory tax rates on pure signaling goods, to achieve Pareto improvements.

equilibria to fully revealing separating equilibria. Importantly, we demonstrate that the amount of information conveyed in equilibrium plays a pivotal role in redistribution when individuals value social status and the government respects this to some extent. By restraining or even obstructing individuals' ability to engage in conspicuous consumption and display their wealth, we unveil the "status channel of redistribution," a feature that has largely been overlooked in the literature.

However, it is essential to carefully balance this new status channel of redistribution against the traditional motivations for taxing conspicuous consumption. We delve into the interplay between these factors, providing valuable insights into achieving an optimal equilibrium between promoting an equitable distribution of social status and pursuing other objectives associated with taxing conspicuous consumption.

A critical element of our framework lies in the inclusion of noisy signaling, which captures the imperfect visibility of consumption used for signaling social status. Unlike the conventional signaling framework where signals are perfectly observable, our model recognizes that the identities of agents engaged in signaling are not fully revealed under a separating equilibrium. Consequently, individuals with higher levels of wealth can distinguish themselves from those with lower wealth by investing in a wider array of conspicuous consumption goods. This strategic choice boosts their chances of being perceived as having high social status, thereby increasing their expected share of the overall social status surplus.

By implementing measures that curb the conspicuous consumption of the affluent, such as taxation, the government can diminish the informativeness of signaling. This action effectively raises the proportion of the social status surplus obtained by individuals with lower levels of wealth. In other words, by reducing the amount of information conveyed through signaling, the government promotes a relatively

higher social status for the less affluent population.

Our analysis, employing a Rawlsian welfare function, explores the implications of the optimal tax on conspicuous consumption. We uncover that when the weight assigned to consumption in the welfare function is relatively low, the optimal tax strategy involves completely suppressing signaling, resulting in no tax revenue generation. In this scenario, redistribution is exclusively achieved by fostering an egalitarian distribution of social status. In contrast, when the weight assigned to consumption is relatively high, the optimal tax strikes a delicate balance between the motive to generate revenue through taxing conspicuous consumption (which is inversely related to the price elasticity of such consumption) and the newfound motive to promote an egalitarian distribution of social status (which is directly related to the price elasticity of conspicuous consumption).

Our findings underscore the significance of considering the equity gains associated with a high marginal tax rate, going beyond its revenue-raising effect. Much like high marginal income tax rates, which can have positive effects before redistributive measures are implemented (i.e., pre-distribution, see Bozio et al. 2020), high commodity tax rates can contribute to a more equitable distribution of welfare, even if they generate minimal government revenue. This highlights the importance of looking beyond revenue generation when evaluating the impact of high marginal taxes on promoting fairness and equality.

While our study primarily focuses on the equity implications and the novel status channel's impact on redistribution, we also uncover a crucial insight regarding efficiency. In doing so, we challenge the prevailing paradigm of "burning money," which suggests that pure signaling is inherently inefficient.

Within our framework, where signals are subject to noise and imperfect informativeness, individuals engaged in pure signaling (without deriving intrinsic value

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from signaling activities) exhibit a concern for variety. Rather than solely focusing on the level of expenditure, these individuals value the quantity consumed as it enhances visibility and renders the signal more informative. Consequently, pure signaling is not necessarily inefficient, as there exists an intrinsic value in allocating greater resources towards goods that enhance exposure and visibility.

Our analysis presents intriguing avenues for future research, inviting scholars to delve deeper into the broader implications surrounding the status channel of redistribution. One captivating area of exploration lies in understanding the concept of visible poverty. Further investigation into the unintended "shaming" effect resulting from conspicuous consumption by the wealthy and its impact on those less fortunate, who are unable to afford such luxuries, would provide valuable insights. Additionally, studying the role of visibility in poverty alleviation programs offers a promising avenue for inquiry. For instance, examining the impact of providing affordable housing to mitigate exposure and the subsequent stigmatization faced by homeless individuals could yield significant findings. Future studies could also delve into the design of optimal transfer systems, taking into account not only resource allocation but also strategies to minimize negative exposure. Exploring the experiences of social assistance programs such as the provision of electronic benefit transfer (EBT) cards as a means to reduce the stigma associated with participants in programs like the US food stamp program (SNAP) and investigating innovative approaches to alleviate the shame associated with public identification as a welfare recipient could provide valuable insights. By shifting the focus beyond the screening value of exposure to the equally important aspect of reducing stigma, future investigations can shed light on effective interventions. Adopting a broader perspective that encompasses the complex interplay among status, redistribution, and social well-being is crucial for advancing our understanding in this field.

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A   Online Appendix: Proofs and Derivations

A.1   Strict convexity of type-1 optimization problem

Formulating the constrained maximization program faced by type-1 yields:

$$\max_{0 \le \tilde{\alpha} \le \alpha} J(\tilde{\alpha}) \equiv \left[w^1 - (1 + t) \cdot \tilde{\alpha} + T \right] + e^{-q(\alpha - \tilde{\alpha})} \cdot \left[1 - \frac{1}{2} \cdot e^{-q\tilde{\alpha}} \right] \cdot B \qquad \text{(A1)}$$

In words, type-1, given the separating equilibrium profile of strategies, is choosing to spend on a subset of α, so as to maximize his expected utility. Notice that $e^{-q(\alpha - \tilde{\alpha})}$ measures the probability that none of the signals on which type-2 spends but type-1 refrains from spending on, $(\alpha - \tilde{\alpha})$, is visible. If at least one of these signals is visible, no surplus is derived by type-1, as, in equilibrium, all type-2 agents spend on these

signals, which serve to distinguish them from their lower-type counterparts. If none of these signals is visible, the surplus derived by type-1 is given by the last term in brackets in (A1). Notably, this term is identical in structure to the second term in brackets of the objective (5), with the exception that $\tilde{\alpha}$ replaces α. That is, the relevant subset of signaling goods that identify type-2 agents is given by $\tilde{\alpha}$. Differentiating $J(\tilde{\alpha})$ with respect to $\tilde{\alpha}$ yields:

$$\frac{\partial J}{\partial \tilde{\alpha}} = -(1+t) + qB \cdot e^{-q(\alpha-\tilde{\alpha})} \tag{A2}$$

Taking the derivative one more time yields:

$$\frac{\partial^2 J}{\partial \tilde{\alpha}^2} = q^2 \cdot B \cdot e^{-q(\alpha-\tilde{\alpha})} > 0 \tag{A3}$$

Thus, $J(\tilde{\alpha})$ is strictly convex with respect to $\tilde{\alpha}$. The optimum for the maximization in (A1) is hence attained by either one of the two corner solutions: $\tilde{\alpha} = 0$ or $\tilde{\alpha} = \alpha$. We conclude that constraint (IC) in program $\mathcal{P}1$ is well defined.

A.2 Proof of Proposition 1

We begin by assuming that (IC) is slack in the optimal solution to $\mathcal{P}1$. Then one can formulate the first-order condition:

$$-\theta \cdot (1+t) + \frac{B}{2} \cdot e^{-q\alpha} \cdot q = 0. \tag{A4}$$

It is straightforward to verify that the second-order condition is satisfied. Denoting by $\alpha(t)$ the optimal choice of the high type (as a function of t) given by the solution to (A4), an interior solution $0 < \alpha(t) < 1$ exists, by virtue of (7), when $1 + t < \frac{qB}{2\theta}$. When $1 + t \geq \frac{qB}{2\theta}$, a corner solution in which the high-type refrains from spending on the signaling goods emerges, namely, $\alpha(t) = 0$. The IC constraint (6) is not necessarily slack, however. Whether (6) is binding or not depends on parametric conditions. We

separate between different cases.

Case I: $1 + t \geq \frac{qB}{2\theta}$ As shown above, in this case, assuming (IC) is not violated, the optimal choice is $\alpha(t) = 0$. It is straightforward to verify that for $\alpha = 0$, the IC constraint is trivially satisfied. Thus, this forms indeed the optimal solution. Levying a sufficiently high tax on the x goods, hence, induces the high-type to refrain from engaging in any signaling. Clearly, in such a case, no tax revenues are being collected and $T = 0$. Thus, redistribution is exclusively confined to the status channel, ensuring that the low-type derives the largest possible share of the social status surplus (an expected surplus of $B/2$).

Case II: $1 + t < \frac{qB}{2\theta}$ We will separate this case into two sub-cases. We first assume that $\theta \geq 1/2$. That is, engaging in signaling is fairly costly for the high-type. As shown in Figure 4 below, which represents condition (IC) under the invoked parametric assumptions, for each t, there are two values of α for which (IC) is satisfied as equality: $\alpha_1(t) = 0$ and $0 < \alpha_2(t) < 1$.

To see that there are two values, notice that the relevant range we are considering (when IC is binding) is $1 + t < \frac{qB}{2\theta}$ where $\theta \geq 1/2$. Thus, we have that:

$$qB > 1 + t, \tag{A5}$$

Consider Figure 4. Differentiating the left-hand-side of (IC) with respect to α and taking the limit when $\alpha \to 0$ yields:

$$\lim_{\alpha \to 0} \frac{\partial}{\partial \alpha} \left(1 - e^{-q\alpha}\right) \cdot B = qB > 1 + t. \tag{A6}$$

Thus, by virtue of (A6), as (IC) is satisfied as equality for $\alpha = 0$, by invoking a first-order approximation, it follows that for sufficiently small $\alpha > 0$ the left hand side

expression of (IC) is strictly exceeding the RHS and hence (IC) is violated. Taking the limit as $\alpha \to 1$ implies that the LHS of (IC) is given by:

$$\lim_{\alpha \to 1} \left(1 - e^{-q\alpha}\right) \cdot B = (1 - e^{-q}) \cdot B < 1 < 1 + t. \tag{A7}$$

where the first inequality follows from (9). Thus, for sufficiently high $\alpha > 0$, the RHS of (IC) is strictly exceeding the LHS and, hence, (IC) is satisfied as a strict inequality. By virtue of the intermediate value theorem, hence, there exists some $0 < \alpha < 1$ for which (IC) is satisfied as an equality. The strict concavity (with respect to α) of the left-hand side expression of (IC), which can be readily verified, along with the linearity of the RHS expression, imply that this value of α is unique.

Let us now go back to Figure 4. The red line represents the RHS of (6), whereas, the blue curve represents the LHS. For $\alpha > \alpha_2(t)$, (IC) is satisfied as a strict inequality, and for $0 < \alpha < \alpha_2(t)$, (IC) is violated. We next show that the interior (unconstrained) solution $\alpha(t)$ to the first order condition (A4) violates (IC), that is, $0 < \alpha(t) < \alpha_2(t)$, which implies that the optimal solution is either given by $\alpha_1(t)$ or $\alpha_2(t)$.
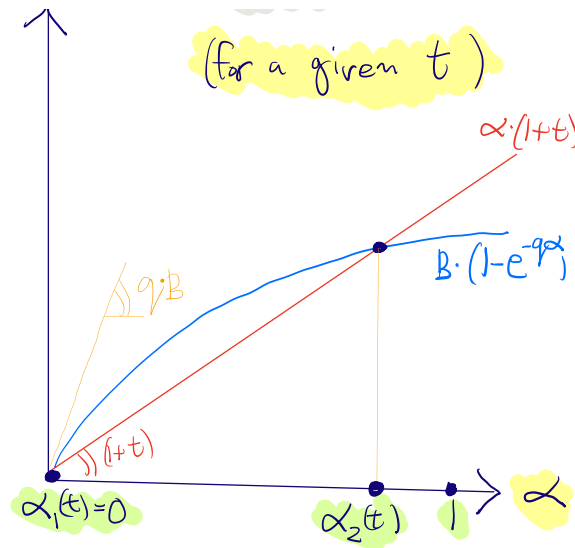

Figure 4: Illustration of the IC constraint (6) .

To show that $0 < \alpha(t) < \alpha_2(t)$, we exploit (A4) and re-arrange to obtain:

$$q \cdot \alpha(t) = -\ln \frac{2\theta \cdot (1+t)}{qB}. \tag{A8}$$

Insertion of (A8) into (IC) given by (6) allows us to express (IC) as follows:

$$H(t) \equiv (1+t)\ln \frac{2\theta \cdot (1+t)}{qB} + qB - 2\theta \cdot (1+t) \leq 0. \tag{A9}$$

It follows immediately that for $1 + t = \frac{qB}{2\theta}$, $H(t) = 0$. Thus, to show that (IC) is violated for $1 + t < \frac{qB}{2\theta}$, it suffices to show that $\frac{dH(t)}{dt} < 0$ in this range. We have that:

$$\frac{dH(t)}{dt} = \ln \frac{2\theta \cdot (1+t)}{qB} + 1 - 2\theta < 0, \tag{A10}$$

where the inequality follows as $1 + t < \frac{qB}{2\theta}$ and the assumption that $\theta \geq \frac{1}{2}$. Thus, $H(t) > 0$ and (IC) is violated in the unconstrained optimum for $1 + t < \frac{qB}{2\theta}$. It follows that in the optimal solution, (IC) is binding and the optimal solution is either given by $\alpha_1(t) = 0$ or $0 < \alpha_2(t) < 1$. We can compare the two candidates for the optimal solution by plugging them into the objective function (5):

$$V(\alpha_1) = \bar{w} + B/2 \tag{A11}$$

$$V(\alpha_2) = \bar{w} + B \cdot (1 - \theta) + B \cdot e^{-q\alpha_2} \cdot (\theta - 1/2). \tag{A12}$$

For $\theta = 1/2$, we have that $V(\alpha_1) = V(\alpha_2)$. Differentiating $V(\alpha_2)$ with respect to θ yields:

$$\frac{\partial V(\alpha_2)}{\partial \theta} = (e^{-q\alpha_2} - 1) \cdot B < 0, \quad \text{as} \quad \alpha_2 > 0. \tag{A13}$$

It follows that $V(\alpha_1) > V(\alpha_2)$ for $\theta > 1/2$. Hence, for any $t < \frac{qB}{2\theta} - 1$ and $\theta \geq 1/2$, the optimal solution is given by: $\alpha(t) = 0$.

We next consider $H(t)$ for the case $\theta < 1/2$. We make the following observations:

- $H(0) > 0$ due to Assumption 1 (by virtue of condition 8)

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- $H(t) = 0$ when $1 + t = \frac{qB}{2\theta}$ (as above, by virtue of equation A9)

- $\frac{dH(t)}{dt} > 0$ when $1 + t = \frac{qB}{2\theta}$ since $\theta < 1/2$ (by virtue of equation A10)

- $\frac{d^2 H(t)}{dt^2} = \frac{1}{1+t} > 0$ for all $1 + t \leq \frac{qB}{2\theta}$ implying that $H(t)$ is strictly convex.

The properties of $H(t)$ imply that there exists a unique $t^* \in (0, \frac{qB}{2\theta} - 1)$, such that $H(t) \leq 0$ (and hence IC is satisfied) for $t \in [t^*, \frac{qB}{2\theta} - 1)$, whereas $H(t) > 0$ (and hence IC is violated) for $t \in [0, t^*)$. To see this formally, notice that as $H(t) = 0$ and $\frac{dH(t)}{dt} > 0$ when $1 + t = \frac{qB}{2\theta}$, by applying a first-order approximation, it follows that for t smaller than but sufficiently close to $\frac{qB}{2\theta} - 1$, $H(t) < 0$. As $H(0) > 0$, it follows by the Intermediate Value Theorem that t^* exists. Uniqueness follows from the strict convexity of $H(t)$. $H(t)$ is illustrated in Figure 5 below.
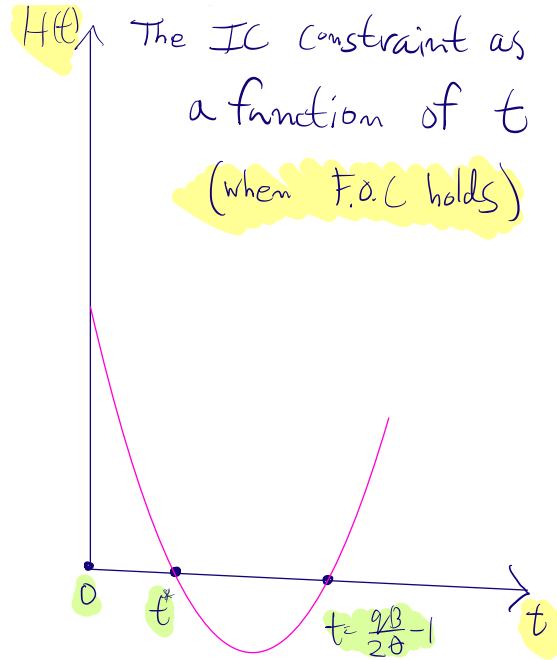

Figure 5: An illustration of $H(t)$ when $\theta < 1/2$.

We conclude that for $t \in [t^*, \frac{qB}{2\theta} - 1)$, the optimal solution is given by condition (A4), which upon re-arrangement yields $\alpha(t) = -\frac{1}{q} \ln \frac{2\theta \cdot (1+t)}{qB}$, whereas for $t \in [0, t^*)$,

the optimum is given by a solution to the binding incentive constraint (6). As before, there are two possibilities for this constraint to bind, either $\alpha_1(t) = 0$ or $0 < \alpha_2(t) < 1$. To see this, notice that the relevant range we are considering (when IC is binding) is $t \in [0, t^*)$. By definition of t^* (see Figure 5) we have that:

$$H(t^*) \equiv (1 + t^*) \ln \frac{2\theta \cdot (1 + t^*)}{qB} + qB - 2\theta \cdot (1 + t^*) = 0. \tag{A14}$$

Moreover,

$$\left. \frac{dH(t)}{dt} \right|_{t=t^*} = \ln \frac{2\theta \cdot (1 + t^*)}{qB} + 1 - 2\theta < 0. \tag{A15}$$

Substituting for $\ln \frac{2\theta \cdot (1+t^*)}{qB}$ from (A14) into (A15) yields upon re-arrangement:

$$qB > 1 + t^* \implies qB > 1 + t \quad \text{for} \quad t < t^*. \tag{A16}$$

Having established this, we can proceed in an identical fashion as for the case $\theta \geq 1/2$.

The level of the objective in each case is again given by equations (A11) and (A12). The difference now is that $\theta < 1/2$. Exploiting (A13), we conclude that $V(\alpha_2) > V(\alpha_1)$. Hence, for $\theta < 1/2$, the optimal solution is given by: $\alpha(t) = \alpha_2(t) > 0$ when $0 \leq t < t^*$.

A.3 Proof of Proposition 2

By Proposition 1, for $t \in [0, t^*)$, $\alpha(t)$ is dictated by the binding IC constraint $(1 + t)\alpha = (1 - e^{-q\alpha}) B$ and $\alpha'(t) = -\frac{\alpha}{1+t-qBe^{-q\alpha}}$. This implies that

$$\frac{1}{|\eta|} = 1 - \frac{qBe^{-q\alpha}}{1+t},$$

or equivalently, exploiting (17),

$$\frac{1}{|\eta|} = 1 - 2\frac{\theta - \lambda}{1 - 2\lambda} = \frac{1 - 2\theta}{1 - 2\lambda}. \tag{A17}$$

For $t \in [t^*, \frac{qB}{2\theta} - 1]$, the IC constraint is slack, and $\alpha(t)$ is given by the unconstrained demand function $\alpha(t) = \frac{1}{q} \ln \frac{qB}{2\theta(1+t)}$, we have that $\alpha'(t) = -\left[q(1+t)\right]^{-1}$ and:

$$\frac{1}{|\eta|} = \ln \frac{qB}{2\theta(1+t)}. \tag{A18}$$

Recall that t^* is the threshold (positive) value for t that separates the region where the IC constraint is binding $(t < t^*)$ from the region where it is slack $(t > t^*)$, and satisfies the following equations:

$$
\begin{aligned}
(1+t)\,\alpha &= \left(1 - e^{-q\alpha}\right) B, \\
\alpha &= \frac{1}{q} \ln \frac{qB}{2\theta(1+t)},
\end{aligned}
$$

where the first equation states the IC constraint as an equality and the second equation provides the unconstrained optimal choice for α by a high-type individual. Combining these equations, we thus have that t^* is implicitly given by the following condition:

$$(1+t) \left[2\theta + \ln \frac{qB}{2\theta} - \ln(1+t)\right] = qB. \tag{A19}$$

As we have shown in the Proof of Proposition 1, for $\theta < 1/2$ there exists a unique t^* in the range $t \in \left(0, \frac{qB}{2\theta} - 1\right)$. Moreover, for $t \in (0, t^*)$ the LHS of (A19) is smaller than its RHS, and vice versa for $t \in \left(t^*, \frac{qB}{2\theta} - 1\right)$. Consider now the value of $\frac{1}{|\eta|}$ when t approaches t^* from the left (IC constraint is binding) and from the right (IC constraint is slack). When t approaches t^* from the left, we have that (see expression (A17)) $\frac{1}{|\eta|} = 1 - 2\theta$ (i.e., $\lim_{t \to t^{*-}} \frac{1}{|\eta|} = \lim_{\lambda \to 0} \frac{1-2\theta}{1-2\lambda} = 1 - 2\theta$). Now consider (A18) and evaluate at which level for t we get that $\frac{1}{|\eta|} = 1 - 2\theta$. Solving the equation

$$\ln \frac{qB}{2\theta} - \ln(1+t) = 1 - 2\theta,$$

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we get

$$t = -1 + \frac{qB}{2\theta}e^{2\theta-1} \equiv \hat{t}. \tag{A20}$$

Notice that, inserting into (A19) the value for t provided by (A20), the LHS of (A19) boils down to $\frac{qB}{2\theta}e^{2\theta-1}$, which is a decreasing function of θ (under our assumption that $0 < \theta < 1/2$). Given that $\lim_{\theta \to 1/2} \frac{qB}{2\theta}e^{2\theta-1} = qB$, we have that, for $0 < \theta < 1/2$, the LHS of (A19) is larger than its RHS when $t = -1 + \frac{qB}{2\theta}e^{2\theta-1}$. Thus, the IC constraint is slack for $t = -1 + \frac{qB}{2\theta}e^{2\theta-1}$, which implies that $-1 + \frac{qB}{2\theta}e^{2\theta-1} > t^*$. Moreover, given that the RHS of (A18) is a decreasing function of t, it also follows that $\lim_{t \to t^{*+}} \frac{1}{|\eta|} > 1 - 2\theta$. We can then conclude that

$$\lim_{t \to t^{*-}} \frac{1}{|\eta|} = 1 - 2\theta < \lim_{t \to t^{*+}} \frac{1}{|\eta|},$$

i.e., the function $\frac{1}{|\eta|}$ is discontinuous at $t = t^*$. Regarding the shape of $\frac{1}{|\eta|}$ for $t \in (0, t^*)$, i.e. when the IC constraint is binding, rearranging (16) we have that

$$\lambda = \frac{(1+t)(q\alpha + 2\theta) - qB}{2[(1+t)(1+q\alpha) - qB]}, \tag{A21}$$

from which we obtain that

$$\frac{\partial \lambda}{\partial t} = \frac{2[(1+t)(1+q\alpha) - qB]\left[q\alpha + 2\theta + (1+t)q\frac{\partial \alpha}{\partial t}\right]}{4[(1+t)(1+q\alpha) - qB]^2}$$
$$- \frac{2[(1+t)(q\alpha + 2\theta) - qB]\left[1 + q\alpha + (1+t)q\frac{\partial \alpha}{\partial t}\right]}{4[(1+t)(1+q\alpha) - qB]^2}. \tag{A22}$$

Taking into account that $\alpha'(t) = -\frac{\alpha}{1+t-qBe^{-q\alpha}}$ for $t \in (0, t^*)$, eq. (A22) can be simplified to obtain

$$\frac{\partial \lambda}{\partial t} = \frac{(1+t-qB)[\alpha(1+t) - B]}{2[(1+t)(1+q\alpha) - qB]^2} \frac{(1-2\theta)q}{qB - (1+q\alpha)(1+t)}$$
$$= \frac{(1-2\theta)(1+t-qB)[\alpha(1+t) - B]q}{2[qB - (1+t)(1+q\alpha)]^3}. \tag{A23}$$

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Given that $1-2\theta > 0$ (by assumption), $1+t-qB < 0$ (a necessary condition for the IC constraint to be binding), $\alpha(1+t)-B < 0$ (since a binding IC constraint requires that $(1+t)\alpha - B = -Be^{-q\alpha}$), and $qB - (1+q\alpha)(1+t) < 0$ (since $\alpha'(t) = \frac{\alpha}{qB-(1+q\alpha)(1+t)}$ and we know that $\alpha'(t) < 0$), it follows from (A23) that $\frac{\partial\lambda}{\partial t} < 0$. Therefore, it also follows (see (A17)) that $|\eta|^{-1}$ is a monotonically decreasing function for $t \in (0, t^*)$.

A.4 Proof of Proposition 3

When the IC constraint is slack, the first order condition (18) can be rewritten as (taking into account Proposition 2)

$$\frac{t}{1+t} = 2\frac{1-\delta}{\delta} + \ln\frac{qB}{2\theta(1+t)} \tag{A24}$$

Given that the LHS of (A24) takes value 0 at $t = 0$ and is monotonically increasing in t, and that the RHS is monotonically decreasing in t, for given δ there is at most one value for t in the range $t \in \left(t^*, \frac{qB}{2\theta} - 1\right)$ that satisfies condition (A24).

When the IC constraint is binding, the first order condition (18) can be rewritten as (taking into account Proposition 2)

$$\frac{t}{1+t} = 2\frac{1-\delta}{\delta}\frac{1-\lambda/\theta}{1-2\lambda} + \frac{1-2\theta}{1-2\lambda}. \tag{A25}$$

Next, we show that the RHS of (A25) is either monotonically decreasing in t or monotonically increasing in t depending on whether, respectively, $\delta > (1+\theta)^{-1}$ or $\delta < (1+\theta)^{-1}$. We also show that for $\delta \leq (1+\theta)^{-1}$ the optimal value for t must be necessarily greater than t^*. Therefore, given that the LHS of (A25) takes value 0 at $t = 0$ and is monotonically increasing in t, for given δ there is at most one value for t in the range $t \in (0, t^*)$ that satisfies condition (A25).

We have that

$$
\begin{aligned}
\frac{\partial \left(2\frac{1-\delta}{\delta}\frac{1-\lambda/\theta}{1-2\lambda} + \frac{1-2\theta}{1-2\lambda}\right)}{\partial t} &= \left[2\frac{1-\delta}{\delta}\frac{-(1-2\lambda)\frac{1}{\theta} + 2(1-\lambda/\theta)}{(1-2\lambda)^2} + \frac{2(1-2\theta)}{(1-2\lambda)^2}\right]\frac{\partial \lambda}{\partial t}\\
&= \left[-2\frac{1-\delta}{\delta\theta}\frac{1-2\theta}{(1-2\lambda)^2} + 2\frac{1-2\theta}{(1-2\lambda)^2}\right]\frac{\partial \lambda}{\partial t}\\
&= 2\frac{1-2\theta}{(1-2\lambda)^2}\left(1 - \frac{1-\delta}{\delta\theta}\right)\frac{\partial \lambda}{\partial t}\\
&= -2\frac{1-2\theta}{(1-2\lambda)^2}\frac{1-\delta-\delta\theta}{\delta\theta}\frac{\partial \lambda}{\partial t}.
\end{aligned}
$$

We know that $1 - 2\theta > 0$ (by assumption) and that $\frac{\partial \lambda}{\partial t} < 0$; thus, we have that

$$
sign\left\{\frac{\partial \left(2\frac{1-\delta}{\delta}\frac{1-\lambda/\theta}{1-2\lambda} + \frac{1-2\theta}{1-2\lambda}\right)}{\partial t}\right\} = sign\left\{1 - \delta - \delta\theta\right\}. \tag{A26}
$$

From the first order condition (14) of the government's problem we have that

$$
t = \frac{1-\delta}{\delta}\frac{qB}{\theta}e^{-q\alpha} - \frac{\alpha}{\alpha'}. \tag{A27}
$$

Assuming that the IC constraint is binding we have that $qBe^{-q\alpha} = qB - (1+t)q\alpha$ and $\alpha/\alpha' = qB - (1+q\alpha)(1+t)$, and therefore we can rewrite (A27) as

$$
t = \frac{1-\delta}{\delta\theta}\left[-(1+t)q\alpha + qB\right] - qB + (1+q\alpha)(1+t),
$$

from which we obtain (after some algebraic manipulations)

$$
t = \frac{\delta\theta}{(1-\delta-\delta\theta)q\alpha} + \frac{B}{\alpha} - 1, \tag{A28}
$$

i.e.,

$$
\alpha(1+t) = \frac{\delta\theta}{(1-\delta-\delta\theta)q} + B.
$$

Given that a binding IC constraint requires that $\alpha(1+t) = (1 - e^{-q\alpha})B$, we can

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rewrite the equation above as

$$-Be^{-q\alpha} = \frac{\delta\theta}{(1 - \delta - \delta\theta) q},$$

from which we obtain

$$\alpha = \frac{1}{q} \ln \frac{(-1 + \delta + \delta\theta) qB}{\delta\theta}, \tag{A29}$$

and therefore, substituting in (A28) the value for α provided by (A29)), we get that

$$t = \frac{\delta\theta}{(1 - \delta - \delta\theta) \ln \frac{(-1+\delta+\delta\theta)qB}{\delta\theta}} + \frac{qB}{\ln \frac{(-1+\delta+\delta\theta)qB}{\delta\theta}} - 1. \tag{A30}$$

The equation above gives the optimal value of t as a function of the various parameters when α is implicitly given by the equation $\alpha (1 + t) = (1 - e^{-q\alpha}) B$. Notice that a necessary condition for α, as defined by (A29), to be positive is that $1 - \delta - \delta\theta < 0$, i.e. $\delta > (1 + \theta)^{-1}$. Notice also that, even for a given value of δ that is greater than $(1 + \theta)^{-1}$, the value for t provided by (A30) might be larger than t^*, in which case one should conclude that the first order condition of the government's problem cannot be satisfied within the range of values for t that make the IC constraint binding. Thus, a necessary (but not sufficient) condition for the first order condition of the government's problem to be satisfied for $t \in (0, t^*)$ is that $1 - \delta - \delta\theta < 0$. Taking into account (A26), this means that a necessary (but not sufficient) condition for the first order condition of the government's problem to be satisfied for $t \in (0, t^*)$ is that $\partial \left(2\frac{1-\delta}{\delta} \frac{1-\lambda/\theta}{1-2\lambda} + \frac{1-2\theta}{1-2\lambda} \right) / \partial t < 0$.

Figures 6-9 below illustrate the various possibilities that can arise when there is at least one value for t that satisfies condition (18). Each figure plots two functions. The increasing function starting at the origin of the axes represents the function $t/(1 + t)$, i.e. the LHS of (18). The other function represents the profile of the RHS of (18), plotted for a given value of δ; this function is characterized by a discontinuity point (at $t = t^*$), which reflects the discontinuity of $1/|\eta|$. The passage from one figure to

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the next can be interpreted as illustrating the effect of lowering the underlying value of δ. This is because a reduction in δ shifts up the function describing the RHS of (18), albeit in a different way for $t < t^*$ (where the shifting is non-parallel) and $t > t^*$ (where the shifting is parallel).[15] Notice also that in drawing figures 6-8 we implicitly assume that $\delta > (1+\theta)^{-1}$ so that, except at $t = t^*$, the RHS of (18) is decreasing in t. In Figure 9 we instead assume that $\delta < (1+\theta)^{-1}$ so that the RHS of (18) is increasing in t for $t \in [0, t^*)$.

Finally, to interpret the figures notice that, if at a given value for t the function $t/(1+t)$ lies below (resp.: above) the other function, it is socially desirable to marginally raise (resp.: lower) t. Moreover, the values for t at which the two functions intersect represent values for t that satisfy the first order condition (18).

In Figure 6 there is only one value for t, lower than t^* and denoted by t^{opt}, that satisfies the first order condition (18).[16] The single value for t that satisfies the first order condition is in this case the optimal tax rate: for all values of t smaller than t^{opt} social welfare increases when t is marginally raised, and for all values of t larger than t^{opt} social welfare decreases when t is marginally raised.

---

[15]For $t > t^*$ a marginal variation in δ changes the RHS of (18) by $-2\delta^{-2}d\delta$; for $t < t^*$ a marginal variation in δ changes the RHS of (18) by $-2\delta^{-2}\frac{1-\lambda/\theta}{1-2\lambda}d\delta$. Thus, while for $t > t^*$ a variation in δ shifts (up or down) in a parallel way the function describing the RHS of (18), this is not the case for $t < t^*$. However, given that $\lambda \to 0$ when t approaches t^* from the left, we have that $\lim_{t \to t^{*-}} 2\frac{1-\delta}{\delta}\frac{1-\lambda/\theta}{1-2\lambda} = 2\frac{1-\delta}{\delta}$. This implies that the magnitude of the jump at t^* does not vary with δ.

[16]For this to happen, a necessary condition is that the value of δ is sufficiently large (i.e., sufficiently close to 1). The condition is however not sufficient. The reason is that there can be cases when the optimal tax rate is larger than t^* also for $\delta = 1$. If this happens, the optimal tax rate will be larger than t^* for all values of $\delta \in [0.5, 1]$.
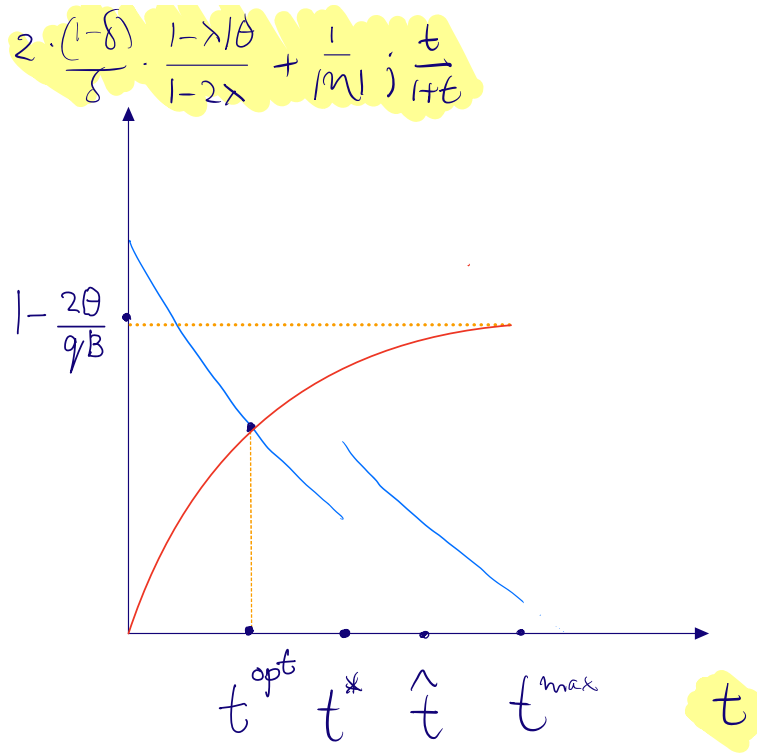
Figure 6: $\delta > (1+\theta)^{-1}$ and $t^{opt} < t^*$.

Figure 7 shows a case where a reduction in δ implies that there are two values of t, one smaller than t^* (denoted in the figure by $\underline{t}$) and the other larger than t^* (denoted in the figure by $\bar{t}$), that satisfy condition (18). For values of t smaller than $\underline{t}$ social welfare increases when t is marginally raised, for $t \in (\underline{t}, t^*)$ social welfare is decreasing in t, but for $t \in (t^*, \bar{t})$ social welfare is again increasing in t thanks to the upward jump in $1/|\eta|$. In this case, whether the optimal tax rate is given by $\underline{t}$ or by $\bar{t}$ will depend on whether or not the losses that are accumulated raising t from $\underline{t}$ to t^* are more than offset by the gains that accrue raising t from t^* to $\bar{t}$.[17]

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[17]In principle, it is also possible that social welfare is the same at $\underline{t}$ and $\bar{t}$, in which case the optimal tax rate would not be unique.
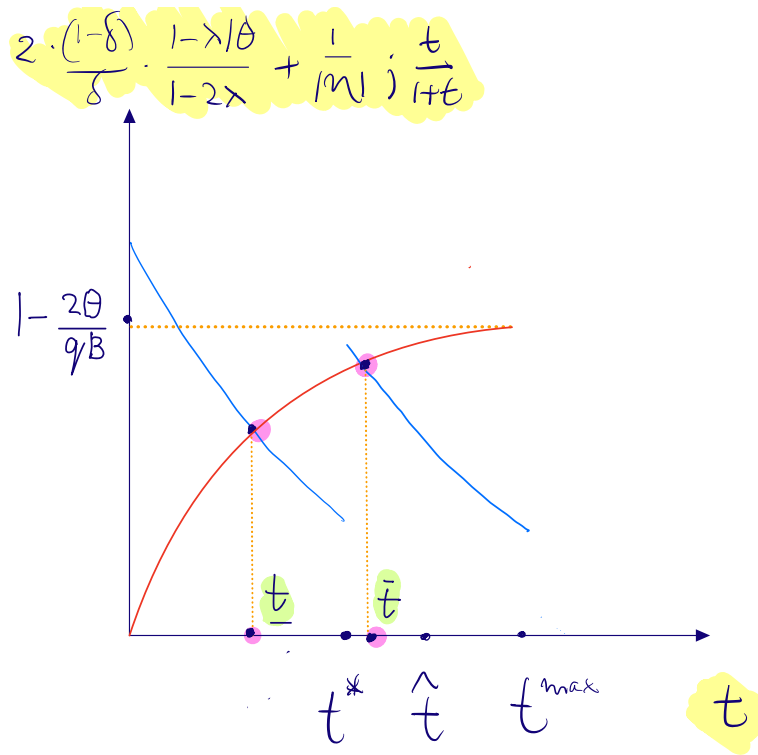
Figure 7: $\delta > (1+\theta)^{-1}$ and two locally optimal solutions.

Figures 8-9 show two cases where, further lowering δ, there is only one value for t, larger than t^* and denoted by t^{opt}, that satisfies condition (18). Once again, the single value for t that satisfies the first order condition is in this case the optimal tax rate.
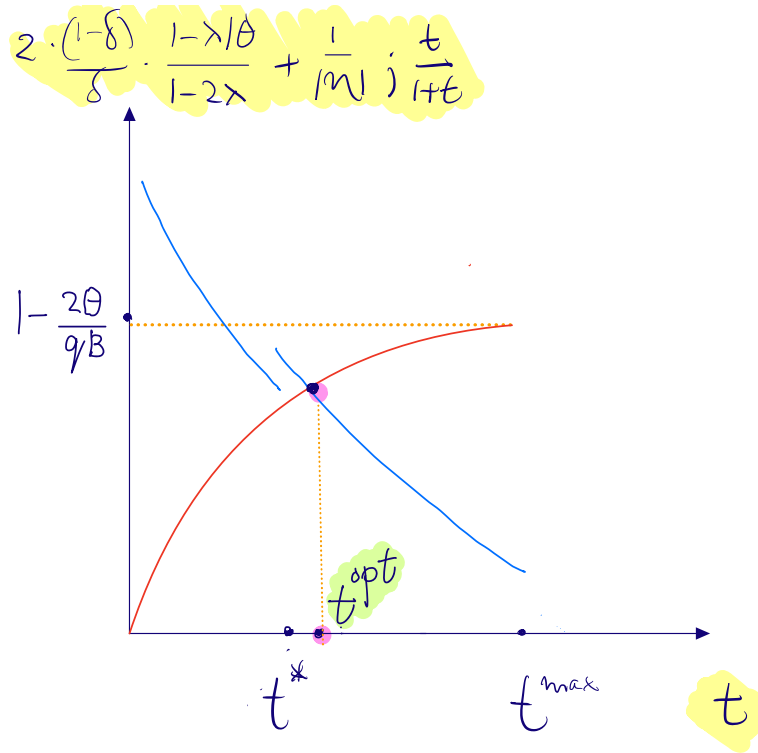
$$2 \cdot \frac{(1-\delta)}{\delta} \cdot \frac{1-\lambda/\theta}{1-2\lambda} + \frac{1}{|m|} \text{ ; } \frac{t}{1+t}$$

$$1 - \frac{2\theta}{q\beta}$$

t^{opt}

t^*

t^{max}

t

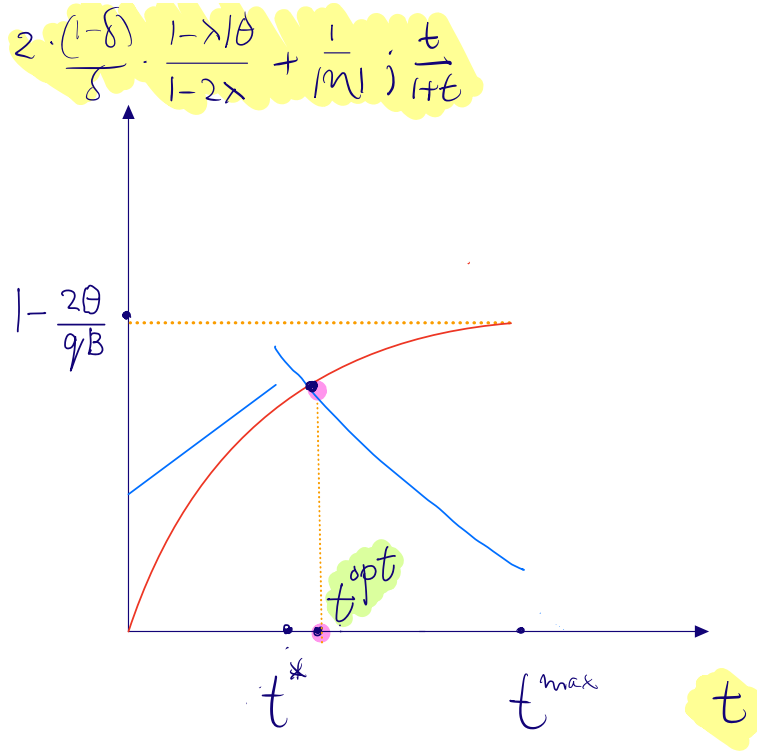Figure 8: $\delta > (1 + \theta)^{-1}$ and $t^{opt} > t^*$

Figure 9: $\delta < (1+\theta)^{-1}$

Apart from the cases when the optimal tax rate fulfills the first order condition (18), there is however the possibility that, for δ sufficiently low (i.e., close to 0.5), the optimal tax policy is given by the corner solution $t = \frac{qB}{2\theta} - 1$ (which induces $\alpha = 0$). To see this, denote by $t^{opt}(\delta)$ the optimal value for t as a function of δ, and remember that we have shown that, for $\delta \leq (1+\theta)^{-1}$, $t^{opt}(\delta)$ necessarily belongs to the set $(t^*, \frac{qB}{2\theta} - 1]$. Given our assumption that $0 < \theta < 1/2$, we have that $\min_{0<\theta<1/2}(1+\theta)^{-1} > 2/3$, and therefore $t^{opt}(\delta) \in (t^*, \frac{qB}{2\theta} - 1]$ for δ sufficiently close to its lower bound 0.5. When $t^{opt}(\delta) \in \left(t^*, \frac{qB}{2\theta} - 1\right)$, it will necessarily satisfy the first order condition (obtained from (18) by using Proposition 2)

$$\frac{t}{1+t} - 2\frac{1-\delta}{\delta} - \ln\frac{qB}{2\theta(1+t)} = 0. \tag{A31}$$

When instead $t^{opt}(\delta) = \frac{qB}{2\theta} - 1$, it will either be the case that $t^{opt}(\delta)$ satisfies the first

order condition $\frac{t}{1+t} = 2\frac{1-\delta}{\delta} + \ln \frac{qB}{2\theta(1+t)}$ or that it represents a corner solution (since $\alpha = 0$ for $t \geq \frac{qB}{2\theta} - 1$). Evaluating the LHS of (A31) for $t \to \frac{qB}{2\theta} - 1$, we have that

$$\lim_{t \to \frac{qB}{2\theta}-1} \frac{t}{1+t} - 2\frac{1-\delta}{\delta} - \ln \frac{qB}{2\theta(1+t)} = 1 - \frac{2\theta}{qB} - 2\frac{1-\delta}{\delta}. \qquad (A32)$$

Thus, given that $1 - \frac{2\theta}{qB} - 2\frac{1-\delta}{\delta} \leq 0$ for $\delta \leq \frac{2qB}{3qB-2\theta}$, and since $\frac{1}{2} < \frac{2qB}{3qB-2\theta} < 1$ (under the assumption that $0 < \theta < 1/2$ and $qB > 2\theta$), it follows that for $\delta \in \left[\frac{1}{2}, \frac{2qB}{3qB-2\theta}\right]$ the optimal tax policy will entail $t = \frac{qB}{2\theta} - 1$.

B   Online Appendix: The status production function and optimal tax differentiation

In our present analysis, for the sake of clarity and simplicity, we have made the assumption that all signaling goods exhibit symmetry in terms of their acquisition costs, visibility, and benefits derived from status. However, it is possible to extend the model and consider certain asymmetries. One approach to achieve this while maintaining tractability is to introduce a status-production technology that demonstrates perfect substitutability.

Consider a scenario where we have two distinct categories of signaling goods denoted as x_{ki}, where i ranges from 1 to n_k and k takes values of 1 or 2. Each category corresponds to a particular group of agents: for instance, category $k = 1$ may pertain to colleagues in a professional setting, while category $k = 2$ could be aimed at friends or relatives. The visibility parameters for each category are given by q_k/n_k, and the unit costs are denoted as θ_k/n_k. It is worth noting that these parameters are specific to their respective categories. Within this framework, it is also possible for the benefits derived from signaling to differ between the two groups, potentially due to inherent

variations or disparities in group sizes. Let us denote the benefit associated with group k as B_k.

Under the assumption of separable technology, the status obtained by type-2 agents can be expressed as:

$$Status^2(\alpha_1, \alpha_2) = \sum_{k=1}^{2} \left[1 - \frac{1}{2} \cdot e^{-\alpha_k q_k} \right] \cdot B_k, \tag{B1}$$

In this equation, α_k represents the proportion of type-2 agents' wealth allocated to the purchase of signaling goods in category k. The visibility parameter for each category is denoted by q_k, and B_k represents the corresponding benefit associated with signaling to the specific group.

On the other hand, the status derived by type-1 agents can be described as:

$$Status^1(\alpha_1, \alpha_2) = \sum_{k=1}^{2} \left[\frac{1}{2} \cdot e^{-\alpha_k q_k} \right] \cdot B_k, \tag{B2}$$

In this equation, the term $\frac{1}{2} \cdot e^{-\alpha_k q_k}$ represents the contribution of type-1 agents' signaling goods in category k to their status.

By assuming separability, we imply that there are zero cross-tax elasticities between the two categories. This allows us to extend our analysis by introducing differentiated commodity tax rates, denoted as t_k, for the two categories of consumption goods ($k = 1, 2$).

In extending our analysis, we generalize formula (A24), which characterizes the optimal tax formula in the baseline case with a single category of consumption goods when the inequality constraint (IC) is slack. Assuming that the (IC) constraint is slack, as demonstrated earlier for an intermediate range of δ values, we have the following expression:

$$\frac{t_k}{1+t_k} + \ln(1+t_k) = 2\frac{1-\delta}{\delta} + \ln\frac{q_k B_k}{2\theta_k}. \tag{B3}$$

In this equation, t_k represents the tax rate applied to category k of consumption goods. The left-hand side of (B3) increases with t_k. This implies that a higher tax rate is levied on goods that yield a greater return on signaling.

In the case of separable technology, tax differentiation relies on the variation in the returns on status signaling across different categories of consumption goods. By observing the increasing relationship on the left-hand side of (B3) with respect to t_k, we can conclude that a higher tax rate is imposed on goods exhibiting a higher return on signaling.

It is worth noting that an alternative assumption of full complementarity between the categories of consumption goods could be considered. Under such an assumption, all agents would observe both categories of consumption and form beliefs about the agent's type. The benefit from status (B) remains the same as in the single category case. The full benefit is obtained when at least one signal from either category is observed, and otherwise, the surplus is evenly divided between the two types. This alternative technology would result in the status measures $Status^2(\alpha_1, \alpha_2) = [1 - \frac{1}{2} \cdot e^{-\sum_{k=1}^{2}\alpha_k q_k}] \cdot B$ and $Status^1(\alpha_1, \alpha_2) = [\frac{1}{2} \cdot e^{-\sum_{k=1}^{2}\alpha_k q_k}] \cdot B$. In the case of full complementarity, the tax formula would account for cross-tax elasticities.