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Attitudes and allocations: status, cognitive dissonance, and the manipulation of attitudes

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Abstract

Economic studies of social status have typically focused on individuals engaging in relative comparisons based on certain characteristics (e.g. consumption, wealth) without considering why these characteristics are deemed “status worthy”. In this paper, individuals choose a status-earning characteristic in order to reduce mental discomfort (dissonance). As a result, those individuals with the highest marginal utility from income are often the first to misconstrue or abandon these incentives in favor of alternate forms of seeking status. The model provides an explanation for endogenous class formation and highlights the role of redistributive taxation in manipulating individuals’ attitudes towards status.

JEL classification: A12; D11; D50

Keywords: Status; Cognitive dissonance; Endogenous preferences

1. Introduction

Standard models of economic decision making contain the basic premise that individual behavior is tailored to attain the greatest level of satisfaction given fixed preferences and endowments. Thus, considerations of the effect of a policy include a focus on how the policy alters an individual’s incentives to choose behaviors that maximize utility given her preferences. While this approach has yielded insights into many aspects of individual and social behavior, it is not without its shortcomings, many arising from the limited context in which economists view behavior. As opposed to economics, other social sciences (particularly psychology) recognize that individuals may not only tailor their behavior to maximize

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satisfaction, but may also alter their attitudes or beliefs to achieve this goal. While a policy alters the incentives that individuals face in choosing behaviors, the policy may also create incentives for individuals to alter their attitudes and beliefs, thereby changing the preferences to be maximized. As a result, policies may have unintended consequences that arise from changes in preferences rather than just changes in behavior.

This paper explores how individuals' attitudes regarding social status are shaped by their relative social positions in the economy. Economists have modeled status by incorporating concerns over relative position into individual preferences. However, this approach fails to address the more fundamental question of how individuals come to deem characteristics as status worthy. To explore this issue, I assume agents who do not earn status experience dissonance (psychological discomfort) between their lack of social esteem and their desire for self-esteem. This dissonance can be reduced by either committing greater resources to status seeking or modifying one's attitudes regarding the characteristics deemed status worthy. The latter method of dissonance reduction (modifying preferences or attitudes) is one of the fundamental ideas in the theory of cognitive dissonance. By incorporating this theory, the model gives insight into the endogenous formation of classes and the role of redistributive taxation in influencing individuals' attitudes surrounding social status.

This paper is organized as follows: Section 2 reviews the related literature on status seeking and cognitive dissonance. Section 3 presents the model. Particular attention is paid to the efficiency of equilibria with cognitive dissonance, and to the role of redistributive taxes in influencing the way people deal with their disenchantment. A simple example illustrates the formation of classes and the use of taxation to manipulate attitudes. Section 4 discusses the model in light of the research on poverty and the underclass. The paper closes with a brief conclusion.

2. Review of the literature

Psychology and sociology have long recognized the role of others' consumption patterns in determining individual satisfaction. While usually not recognized as part of the neoclassical model of individual choice, economists have similarly recognized the interdependence of consuming to satisfy objective wants and acquiring the deference of others (Veblen, 1899). Frank (1985), Hirsch (1976), and Scitovsky (1992) argue that a substantial portion of individuals' satisfaction is dependent not only on how much one consumes, but on how one's level of consumption compares with that of others. As Hirsch argues, once the basic necessities of life have been fulfiled (however those necessities may be defined), the utility derived from private consumption becomes increasingly dependent on social comparisons. In this way, consumption serves the dual purpose of satisfying objective wants and competing for social rank.

The dependence of satisfaction on relative standing implies that private consumption has a quasi-public nature and, as economic intuition suggests, that private choices will be inefficient. For example, Cole et al. (1992) present a model in which agents are concerned with private utility and the signal consumption sends to potential mates. In order to prevent low wealth agents from attracting high wealth spouses, wealthy individuals compete in a positional game allocating mates. This type of non-market competition creates inefficiency via over-consumption of the signaling good.[1] In this way, the desire for status acts as a wedge between individual and social goals: individuals compete for relative position rather than (absolute) performance. While individuals may consider the former to be welfare enhancing, the latter fuels social advancement and economic growth.

Due to the scarcity of social rank, only some individuals can be deemed status worthy. In terms of psychology, individuals who fail to earn status can be considered as experiencing dissonance: a feeling generally described as psychological discomfort. The original theory of cognitive dissonance (Festinger, 1957) postulated that individuals holding inconsistent beliefs, or acting in a manner contrary to their beliefs, experience dissonance, and eliminating it is a motivator for behavioral and cognitive change. The modern theory of cognitive dissonance (Aronson, 1994; Beauvois and Joule, 1996) argues that dissonance revolves primarily around issues of self-esteem and the desire to rationalize one's actions. That is, dissonance and dissonance reducing behavior are most prevalent when an individual's actions or beliefs are in conflict with her desire to be considered a good or intelligent person. In this sense, individuals who do not earn status experience dissonance between their desire for self-esteem and their lack of social esteem.[2]

To reduce dissonance, an individual may devote greater resources to status seeking. This yields the standard result of over-consumption of the positional good. Alternately, the individual may change her attitudes regarding what determines status, thereby rationalizing her current social position. Using the language of Congleton (1989), dissonance reduction implies that status games display an "accelerating effect" with individuals devoting more resources to positional competition, and a "discouragement effect" with individuals abandoning status seeking on one characteristic in favor of another. By allowing for cognitive changes, the theory of cognitive dissonance implies that the status game itself is a choice of the consumer, not merely the mode of play (e.g. how much to consume).

While the theory of cognitive dissonance has been frequently applied in social psychology and marketing, its application in economics has been limited. Akerlof and Dickens (1982) were the first to model explicitly cognitive dissonance in an economic framework. In their paper, workers in a hazardous industry experience dissonance between their decision to work in the industry and their fear of an accident. To eliminate dissonance, workers in the hazardous industry opt to view the industry as safe and allay their fears. When safety equipment becomes available, workers may fail to adopt the equipment due to incorrect subjective beliefs over risk. In a similar vein, Rabin (1994) models a process of social change. Social morality may create dissonance within individuals who break moral codes. To reduce dissonance, an individual may revise what she deems the morally acceptable level of an activity. Dissonance reducing behavior can thereby lead to a greater number of

[1] Other inefficiencies arising as a result of status seeking include unemployment (Akerlof, 1976, 1980) and reduced technological growth (Fershtman and Weiss, 1993; Fershtman et al., 1996).

[2] While the theory of cognitive dissonance fell out of favor with the cognitivist revolution in the 1970s, it serves as a theoretical umbrella for research in social psychology. Current revisions of the original theory focus on the conditions that evoke dissonance (e.g. conflicts with self-consistency, responsibility for aversive consequences, etc.). For a review of the current state of the theory, see Harmon-Jones and Mills (1999). For a defense of the theory in light of developments since Festinger's original thesis, see Aronson (1992) and the subsequent responses.

individuals breaking the moral code as they revise upward what is considered a socially acceptable level of the activity.[3]

3. The model

To develop a model of status seeking in which agents experience cognitive dissonance, we proceed in two stages. To motivate the discussion, a standard model of status seeking with a positional good is presented. Status is assigned based on an individual's ability to consume above average. Status concerns lead individuals to exert greater effort, thereby raising average consumption above the efficient level. Since all agents behave similarly to maintain their relative position, this type of status competition leaves each individual's rank unchanged.

We then introduce the theory of cognitive dissonance into the model. Individuals who pursue but do not attain status experience dissonance between their private desire for prestige and their lack of social esteem. Individuals in this state have two methods available to reduce dissonance. First, expending greater resources (effort) increases private consumption and, hence, consumption-derived status. Alternatively, agents may choose to modify their attitudes regarding what they deem status worthy. Thus, individuals are able to choose which status game to play. Rather than view status as accruing to those who consume above average, an individual may opt to regard status as accruing to individuals who, say, consume more leisure than average. I will refer to this method of dissonance reduction as a change in an agent's "status orientation". Since different agents will choose to assign status based on different characteristics (choosing to play a "leisure status game" versus a "consumption status game"), the scarcity of social rank is alleviated and welfare is increased. Additionally, policies that alter an individual's dissonance will change the incentives to engage in dissonance reduction via attitude change. Proofs of the theoretical results are presented in Appendix A available on the journal's web page.

3.1. A simple model of status seeking behavior

To set the stage for the model incorporating cognitive dissonance, consider a basic model of status seeking behavior. The population is comprised of a continuum of agents with identical utility functions over consumption and effort. Agents are also concerned with social status. In particular, non-monetary status returns are allocated in a monotonically increasing manner based on private consumption relative to average consumption in the economy. For simplicity, it is assumed that direct utility and status are additively separable and that average consumption is observable by all in the economy. For any agent of type $i \in I$, utility is given by

$$U(x^i, e^i, \bar{x}) = u(x^i) - c(e^i) + \delta S(x^i, \bar{x}). \tag{1}$$

[3] Other applications of the theory of cognitive dissonance in economic analysis include explaining Federal Reserve behavior (Mayer, 1990), criminal behavior (Dickens, 1986), altruism norms (Montgomery, 1994), development policy (James and Gutkind, 1985), and the behavior of mutual fund investors (Goetzmann and Peles, 1997).

It is assumed that the utility from consumption $u(x^i)$ is increasing and concave while the cost of effort $c(e^i)$ is increasing and convex.

The function $S(x, \bar{x})$ assigns non-monetary status returns based on private consumption relative to average consumption $\bar{x}$. It is assumed that $S(x, \bar{x})$ depends only on the difference $x - \bar{x}$, that is, $S(x, \bar{x}) = \tilde{S}(x - \bar{x})$, where $\tilde{S}(x - \bar{x})$ is a strictly increasing, concave function satisfying $\tilde{S}(0) = 0$. The concavity of $\tilde{S}(\cdot)$ implies that agents' derive the stronger benefits from being considered "above average". In a sense, average consumption in the society plays the role of a benchmark by which individuals measure themselves, with primacy placed on being above this level. The taste parameter $\delta > 0$ measures the weight assigned status relative to absolute consumption.

To allow for differences among consumers, each agent of type i is assumed to receive a non-wage endowment, y^i, denominated in units of the consumption good (numeraire). Non-wage endowments are distributed over the interval $[y^l, y^h]$ with mean $\bar{y}$ and cumulative distribution $F(y)$.

Agents take the competitively determined wage ω as given. Wages are determined by a constant returns to scale technology employed by all firms, thereby eliminating issues surrounding profits and wage determination. This simplifying assumption allows attention to be focused on the cognitive processes and behaviors of the agents.

Each agent's objective is to maximize utility subject to the budget constraint $x^i = \omega e^i + y^i$. Substituting the constraint into Eq. (1) and differentiating with respect to effort yields the first-order condition

$$\omega \frac{\partial u(x^i)}{\partial x^i} - \frac{\partial c(e^i)}{\partial e^i} + \omega\delta \frac{\partial S(x^i; \bar{x})}{\partial x^i} = 0. \tag{2}$$

As expected, concerns over relative consumption provide incentives for agents to exert additional effort.

Given individuals' choices, the equilibrium with status seeking is inefficient as each agent fails to account for the effect of her effort choice on others. In particular, the total external harm per marginal unit of effort is

$$-\omega\delta \int_{j \in I} \alpha^j \frac{\partial s(x^j, \bar{x})}{\partial \bar{x}} \, \mathrm{d}F(j), \tag{3}$$

where α^j is the inverse of the marginal benefit from consumption for an agent of type $j \in I$. An efficient allocation can be implemented by imposing a tax τ equal to the total external harm per unit of effort (expression 3) and returning tax revenues via lump sum redistributions.[4]

Notice that agents with less than average consumption experience negative status returns, $\delta S(x^i; \bar{x}) < 0$. This negative return can be interpreted as the cost experienced when chided by the rest of society or, perhaps more applicable to what follows, the psychological dissonance arising from the inconsistency between exerting greater effort to attain status and the failure to consume above average.

[4] Alternately, if individual effort is not directly observable, the efficient level of effort could be implemented by a tax of $t = \tau/\omega$ per unit of consumption.

3.2. Incorporating dissonance reducing behavior

Following Aronson (1994), dissonance is especially acute surrounding issues of self-esteem. Individuals may therefore experience dissonance between cognitions surrounding their own status ("I am status worthy") and their inability to consume at an above average level ("I do not consume at a status worthy level").

To model dissonance reducing behavior, I assume agents are identically and immutably concerned with status but can choose how they subjectively assign social rank. That is, individuals are actively concerned with their relative position among others but can choose how these relative differences are measured. Status in this sense is more a measure of self-esteem than of the deference of others.[5] This is not an unreasonable assumption: many of the costs derived from not being able to "keep up with the Joneses" are purely internal. Individuals do not ostensibly punish those who consume at a level below their own. Rather, individuals consuming at low levels experience self-imposed costs associated with feelings of envy, disappointment, and apathy. While this assumption abstracts from any social punishment or peer pressure that may exist, it focuses attention on the role of cognition in status competition.

Agents can choose to compare themselves on one of two social indices: consumption or effort. The status assigning mechanism ranks an agent based on her private performance (on her chosen index) relative to average performance. As before, consumption-derived status is determined by an agent's private consumption relative to average consumption. Status with respect to effort is earned by exerting less than average effort. Exerting low levels of effort may imply greater consumption of leisure. Alternately, less effort allocated to deriving consumption may imply greater effort expended in other areas (e.g. religious or community activities). Some ethnographers and sociologists have argued that among the poor, exerting low effort can be status-earning although viewed as aberrant by mainstream society.[6] Low work effort may demonstrate "courage" or "fearlessness" by opposing mainstream values. As a result, individuals who see themselves as marginalized by mainstream society may abdicate social norms or work ethics in order to strengthen their sense of identity in society.

Dissonance reduction is captured by allowing agents to choose the weight assigned to each status-earning characteristic. The status function can now be written as dependent on a choice variable $\lambda^i \in [0, 1]$ summarizing the relative weight an individual assigns to consumption and effort in determining overall returns from status:

$$S(x^i, e^i, \lambda^i, \bar{x}, \bar{e}) = \lambda^i s(x^i, \bar{x}) + (1 - \lambda^i) s(\bar{e}, e^i), \tag{4}$$

where $s(x, \bar{x}) = \tilde{s}(x - \bar{x})$, $s(\bar{e}, e) = \tilde{s}(\bar{e} - e)$, and $\tilde{s}(\cdot)$ is a strictly increasing, concave function satisfying $\tilde{s}(0) = 0$. Thus an individual's status depends on how much she consumes above

[5] This is in contrast to the models of Bernheim (1994) and Cole et al. (1992) in which status generates external returns to the individual. This instrumental view of status is described in Postlewaite (1998). The approach taken in this essay is more akin to that of Frank (1988).

[6] For examinations of this premise with respect to those living in poverty, see Auletta (1982), Kelso (1994), Liebow (1967), and Rainwater (1970).

average consumption, how much effort she exerts below average effort, and how much the relative weight is assigned to each, λ^i.[7]

It might be argued that agents with similar values of λ^i represent peer groups in which λ^i is a behavioral norm. If this is the case, each of these groups could be considered a separate subculture. Given this, we might expect each subculture to discount the behavior of outsiders and compete for status solely within their group. However, many have argued that subcultures cannot be understood without reference to the society at large (Schwartz, 1991). These groups are not explicitly differentiated from others in ways permitting easy identification. Rather, they are in constant contact with mainstream society. Their adoption of behaviors that appear inconsistent with mainstream norms arise out of attempts to differentiate themselves in mainstream comparisons. Thus, their dissonance, and any associated dissonance reducing behavior, exists precisely because of their contact with mainstream society.

Given the linearity of λ^i in $S(\cdot)$, no agent will choose λ^i in the interior of $[0, 1]$. In a sense, agents have a comparative advantage in status-earning by either consuming above average or exerting below average effort. The analysis can therefore be restricted to $\lambda^i \in \{0, 1\}$. To develop a nomenclature, I will refer to agents choosing $\lambda = 1$ as "consumption" oriented and agents choosing $\lambda = 0$ as "leisure" oriented. I will assume that agents initially hold a consumption orientation towards status. Thus, dissonance reduction by way of attitude modification (choosing a leisure orientation) requires deviating from society's norm.[8]

Modifying one's attitudes (choosing $\lambda^i = 0$) is not without a cost. Following Festinger and Eagly and Chaiken (1993), changing attitudes involves gathering and processing new information, re-evaluating past behavior, and breaking cognitive habits. We can think of agents as facing "cognitive constraints" that limit their ability to modify beliefs and attitudes. To capture this cognitive cost, it is assumed that the cost of changing one's attitudes towards status is $\gamma \geq 0$. Thus, attitude changes are systematic: individuals change status orientations only when the benefits of attitude change (i.e. dissonance reduction) exceeds the costs of doing so. By incurring the cost γ an agent can be thought of as altering her stock of "psychological capital" to maximize utility. This is analogous to the consumption capital approach of Stigler and Becker (1977). By interpreting changes in attitudes in this way, the model captures the possibility that an agent may find dissonance reduction by way of attitude modification too costly.

Agent i's maximization problem can now be written as

$$\max_{x^i, e^i, \lambda^i} U(x^i, e^i, \lambda^i, \bar{x}, \bar{e}) = u(x^i) - c(e^i) + \delta[\lambda^i s(x^i, \bar{x}) + (1 - \lambda^i) s(\bar{e}, e^i)] - (1 - \lambda^i)\gamma, \quad (5)$$

[7] This modeling approach is similar to the ideas of Durkheim (1912): individuals maximize utility not only through behavior but by adopting a view of reality consistent with their well-being. These views of reality have a direct effect on behavior, affecting one's work ethic, political views, and social behavior. For an application of Durkheim's ideas to economics, see Akerlof (1989).

[8] This follows Hirsch (1976) and Scitovsky (1992) who argue that consumption is a primary indicator of social rank. Similar arguments are made by Auletta (1982), Behr (1995), and Kelso (1994).

subject to $x^i = \omega e^i + y^i$. The bracketed term represents status returns dependent on the agent's orientation. The final term is the cognitive cost incurred if the agent modifies her attitude towards status.[9]

Substituting in the budget constraint and maximizing yields the following first-order conditions on effort for agents choosing a consumption orientation (Eq. (6) where $\lambda^i = 1$) and a leisure orientation (Eq. (7) where $\lambda^i = 0$):

$$\omega \frac{\partial u(x^i)}{\partial x^i} - \frac{\partial c(e^i)}{\partial e^i} + \delta\omega \frac{\partial s(x^i, \bar{x})}{\partial x^i} = 0, \tag{6}$$

$$\omega \frac{\partial u(x^i)}{\partial x^i} - \frac{\partial c(e^i)}{\partial e^i} + \delta \frac{\partial s(\bar{e}, e^i)}{\partial e^i} = 0. \tag{7}$$

Let $X(y^i, \bar{x}, \bar{e})$ be the set of solutions to the program (5). Let $V(y^i, \bar{x}, \bar{e})$ be the corresponding maximum value function.

We can interpret the agent's choice of $\lambda^i \in \{0, 1\}$ as putting the agent into one of two regimes. Let $X_\lambda(y^i, \bar{x}, \bar{e})$ be the set of solutions to the program (5) under the additional constraint that the agent is restricted to regime $\lambda \in \{0, 1\}$. Let $(x^i_\lambda, e^i_\lambda)$ be an element of $X_\lambda(y^i, \bar{x}, \bar{e})$.

To allow for the possibility that all agents of a given type are not necessarily in the same status regime, let m^i_λ be the proportion of agents of type i who choose $\lambda^i = \lambda \in \{0, 1\}$. An allocation can now be thought of as a triple $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ assigning each agent of each type i a status orientation λ, along with a level of consumption and effort. The allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is feasible if

$$m^i_1 + m^i_0 = 1; \quad \forall i \in I,$$

and

$$\int_I (x^i_1 m^i_1 + x^i_0 m^i_0)\, \mathrm{d}F(i) = \omega \int_I (e^i_1 m^i_1 + e^i_0 m^i_0)\, \mathrm{d}F(i) + \int_I y^i\, \mathrm{d}F(i).$$

We can now define equilibrium with malleable attitudes.

Definition 1. An equilibrium with dissonance reduction is a feasible allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ such that

(i) $(x^i_\lambda, e^i_\lambda, \lambda) \in X(y^i, \bar{x}, \bar{e})$, for every $i \in I$ and $\lambda \in \{0, 1\}$ with $m^i_\lambda > 0$, and
(ii) agents' individual behaviors are consistent with average behaviors:

$$\bar{x} = \int_I (x^i_1 m^i_1 + x^i_0 m^i_0)\, \mathrm{d}F(i),$$

and

$$\bar{e} = \int_I (e^i_1 m^i_1 + e^i_0 m^i_0)\, \mathrm{d}F(i).$$

[9] The model described in the previous sub-section can be considered a special case of this model with $\gamma = \infty$.

Let $U_\lambda(x^i_\lambda, e^i_\lambda, \bar{x}, \bar{e})$ be the utility of agent i having made status orientation choice λ and receiving the consumption and effort allocation $(x^i_\lambda, e^i_\lambda)$. The allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ with averages $(\bar{x}, \bar{e})$ involves equal treatment within type i if

$$U_1(x^i_1, e^i_1, \bar{x}, \bar{e}) = U_0(x^i_0, e^i_0, \bar{x}, \bar{e}).$$

This condition will hold in any equilibrium allocation for all types i such that $m^i_\lambda \in (0, 1)$. Thus, in equilibrium agents cannot benefit by altering their attitudes.

Except in the trivial case when the measure of agents who choose the leisure regime is equal to zero, allowing for dissonance reduction increases the welfare of all agents.

Proposition 1. *Assume $\int_I m^i_0 \,\mathrm{d}F(i) > 0$. Then, in the equilibrium allowing for dissonance reduction by way of attitude modification, the welfare levels of all consumption oriented individuals and of all effort oriented individuals are strictly greater than when λ^i is not a choice variable.*

This proposition expresses the fact that dissonance reduction, although not normally considered congruent with economic rationality, is welfare enhancing. Note that, as modeled, cognitive dissonance reduces the scarcity of social rank by introducing multiple positional characteristics for status-earning. Further, agents of different status orientations create positive externalities for one another. Leisure oriented agents impose a positive externality on consumption oriented agents by consuming less, thereby lowering average consumption. This is due not to low endowments, but to an orientation which creates non-monetary returns from exerting low effort. Likewise, consumption oriented agents exert greater effort and raise the average level of effort, thereby increasing the status of leisure oriented agents.

The striking part of this proposition is the implication that status conscious agents benefit from separating into behaviorally distinct classes: agents prefer a socially stratified society over one without classes. In a sense, members of one class benefit psychologically by incorporating the other class as a frame of reference to gauge relative performance.

We now address the efficiency of an equilibrium with dissonance reduction.

Definition 2. Given two feasible, equal treatment allocations $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ and $\{(\hat{m}^i_\lambda, \hat{x}^i_\lambda, \hat{e}^i_\lambda)_{i\in I}\}$ with averages $(\bar{x}, \bar{e})$ and $(\hat{x}, \hat{e})$, the latter Pareto improves the former if

$$U_\lambda(\hat{x}^i_\lambda, \hat{e}^i_\lambda, \hat{x}, \hat{e}) \geq U_\lambda(x^i_\lambda, e^i_\lambda, \bar{x}, \bar{e}); \quad \forall i \in I, \ \ \forall \lambda \in \{0, 1\},$$

with a strict inequality for at least one $i \in I$, $\lambda \in \{0, 1\}$.

Definition 3. A feasible, equal treatment allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is unconstrained (Pareto) efficient if there does not exist another feasible, equal treatment allocation that Pareto improves.

Definition 4. A feasible, equal treatment allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is constrained (Pareto) efficient given $\{(m^i_\lambda)_{i\in I}\}$ if there does not exist a feasible equal treatment allocation $\{(m^i_\lambda, \hat{x}^i_\lambda, \hat{e}^i_\lambda)_{i\in I}\}$ that Pareto improves.

Intuitively, a constrained efficient allocation is efficient when given agents' status orientations are held fixed (for example, at their laisse-faire values). It can be thought of as an optimal solution to the problem faced by an idealized social planner *after* agents have made their choices regarding dissonance reduction. By contrast, an unconstrained efficient allocation can be thought of as an optimal solution to the problem faced by an idealized social planner *before* agents have made choices regarding dissonance reduction. Notice that the distinction between constrained and unconstrained efficiency implies that policies aimed at correcting for inefficient status seeking may have an effect on the distribution of status orientations by altering economy-wide averages. Thus, we can begin to think of efficiency not only in terms of the allocation of effort, but also in terms of the distribution of attitudes (regime choices).

Analogous to the standard model of status seeking, an equilibrium with dissonance reduction is typically not constrained efficient as agents fail to account for the external effects of increasing their effort. The total external harm to consumption oriented agents of each marginal unit of effort is

$$-\delta\omega \int_{j\in I} \alpha_1^j \frac{\partial s(x^j, \bar{x})}{\partial \bar{x}} m_1^j \, \mathrm{d}F(j), \tag{8}$$

where α_1^j is the inverse of the marginal benefit from income for an agent of type j in regime $\lambda = 1$. Similarly, the total external harm to leisure oriented agents of each marginal unit of effort is

$$-\delta \int_{j\in I} \alpha_0^j \frac{\partial s(\bar{e}, e^j)}{\partial \bar{e}} m_0^j \, \mathrm{d}F(j), \tag{9}$$

where α_0^j is the inverse of the marginal benefit from income for an agent of type j in regime $\lambda = 0$. (Notice that this "harm" is negative since $(\partial s(\cdot)/\partial \bar{e}) > 0$.) As in the basic model, a constrained efficient allocation can be implemented by imposing a Pigouvian tax τ equal to the total external harm per unit of effort (expressions 8 and 9) and returning tax revenues via lump sum redistributions.

To formalize, notice that with a per unit labor tax τ and lump sum tax redistribution R^i, the agent's maximization program becomes

$$\max_{x^i, e^i, \lambda^i} U(x^i, e^i, \lambda^i, \bar{x}, \bar{e}) = u(x^i) - c(e^i) + \delta[\lambda^i s(x^i, \bar{x}) + (1-\lambda^i) s(\bar{e}, e^i)] - (1-\lambda^i)\gamma, \tag{10}$$

subject to $x^i = (\omega - \tau)e^i + y^i + R^i$. Let $\hat{X}(y^i, \tau, R^i, \bar{x}, \bar{e})$ be the set of solutions to the program (10) and $\hat{V}(y^i, \tau, R^i, \bar{x}, \bar{e})$ be the corresponding maximum value function. Relatedly let $\hat{X}_\lambda(y^i, \tau, R^i, \bar{x}, \bar{e})$ be the set of solutions to the program (10) and $\hat{V}_\lambda(y^i, \tau, R^i, \bar{x}, \bar{e})$ be the corresponding maximum value function under the additional constraint that the individual is restricted to the regime choice $\lambda \in \{0, 1\}$.

Since agents of the same type in different status regimes may receive different redistributions, let R_λ^i be the redistribution received by an agent of type i having chosen status regime

λ. Redistributions $\{(R^i_\lambda)_{i\in I}\}$ are feasible if

$$\int_I (R^i_1 m^i_1 + R^i_0 m^i_0)\,\mathrm{d}F(i) = \tau\bar{e}.$$

The tax τ and redistributions $\{(R^i_\lambda)_{i\in I}\}$ alter the laisse-faire equilibrium as follows.

Definition 5. An unconstrained (Pigouvian) equilibrium with dissonance reduction is a feasible, equal treatment allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ with effort tax τ and feasible redistributions $\{(R^i_\lambda)_{i\in I}\}$ such that $R^i_1 = R^i_0 = R^i$ and

(i) $(x^i_\lambda, e_\lambda, \lambda) \in \hat{X}(y^i, \tau, R^i, \bar{x}, \bar{e})$, for all $i \in I$ and all $\lambda \in \{0, 1\}$ with $m^i_\lambda > 0$,
(ii) agents' individual behaviors are consistent with average behaviors:

$$\bar{x} = \int_I (x^i_1 m^i_1 + x^i_0 m^i_0)\,\mathrm{d}F(i),$$

and

$$\bar{e} = \int_I (e^i_1 m^i_1 + e^i_0 m^i_0)\,\mathrm{d}F(i),$$

(iii) $\tau = -\delta\omega \int_{j\in I} \alpha^j_1 \frac{\partial s(x^j,\bar{x})}{\partial x} m^j_1\,\mathrm{d}F(j) - \delta \int_{j\in I} \alpha^j_0 \frac{\partial s(e,\bar{e}^j)}{\partial e} m^j_0\,\mathrm{d}F(j)$

where

$$\alpha^j_1 = \left(\frac{\partial u(x^j)}{\partial x^j} + \delta\frac{\partial s(x^j,\bar{x})}{\partial x^j}\right)^{-1},$$

$$\alpha^j_0 = \left(\frac{\partial u(x^j)}{\partial x^j}\right)^{-1}.$$

Definition 6. Given $\{(m^i_\lambda)\}_{i\in I}$, a constrained (Pigouvian) equilibrium with dissonance reduction is a feasible, equal treatment allocation $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ along with effort tax τ and redistributions $\{(R^i_\lambda)_{i\in I}\}$ satisfying conditions (ii) and (iii) above as well as

(i′) $(x^i_\lambda, e^i_\lambda) \in \hat{X}_\lambda(y^i, \tau, R^i_\lambda, \bar{x}, \bar{e})$, for all $i \in I$ and all $\lambda \in \{0, 1\}$ with $m^i_\lambda > 0$.

Intuitively, a constrained Pigouvian equilibrium with dissonance reduction is an equilibrium in which status orientations are taken as given when determining the optimal tax per unit of effort. That a laisse-faire allocation does not even lead to a constrained efficient allocation follows from the following proposition.

Proposition 2. *Any feasible, equal treatment allocation* $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ *is constrained* (*Pareto*) *efficient iff it is a constrained* (*Pigouvian*) *equilibrium with dissonance reduction for some feasible redistributions* $\{(R^i_\lambda)_{i\in I}\}$.

Consider the case in which $\tau > 0$. Here, efficiency requires agents to reduce their individual effort levels, thereby reducing the average levels of consumption and effort in the economy.[10] As expected, the tax reduces the marginal benefit of exerting effort for all agents. Given that the tax engenders lower levels of average behaviors, there may be agents who would prefer a different status orientation than that chosen prior to the implementation of the tax τ. That is, given the constrained Pigouvian redistribution R^i_λ,

$$\hat{V}_{\lambda'}(y^i, \tau, R^i_\lambda, \bar{x}, \bar{e}) > \hat{V}_\lambda(y^i, \tau, R^i_\lambda, \bar{x}, \bar{e}); \quad \lambda' \neq \lambda, \tag{11}$$

for some agents. Thus, while the constrained equilibrium is efficient in the allocation of effort, it is not fully efficient since the welfare of some agents could be improved were they able to reconsider their method of dissonance reduction.[11] This is the idea behind an unconstrained equilibrium.

An unconstrained equilibrium can be thought of as a solution to the social planner's problem prior to agents' choices of dissonance reduction. Thus, the social planner has the ability to use taxation and redistribution to influence agents' choices regarding dissonance reduction. This ability derives from the tax τ (i) altering average consumption and effort levels and (ii) redistributions changing agents' non-wage incomes and relative consumption possibilities. This highlights an interesting but neglected aspect of redistributive taxation. By changing economy averages and non-wage incomes, the equilibrium regime choice of each agent is dependent upon the redistribution she receives. As such, one can think of redistribution as a tool for influencing or manipulating the methods agents choose to reduce dissonance.

We can therefore think of an unconstrained equilibrium as efficient not only in the allocation of effort, but also in the distribution of attitudes $\{(m^i_\lambda)_{i\in I}\}$ and hence in the methods of dissonance reduction. There is one interesting caveat: while an unconstrained equilibrium leads to an allocation that satisfies all the first-order necessary conditions for Pareto efficiency, dissonance reduction by way of attitude modification may introduce a non-convexity into the program of a social planner searching for a globally efficient allocation. Thus, the first-order necessary conditions may not be sufficient for global efficiency. In other words, an unconstrained (Pigouvian) equilibrium may be only locally efficient.

Proposition 3. *If* $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ *is unconstrained* (*Pareto*) *efficient, then* $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ *along with appropriate tax* τ *and redistributions* $\{(R^i_\lambda)_{i\in I}\}$ *form an unconstrained* (*Pigouvian*) *equilibrium. Conversely, if* $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$, τ, *and* $\{(R^i_\lambda)_{i\in I}\}$ *form a* (*Pigouvian*) *equilibrium, then* $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ *satisfies all the first-order necessary conditions for an unconstrained* (*Pareto*) *efficient allocation.*

As Elster (1983) points out, the analysis raises a larger issue: is Pareto efficiency applicable to this type of problem? Attitudes are now modified by a largely unconscious cognitive process that clouds the question of efficiency. However, in the context of the model, agents alter their attitudes within a stable preference set when they consider consumption based

[10] When $\tau < 0$, efficiency requires that all agents exert greater effort. This may typify an under-developed economy in which the existing status norm is more closely tied to non-consumption or non-work activities.

[11] As in George (2001), one might argue that the market failure introduced by status seeking leads to an inefficient "production of preferences". That is, in the constrained equilibrium, the attitudes adopted by individuals do not necessarily maximize their welfare.

social status to be out of their reach. Further, changing one's attitudes is costly. Given this cost, efficiency requires that agents only modify their attitudes and incur this cost only if they truly cannot reduce dissonance through increased effort and consumption. The typical "rat race" phenomenon implies that consumption is "too" high. As a result, average consumption sends an exaggerated signal regarding what society considers deserving of prestige. Just as a laisse-faire equilibrium is inefficient when attitude change is impossible, it is doubly inefficient when preference changes are present. Inefficiency in terms of attitude change derives from agents basing their choice of status regime on the inefficient level of average consumption under laisse-faire. Thus, a portion of the population has unnecessarily incurred the costs required to reorient themselves regarding what they deem status worthy.

This approach is different than the meta-preference or multiple-self-approaches put forth by Elster (1986), George (2001) and Thaler and Shefrin (1981). In this line of research, preference changes arise due to a tension between first-order preferences (those of a myopic doer) and meta- or second-order preferences (those of a farsighted planner). Efficiency is less clear in this literature as it is not obvious which preferences should be given primacy when maximizing utility. The differences between the stable utility metric approach taken here, in Stigler and Becker, and elsewhere and the meta-preference approach is in many ways a philosophical issue and beyond the scope of the present analysis.

3.3. An example

To illustrate the various equilibrium concepts and the role of taxation in changing individuals' attitudes towards status, consider a simple example. To begin, assume $u(x^i) = x^i$, $s(a, b) = a - b$, and $c(e^i) = (1/2)(e^i)^2$. This implies that agents have constant marginal benefits from income and that effort choices are independent of both endowments and average behaviors (except insofar as these affect the choice of regime). In particular, under laisse-faire

$$e_1^* = \omega(1 + \delta); \quad \forall i \text{ choosing } \lambda^i = 1, \tag{12}$$

$$e_0^* = \omega - \delta; \quad \forall i \text{ choosing } \lambda^i = 0. \tag{13}$$

Further, assume non-wage endowments are distributed uniformly over $[0, y^h]$ where

$$y^h > \delta(\omega + 1)^2 + \frac{2\gamma}{\delta}. \tag{14}$$

This ensures the distribution of income is sufficiently unequal to make deviation from the status norm optimal for some positive measure of the population.

Together, these assumptions imply the existence of a unique pivotal agent with income $\tilde{y}$ who is indifferent between the two status orientations. The pivotal type $\tilde{y}$ is implicitly defined by the equation

$$V_1(\tilde{y}; \bar{x}, \bar{e}, \omega, \delta, \gamma) = V_0(\tilde{y}; \bar{x}, \bar{e}, \omega, \delta, \gamma). \tag{15}$$

Solving explicitly for $\tilde{y}$ yields

$$\tilde{y} = \frac{[(\delta/2)(\omega + 1)^2 - (\gamma/\delta) + \delta\bar{y}]y^h}{y^h + \delta(\omega + 1)^2}. \tag{16}$$

This is the laissez-faire equilibrium. Agents with income above $\tilde{y}$ display an "accelerating effect" with respect to consumption, gaining status by exerting greater effort to raise private consumption. Agents with non-wage income below the threshold level display a "discouragement effect" with respect to consumption-derived status and reduce dissonance by choosing $\lambda^i = 0$. The fraction of the population modifying its preferences, $F(\tilde{y})$, could be characterized as pessimistic or disenchanted with the traditional mechanism of social recognition.[12]

As previously discussed, the equilibrium is (constrained) inefficient. That is, it is inefficient in the allocation of effort given the agents' choices regarding the means of dissonance reduction (the distribution of attitudes). Using Eq. (10), the tax necessary to implement a Pareto improvement is

$$\tau(\tilde{y}) = (1 - F(\tilde{y}))\frac{\delta\omega}{1+\delta} - F(\tilde{y})\delta > 0. \tag{17}$$

More interesting, the equilibrium is unconstrained inefficient as well. In other words, the equilibrium is inefficient in the distribution of attitudes. To see this, let $\hat{\omega} = \omega - \tau(\tilde{y})$. Substituting $\hat{\omega}$ into Eq. (16) in place of ω and assuming equal redistribution ($R^i_\lambda = \bar{R}$, for all i and λ), we find $(\partial\tilde{y}/\partial\hat{\omega}) > 0$ and hence $(\partial F(\tilde{y})/\partial\hat{\omega}) > 0$.[13] That is, the reduction in aggregate effort and consumption implemented by the tax is sufficient for some agents to wish they had chosen a different status orientation.

In the unconstrained equilibrium, the Pigouvian tax is implemented before agents choose their methods of dissonance reduction, and thereby it alters the incentives they face in choosing to abide by or abandon the status norm. The fraction of the population choosing to deviate from the status norm under the unconstrained equilibrium $F(\hat{y})$ is obtained by solving for the agent with income $\hat{y}$ who is indifferent between dissonance reduction via effort exertion and attitude change.[14] That is, $\hat{y}$ solves

$$\hat{V}_1(\hat{y}; \hat{x}, \hat{e}, \hat{\omega}, \delta, \gamma) = \hat{V}_0(\hat{y}; \hat{x}, \hat{e}, \hat{\omega}, \delta, \gamma), \tag{18}$$

where

$$\hat{e} = (1 - F(\hat{y}))\hat{\omega}(1+\delta) + F(\hat{y}))(\hat{\omega} - \delta), \tag{19}$$

$$\hat{x} = \hat{\omega}\hat{e}, \tag{20}$$

$$\hat{\omega} = \omega - \tau(\hat{y}) = \omega - (1 - F(\hat{y}))\frac{\delta\omega}{(1+\delta)} + F(\hat{y})\delta. \tag{21}$$

Fig. 1 illustrates the fractions of the population choosing to reduce dissonance by way of attitude modification under both the laissez-faire ($F(\tilde{y})$) and unconstrained equilibria ($F(\hat{y})$)

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[12] One may consider the cost γ to be an increasing function of the fraction of the population abiding by the norm. Thus, as discussed in Kuran (1995), it may be more difficult for agents to abandon the status norm when a large fraction of the population continues to seek status based on relative consumption.

[13] Notice, since relative comparisons matter in determining $\tilde{y}$, the use of equal redistributions does not in and of itself alter the fraction of the population abandoning the status norm. Allowing for redistributions that provide more to those with low endowments would further reduce the fraction of the population deviating from the status norm.

[14] In this example, the unconstrained Pigouvian equilibrium is not only locally efficient, but also globally efficient.

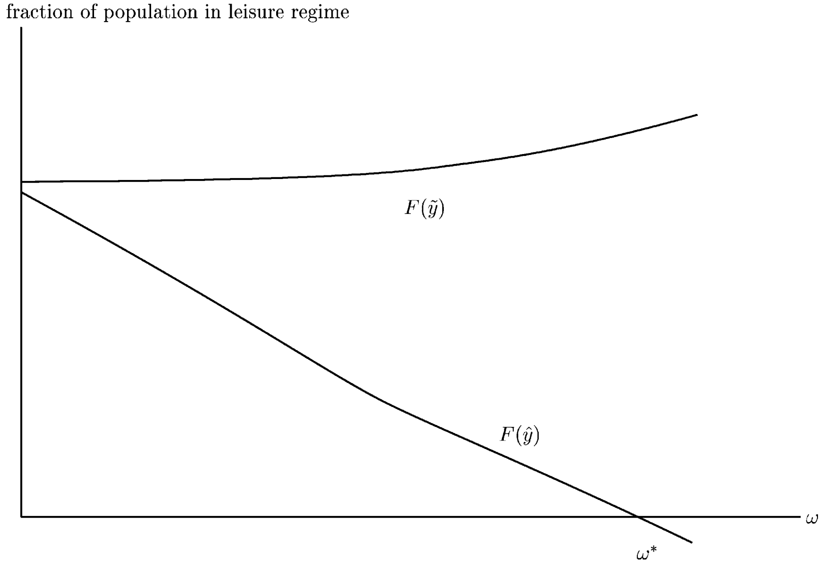

Fig. 1. Manipulating attitudes via taxation: the fraction of the population deviating from status norm as a function of wages.

as a function of the wage level. Notice that the fraction of the population choosing a leisure orientation under laisse-faire is increasing in ω. This follows directly from Eq. (16) where $(\partial\tilde{y}/\partial\omega) > 0$. However, the fraction of the population choosing the leisure regime under the unconstrained equilibrium $F(\hat{y})$ is strictly decreasing in ω: as the marginal productivity of labor rises, it becomes less efficient to have any agents reduce dissonance by abandoning the status norm. In fact, since $F(\hat{y})$ is bounded below by zero, values of $\omega > \omega^*$ imply that no agent will choose the leisure regime in the unconstrained equilibrium.[15]

Thus, if a social planner could implement a tax on effort prior to individuals making their choices regarding methods of dissonance reduction, fewer agents would opt for attitude modification. As a result, taxation serves as a means of mitigating the dissonance of those with low endowments and reduces the level of deviation from the status norm. This demonstrates how taxation can effect both the direct incentives to exert effort and the indirect incentives that determine compliance or abandonment of the status seeking norm.

4. Discussion

A natural place to consider the model presented here is in the literature on poverty and the underclass Auletta (1982), Kelso (1994), and Wilson (1987). Much research has explored the psychological consequences of poverty. Depression, feelings of disenfranchisement

[15] This type of process may shed light on the role of income inequality in economic growth (Aghion et al., 1999). The role of attitude change in economic development is discussed in Oxoby (2001b).

and apathy are often concentrated among those with low endowments. Perhaps more importantly, these feelings may engender behaviors that, from a casual observer's point of view, appear to exacerbate rather than mitigate one's poverty and associated emotions. The term "underclass" is often used to differentiate the class exhibiting these behaviors from those living in poverty. Typically the underclass is defined as the

> group of individuals who lack training and skill and either experience long term unemployment or are not members of the labor force, individuals who engage in street crime and other forms of aberrant behavior, and families that experience long term spells of poverty and/or welfare dependency (Wilson, p. 8).

Drawing on the work of Merton (1968), Kelso argues that changes in American culture emphasizing social status and affluence have left those living in poverty in a state of *anomie*: they experience an inconsistency between cultural goals and the means available to fulfill these goals. As a result, members of the underclass abandon traditional norms and seek to fulfill alternate goals via alternate means. Emphasizing the breakdown of traditional norms, Auletta and Kelso explain the higher levels of crime, drug use, and out of wedlock births seen in the underclass.

The model here can explain the behaviors exhibited by those considered the underclass by accounting for the process of cognitive adaptation that these individuals undergo (see Oxoby, 2001a). Their behaviors are not necessarily the result of irrationality or responses to incentives to engage in crime or exit the labor force. Rather, these behaviors may naturally arise through a process of dissonance reduction by which attitudes towards status seeking are modified and the power of traditional incentives is reduced. As the current model suggests, there may be efficiency consequences associated with these changes as individuals psychologically adapt to their situations and positions in society. To the extent that redistribution can reduce feelings of dissonance or anomie experienced by those living in poverty, costly attitude change is avoided and welfare is increased.

From a Paretian efficiency standpoint, the potential to reduce costly attitude change among a fraction of the population may yield additional benefits driven by other externalities. For example, reducing the potential for individuals to abandon social norms may reduce the incidence of criminal behaviors and long term unemployment. Mitigating the abdication of work ethics may enhance policies for battling urban under-development. In some cases, reducing the penchant to adopt a leisure orientation towards status may raise the average level of effort in an economy, something particularly important in cases where human capital or work effort display limited increasing returns.

5. Conclusion

The existing literature on status seeking takes agents' status orientation as a primitive aspect of preferences. However, if economists' rational choice framework is to clarify the behavioral differences between agents of different classes, this framework must be expanded to allow for the psychological processes that act upon human desires. This not only enriches the modeling techniques of economics, but also reconciles the economic method with those of other social sciences.

This paper incorporates the theory of cognitive dissonance into a model of status seeking behavior. Given the importance of social status and recognition in one's self-esteem, this is an apt area to incorporate this psychological theory. The model provides a means of discussing efficiency not only in the allocation of resources, but also in distribution of attitudes. In exploring the efficiency of the latter, we have seen how redistributive taxation can be used to manipulate the means individuals use to reduce dissonance.

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Appendix A. Proofs of propositions

Proof of Proposition 1. Let $\{(x^i, e^i)_{i\in I}\}$ be a status seeking equilibrium when λ is not a choice variable. Let $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ be a status seeking equilibrium with dissonance reduction (where λ is a choice variable). Let $(\bar{x}, \bar{e})$ and $(\bar{x}_\lambda, \bar{e}_\lambda)$ be the corresponding average levels of consumption and effort.

If $\bar{e}_\lambda < \bar{e}$ (and hence $\bar{x}_\lambda < \bar{x}$) then clearly

$$V_1(y^i, \bar{x}_\lambda, \bar{e}_\lambda) > V_1(y^i, \bar{x}, \bar{e}); \quad \forall i \text{ such that } \lambda = 1.$$

Thus, all agents with $\lambda = 1$ are better off when λ is a choice variable. Further

$$V_0(y^i, \bar{x}_\lambda, \bar{e}_\lambda) \geq V_1(y^i, \bar{x}_\lambda, \bar{e}_\lambda) > V_1(y^i, \bar{x}, \bar{e}); \quad \forall i \text{ such that } \lambda = 0.$$

Hence, all agents with $\lambda = 0$ are also better off when λ is a choice variable.

To complete the proof, consider the possibility that $\bar{e}_\lambda \geq \bar{e}$. Let $\Delta\bar{e} = \bar{e}_\lambda - \bar{e} \geq 0$. Then for all i with $\lambda = 1$ the marginal benefit of effort has increased by $\Delta\bar{e}$ (recall $s(x, \bar{x})$ depends only on the difference $x - \bar{x}$). Since the marginal cost of effort is increasing,

$$e^i_\lambda - e^i \leq \Delta\bar{e}; \quad \forall i \text{ such that } \lambda = 1.$$

For all i such that $\lambda = 0$, the marginal benefit of effort is reduced. Therefore,

$$e^i_\lambda - e^i < 0; \quad \forall i \text{ such that } \lambda = 0.$$

Together these imply

$$\bar{e}_\lambda - \bar{e} < \Delta\bar{e},$$

contradicting the original assumption. Thus, all agents are better off when λ is a choice variable. □

Proof of Proposition 2. Let $\{(\hat{m}^i_\lambda, \hat{x}^i_\lambda, \hat{e}^i_\lambda)_{i\in I}\}$ be an equal treatment allocation with average consumption $\hat{x}$ and final utilities $\hat{U}^i$ where

$$\hat{U}^i = u(\hat{x}^i_1) - c(\hat{e}^i_1) + \delta s(\hat{x}^i_1, \hat{x}).$$

Let T^i_λ be a tax imposed on each individual i in regime λ.

Consider the following Pareto program in which one tries to maximize total tax revenue subject to all agents achieving at least their utility $\hat{U}^i$ and attitudes remaining fixed. Clearly, $\{(\hat{m}^i_\lambda, \hat{x}^i_\lambda, \hat{e}^i_\lambda)_{i\in I}\}$ is constrained Pareto efficient iff it solves the Pareto program with $\int (T^i_1 m^i_1 + T^i_0 m^i_0) = 0$: no money can be raised by feasibly rearranging resources if everyone's final utility must be at least $\hat{U}^i$ when each m^i_λ is fixed at $\hat{m}^i_\lambda$. (The positive constant ψ in the objective function below is added for convenience. In particular, it will be convenient to let $\psi = 1 + \int_{j\in I} \hat{m}^j_1 \delta(\partial s(\hat{x}^j_1, \hat{x})/\partial \hat{x})\, \mathrm{d}F(j)$.)

The maximization program can be written as

$$\max_{x^i_\lambda, e^i_\lambda, T^i_\lambda} \psi \int_I (T^i_1 m^i_1 + T^i_0 m^i_0)\, \mathrm{d}F(i), \tag{A.1}$$

subject to

$$m^i_1[u(x^i_1) - c(e^i_1) + \delta s(x^i_1, \bar{x})] \geq m^i_1 \hat{U}^I, \tag{A.2}$$

$$m^i_0[u(x^i_0) - c(e^i_0) + \delta s(\bar{e}, e^i_0) - \gamma] \geq m^i_0 \hat{U}^I, \tag{A.3}$$

$$x^i_\lambda = \omega e^i_\lambda + y^i - T^i_\lambda, \tag{A.4}$$

$$\bar{e} = \int_I (e^i_1 m^i_1 + e^i_0 m^i_0)\, \mathrm{d}F(i), \tag{A.5}$$

$$\bar{x} = \omega \bar{e} + \bar{y} - \int_I (T^i_1 m^i_1 + T^i_0 m^i_0)\, \mathrm{d}F(i), \tag{A.6}$$

where each $m^i_\lambda = \hat{m}^i_\lambda$. Notice that constraints (A.2) and (A.3) require equal treatment.

Substituting constraints (A.4)–(A.6) into the objective function, the first-order conditions on taxes T^i_1 and T^i_0 imply

$$\alpha^i_1 = \left(\frac{\partial u(x^i_1)}{\partial x^i_1} + \delta \frac{\partial s(x^i_1)}{\partial x^i_1}\right)^{-1}, \tag{A.7}$$

$$\alpha^i_0 = \left(\frac{\partial u(x^i_0)}{\partial x^i_0}\right)^{-1}. \tag{A.8}$$

The first-order conditions on e^i_1 and e^i_0 are

$$\left[\omega \frac{\partial u(x^i_1)}{\partial x^i_1} - \frac{\partial c(e^i_1)}{\partial e^i_1} + \omega\delta \frac{\partial s(x^i_1, \bar{x})}{\partial x^i_1}\right] - \frac{1}{\alpha^i_1}\tau = 0, \tag{A.9}$$

$$\left[\omega\frac{\partial u(x_0^i)}{\partial x_0^i}-\frac{\partial c(e_0^i)}{\partial e_0^i}+\delta\frac{\partial s(\bar{e},e_0^i)}{\partial e_0^i}\right]-\frac{1}{\alpha_0^i}\tau=0, \tag{A.10}$$

where

$$\tau=-\omega\delta\int_{j\in I}\alpha^j\frac{\partial s(x_1^j,\bar{x})}{\partial\bar{x}}m_1^j\,\mathrm{d}F(j)-\delta\int_{j\in I}\alpha^j\frac{\partial s(\bar{e},e_0^j)}{\partial\bar{e}}m_0^j\,\mathrm{d}F(j).$$

Without loss of generality, we can assume $(x_\lambda^i, e_\lambda^i, \lambda)\in\hat{X}_\lambda^i(y^i,\tau,R_\lambda^i,\bar{x},\bar{e})$ even if $m_\lambda^i=0$. Since the objective function is concave in all arguments, these conditions are sufficient for constrained Pareto efficiency.

Suppose $\{(m_\lambda^i, x_\lambda^i, e_\lambda^i)_{i\in I}\}$ is a constrained Pareto efficient allocation with taxes $\{(T_\lambda^i)_{i\in I}\}$. Eqs. (A.7)–(A.10) are identical to the first-order conditions for a constrained Pigouvian equilibrium. Further, since the utility functions of all agents are concave, these conditions are sufficient for a constrained Pigouvian equilibrium. Thus, $\{(m_\lambda^i, x_\lambda^i, e_\lambda^i)_{i\in I}\}$ along with tax rate τ and redistributions $\{(R_\lambda^i)_{i\in I}\}$ defined by $R_\lambda^i=\tau e_\lambda^i-T_\lambda^i$ form a constrained Pigouvian equilibrium.

Conversely, suppose $\{(m_\lambda^i, x_\lambda^i, e_\lambda^i)_{i\in I}\}$ is a constrained Pigouvian equilibrium with tax rate τ and redistributions $\{(R_\lambda^i)_{i\in I}\}$. Because the first-order conditions for a constrained Pigouvian equilibrium are identical to Eqs. (A.7)–(A.10), any constrained Pigouvian equilibrium is also constrained Pareto efficient. (Recall conditions (A.7)–(A.10) are sufficient for constrained Pareto efficiency.) □

Proof of Proposition 3. As in the proof of Proposition 2, let $\{(\hat{m}_\lambda^i, \hat{x}_\lambda^i, \hat{e}_\lambda^i)_{i\in I}\}$ be an equal treatment allocation with average consumption $\hat{x}$ and final utilities $\hat{U}^i$. Consider the above Pareto problem now with m_λ^i as a choice variable. Clearly, $\{(\hat{m}_\lambda^i, \hat{x}_\lambda^i, \hat{e}_\lambda^i)_{i\in I}\}$ is unconstrained Pareto efficient iff it solves the Pareto program with $\int(T_1^i m_1^i+T_0^i m_0^i)=0$, $m_1^i+m_0^i=1$, and each $m_\lambda^i\leq 1$.

Letting β^i be the multiplier on the constraint $m_0^i\leq 1$ and substituting the constraint $m_1^i=1-m_0^i$ into the objective function, the first-order condition for an optimal choice of m_0^i is

$$\psi(T_0^i-T_1^i)+\tau(e_0^i-e_1^i)-\int_{j\in I}m_1^j\alpha_1^j\delta\frac{\partial s(x_1^j,\bar{x})}{\partial\bar{x}}(T_0^i-T_1^i)\,\mathrm{d}F(j)-\beta^i\leq 0, \tag{A.11}$$

where

$$\tau=-\omega\delta\int_{j\in I}\alpha^j\frac{\partial s(x_1^j,\bar{x})}{\partial\bar{x}}m_1^j\,\mathrm{d}F(j)-\delta\int_{j\in I}\alpha^j\frac{\partial s(\bar{e},e_0^j)}{\partial\bar{e}}m_0^j\,\mathrm{d}F(j).$$

Again letting

$$\psi=1+\int_{j\in I}\hat{m}_1^j\delta\frac{\partial s(\hat{x}_1^j,\hat{x})}{\partial\hat{x}}\,\mathrm{d}F(j),$$

Eq. (A.11) reduces to

$$(T_0^i-T_1^i)-\tau(e_0^i-e_1^i)\leq\beta^i. \tag{A.12}$$

Letting $R^i_\lambda = \tau e^i_\lambda - T^i_\lambda$, Eq. (A.12) reduces to

$$R^i_1 - R^i_0 \leq \beta^i. \tag{A.13}$$

The associated complementary slackness conditions are

$$m^i_0(R^i_1 - R^i_0 - \beta^i) = 0, \tag{A.14}$$

$$\beta^i(1 - m^i_0) = 0. \tag{A.15}$$

Notice that if $m^i_0 \in (0, 1)$, then $\beta^i = 0$ implying $R^i_1 = R^i_0$: equal redistributions for each type i. If $m^i_0 = 0$ then $\beta^i = 0$ and $R^i_1 \leq R^i_0$: each consumption oriented agent cannot benefit by taking her redistribution and changing status regimes. Similarly, if $m^i_0 = 1$ then $\beta^i \geq 0$ and $R^i_1 \geq R^i_0$: each leisure oriented agent cannot benefit by taking her redistribution and changing status regimes.

Suppose $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is an unconstrained Pareto efficient allocation with taxes $\{(T^i_\lambda)_{i\in I}\}$. We now show that $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ along with tax rate τ and redistributions $\{(R^i_\lambda)_{i\in I}\}$ (as defined above) form an unconstrained Pigouvian equilibrium. From Proposition 2, we know these form a constrained Pigouvian equilibrium. Further, Eqs. (A.13)–(A.15) imply

$$\hat{V}_\lambda(y^i, \tau, R^i_\lambda, \bar{x}, \bar{e}) \geq \hat{V}_{\lambda'}(y^i, \tau, R^i_\lambda, \bar{x}, \bar{e}).$$

Hence, $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is also an unconstrained Pigouvian equilibrium.

Conversely, suppose $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ is an unconstrained Pigouvian equilibrium with tax rate τ and redistributions $\{(R^i_\lambda)_{i\in I}\}$. From Proposition 2, an unconstrained Pigouvian equilibrium satisfies Eqs. (A.7)–(A.10). From the definition of an unconstrained Pigouvian equilibrium, we know the following: (i) if $m^i_0 \in (0, 1)$ then $R^i_1 = R^i_0$; (ii) if $m^i_0 = 0$, then $R^i_1 \leq R^i_0$, otherwise any consumption oriented agent could increase her utility by taking R^i_1 and changing status regime; (iii) if $m^i_0 = 1$, then $R^i_1 \geq R^i_0$, otherwise any leisure oriented agent could increase her utility by taking R^i_0 and changing status regime. Let β^i be defined as follows:

$$\beta^i = \begin{cases} 0; & \text{if } m^i_0 \in [0, 1), \\ R^i_1 - R^i_0; & \text{if } m^i_0 = 1. \end{cases} \tag{A.16}$$

The unconstrained Pigouvian equilibrium $\{(m^i_\lambda, x^i_\lambda, e^i_\lambda)_{i\in I}\}$ with tax rate τ, redistributions $\{(R^i_\lambda)_{i\in I}\}$, and this β^i satisfy Eqs. (A.13)–(A.15). Therefore, any unconstrained Pigouvian equilibrium satisfies all the first-order necessary conditions for an unconstrained Pareto efficient allocation. □

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