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CONSPICUOUS CONSUMPTION
IN THE LAND OF PRINCE CHARMING

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ABSTRACT. People incur in conspicuous consumption as a way to get non-market goods (i.e. goods that cannot be traded in markets). In sharp contrast to the existing literature, in our model people do not want to signal wealth but some unobservable traits that, conditional on other observable information, are correlated with wealth. For instance, people work hard and buy conspicuous goods in order to signal personal traits like talent, trustworthiness and creativity, and then get non-markets goods like respect, admiration, authority, relationships, etc. Both the nature of the equilibrium and the policy implications depart dramatically from the rest of the literature. We provide an application to optimal income taxation. Finally, our model offers many explanations beyond the current reach of the literature.

Keywords: Conspicuous consumption, signaling, non-market goods.

JEL Codes: D49, D31, D83, H21, P16.

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1. INTRODUCTION

Ever since Veblen (1898) theories on status concerns have been based on envy, greediness and similar moral sentiments, leading to the conclusion that conspicuous consumption is just a waste of resources (i.e. a rat race). Cole et al. (1992, 1995) started to change that perspective in a breakthrough contribution, by recognizing that people incur in conspicuous consumption as a way to get non-market goods (i.e. goods that cannot be traded in markets). However, the literature still assumes that people only care about wealth directly. Instead, we recognize that people also want to signal some unobservable traits that, conditional on other observable information, are correlated with wealth.

Intuitively, people work hard and buy conspicuous goods in order to signal personal traits like talent, trustworthiness and creativity, and then get non-markets goods like respect, admiration, authority, relationships, etc. Since the link between unobservable traits and incomes is endogenous, the nature of the equilibrium changes dramatically with respect to the rest of the literature. Additionally, we let individuals use lotteries, which has never been contemplated by any signaling model. We also incorporate exogenous randomness in the income generating process. Those elements generate a semi-separating equilibrium that is much more intuitive and
realistic than the usual pure-separating equilibrium considered in the literature (e.g. Bagwell and Bernheim, 1996). More importantly, our formulation has deep consequences for the welfare analysis. For example, the prevalent view is that status concerns lead to an arms race that is harmful for society (e.g. Frank, 1985). On the contrary, our model suggests that conspicuous consumption improves social welfare.

The main objective is to provide a better general-equilibrium framework to analyze optimal taxation. We show that the presence of non-market goods alleviates the usual moral-hazard problem brought by income taxation, thereby increasing the optimal tax rate. In other words, income taxes can be welfare-improving by serving as Pigou taxes on conspicuous production. One serious problem with the literature is that there are so many functional forms for relative concerns that, as a group, they could generate any policy conclusion (e.g. Hopkins, 2008). Furthermore, we can always add a twist to the utility functions as to rationalize new observable evidence. On the contrary, we pin down both the supply and demand for non-markets goods, and let the status concerns arise endogenously in general-equilibrium. By doing so we generate sharp testable implications and eliminate ambiguities in the policy implications.\footnote{Moreover, since the conspicuous goods are traded in markets, we can infer the structural parameters of non-market goods from data on market behavior.}

Finally, the semi-separating equilibrium offers many results beyond the current reach of the literature: e.g. it can explain the disconnection between risk aversion measures from small- and large-stakes lotteries, why conspicuous consumption can be more important among the poor, the shape of the equilibrium distribution of income, etc. In particular, the model provides a clean and sound theoretical argument for a usual claim that has never been micro-founded: income inequality is not a intrinsically bad property of an economy. On the contrary, some income inequality is a signal of an efficient provision of non-market goods.

In Section 2 we motivate the new framework. In Section 3 we provide a stylized version of the Prince Charming’s Model, where intuitions are very easy to grasp. In Section 4 we consider a more rigorous and complete model, which unveils new predictions but also confirms the basic qualitative results from Section 3. Some extensions to the model are discussed in Section 5. The final Section concludes.

2. A NEW FRAMEWORK FOR CONSPICUOUS CONSUMPTION

Status concerns have been long recognized not only by economists, but also by sociologists, philosophers, psychologists, and recently extended to other fields such as sociobiology. Among the economists, the first contributor was Adam Smith, who dedicated a great deal of his Theory of Moral Sentiments to the study of admiration and esteem (Smith, 1759). Other classical economists like Marshall (1890) and Pigou (1903) contributed to the discussion. But it was Veblen’s Theory of the Leisure Class (Veblen, 1898) that coined the term conspicuous consumption, used to refer to expenditures in goods that signal the consumer’s position in society. Veblen’s arguments were not taken further until 50 years later, when Duesenberry (1949) insisted with the importance of relative standings in determining consumption and savings patterns over time.
During the following decades there were some isolated contributions on the subject: e.g. Leibenstein (1950), Galbraith (1958), Hirsch (1976), Pollack (1976), Boskin and Sheshinski (1978) and Frank (1985). Nonetheless, the last couple of decades have witnessed a wave of papers on conspicuous consumption and related topics.²

One of the main problems in the literature is that all the policy implications, such as optimal income taxation, depend sensibly on the functional form assumptions (Hopkins, 2008).³ Furthermore, we can always add a twist to the utility function in order to explain new behavioral evidence. As Cole et al. (1992) pointed out, if allowing agents to care about status can explain everything, it has explained nothing. Indeed, the classical economists were well aware of the methodological challenges that relative concerns brought to the classical economics framework (e.g. Pigou, 1903). In a breakthrough contribution, Cole et al. (1992) showed that relative concerns can be endogenously determined in a model where agents only care about their own consumption. That idea was later incorporated to micro-found conspicuous consumption: i.e. people are willing to "burn money" as to signal wealth and then get non-market goods (Cole et al., 1995; see also Postlewaite, 1998). We share the motivation in Cole et al. (1992, 1995), but depart from their model in both economic content and methodology.⁴

Non-market goods are goods and services (in a broad sense) that people consume but cannot purchase through standard markets. Even though they are a very important source of happiness (e.g. Scitovsky, 1976), they are far from the spotlight of modern economic analysis.⁵ There are many reasons why they cannot be traded in markets. For instance, some transactions may face moral and legal restrictions. Roth (2007) gives many examples of repugnance as a constraint on markets: sex, indentured servitude, adoption, friendships, short selling, simony, vote selling, etc. Some non-market goods cannot be traded in markets simply because of their intrinsic nature: i.e. the very fact that someone tried to buy your admiration would make it impossible for you to admire her.
Contrary to the rest of the literature, in the Prince Charming’s Model (PCM) people do not want to signal wealth directly, but some unobservables traits that are correlated to wealth. In a nutshell, the model is based on three simple facts:

**Fact 1:** Some individual traits are not perfectly observable to all the other individuals.

This is beyond reasonable doubt. For instance, firms (universities) dedicate lots of resources to spot talented workers (students), but only with very limited success. However, the assumption is much deeper than it seems, since many personal traits may be unobservable even to ourselves: e.g. people do not know whether they could be brilliant chefs or physicists until they actually try at cooking or writing.

**Fact 2:** Conditional on all the observable information, in some interactions wealth is positively (negatively) correlated to good (bad) unobservable traits.

This claim is actually very weak. Since people can generally choose whether to display or not a particular observable good (i.e. a golden watch), they could choose not to display them in occasions where income (conditional on other observables) is negatively correlated to goods traits.¹

Most of the unobservable traits are cognitive and non-cognitive abilities. As we know well from the labor literature, they are strongly correlated to income. Furthermore, the correlation is likely to become stronger if we control for some basic observables, which may vary with the particular situation at hand: e.g. age, occupation, social origin, memories from previous interactions, etc. For example, people know for a fact that in some occupations workers can extract a higher proportion of their marginal productivities: e.g. most clowns can extract a great deal of the social product they generate, but some mathematicians can only enjoy a minuscule share of their contribution to society. Our model does not predict that a clown earning $100,000 per year would be more admired than a mathematician earning $80,000. But it certainly predicts that a given clown will be more admired the higher his income. Likewise, owning a Ferrari is a very different signal if it comes from a bank clerk than from an Internet entrepreneur. For instance, people will infer that the latter is much more likely to have earned the money by herself.²

Because of those simple facts, conspicuous consumption can work as a signal of unobservable personal traits. The remaining fact explains the demand for such signals:

**Fact 3:** The allocation decisions regarding some non-market goods depend upon unobservable traits.

For instance, when deciding whom to admire or marry, people are interested in recognizing people who are talented, creative, trustworthy, etc. This principle seems to be true for most

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¹That is, income could be (conditional on observables) negatively correlated with good traits in the average situation and the assumption would still hold. For instance, after the outbreak of "express kidnappings" in Argentina after the 2001 crisis, rich people started to use two cars: the usual luxury car, and an old cheap car when travelling across poorer areas.

²The formation of perceptions would be like this: "conditional on his observable information like age, social origin, profession and some previous conversations, if someone earned twice as much then my (probabilistic) belief about her talents would increase considerably."
non-market goods: e.g. respect, admiration, friends, marital and business partners, political and civil leaders, authorities, political, cultural and civic representatives, role models, etc. Note that not every unobservable trait that is positively correlated to wealth has to be a desirable trait for the allocation of every non-market good. On the contrary, the only condition we need is that some of the traits that are unobservable also are desirable for the allocation of some non-market goods.

As aforementioned, the alternative would be that non-market goods are allocated according to wealth, but only directly. As a thought experiment, think what would happen in a world with no correlation between incomes and talents. The perfect example is Babylon (Borges, 1998), a nation where everybody’s destiny is entirely determined by a public lottery. If people relied substantially on conspicuous consumption in such a place, our model would be invalidated. Unfortunately, no matter how much we would like to, we cannot visit Babylon. If it serves as consolation, we can exploit variation across existing societies. For instance, most people would agree that the US is one of the most meritocratic countries in the world. Indeed, Ayn Rand argued that the expression "to make money" was invented by Americans. As expected, American people seem to clearly recognize wealth as a signal of value. For example, when some American newspapers made a reference to a businessmen, they used to put her total wealth in parentheses next to her name. Rankings of rich people are still very popular (e.g. Fortune). On Twitter people of all ages follow the daily lifes of entrepreneurs like teenagers follow rockstars. And the list of anecdotic evidence could go on for pages.

Fortunately, we can perform a simple test of our claim. According to the alternative theory:

"... the utility of both (conspicuous leisure and conspicuous consumption) alike for the purposes of reputability lies in the waste that is common to both. In the one case it is a waste of time and effort, in the other it is a waste of goods. Both are methods of demonstrating the possession of wealth, and the two are conventionally accepted as equivalents." Veblen (1899)

If people cared only directly about wealth, then conspicuous leisure would send the right signal: i.e. the individual is so wealthy that he does need to work. But if wealth only mattered indirectly, leisure would send the wrong signal: e.g. people would infer that his time is not valuable, or that his wealth is inherited, which are not good signals about his innate talents. Consistently with our theory, people do not use leisure conspicuously but, on the contrary, they talk extensively about how much they work and how little they get to see their families. For

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8Smith (1759) seemed to agree with our perspective: "He must acquire superior knowledge in his profession, and superior industry in the exercise of it. He must be patient in labour, resolute in danger, and firm in distress. These talents he must bring into public view, by the difficulty, importance, and, at the same time, good judgement of his undertakings, and by the severe and unremitting application with which he pursues them... We desire both to be respectable and to be respected. We dread both to be contemptible and to be contemned... To deserve, to acquire, and to enjoy the respect and admiration of mankind, are the great objects of ambition and emulation."

9Ayn Rand (1957): "No other language or nation had ever used these words before; men had always thought of wealth as a static quantity - to be seized, begged, inherited, shared, looted or obtained as a favor. Americans were the first to understand that wealth has to be created."

10Even some people that inherited all of their wealth try to "look like" they are working hard.
example, Anger (2008) shows that overtime work is used as a signal of productivity. And Solnick and Hemenway (1998) found that leisure is the least positional of the consumption goods.

In particular, we insist that an important family of non-markets goods is that of respect, admiration and esteem. Economists have rarely incorporated admiration and respect into economic models. The most remarkable exception is Brenan and Pettit (2004), who offer an extensive analysis of esteem and give a brilliant synthesis: "It is almost as if there were a conspiracy in social sciences not to register or document the fact that we are, and always have been, an honour-hungry species." Among the other exceptions, Becker and Murphy (2000) claim: "Great scientists and outstanding entrepreneurs receive enormous prestige and status precisely in order to encourage scientific and startup activities." Also, Frey (1997) introduced a broader economic theory of personal motivation. And Piketty (1998) proposed social mobility as a signal of intelligence. In spite of the relatively low popularity in modern economic analysis, esteem and admiration had a high standing among the classical economists. Indeed, a great deal of Smith’s *Theory of Moral Sentiments* was dedicated to the subject:

> "To what purpose is all the toil and bustle of this world? . . . To be observed, to be recognized, to be taken notice of with sympathy are all the advantages which we can propose to derive from it. It is vanity, not pleasure, which really interests us... It is not wealth that men desire, but the consideration and good opinion that wait upon riches." (Smith, 1759)

Marshall (1890) noted: "The desire to earn the approval, or to avoid the contempt, of those around us is a stimulus to action which often works with some uniformity in any class of persons at a given time and place." Bentham discussed the "pleasures of self-recommendation" (see Loewenstein, 1999), and the list goes on and on. Also, philosophers from Aristotle to Kant, Marx and Locke gave esteem, admiration and respect a key role in pulling the strings of the world. Psychologists (Lukes, 1973) and sociologists (e.g. Weber, 1922) have always highlighted recognition from others as a primary source of happiness. And the list extends even to sociobiology (e.g. Zahavi, 1975).

Once people achieved some basic needs, being respected and admired are some of the most important sources of happiness. For instance, Rosenberg (1957) asked people to what extent a job or career would have to satisfy each of ten requirements in order to be considered ideal: e.g. make a great deal of money, exercise leadership, etc. The most highly ranked career value was "provide an opportunity to use my special abilities or aptitudes," rated as highly important by 78% of respondents. Colin Camerer took a similar poll at the Davos World Economic Forum,

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11His model was later extended by Cowan and Jonard (2005) and Cervellati et al. (2009).
12He insisted with the idea in *Wealth of Nations*: "Nature, when she formed man for society, (…) rendered their approbation most flattering and most agreeable to him for its own sake; and their disapprobation most mortifying and most offensive" (Smith, 1982)
13Brennan and Pettit (2004) offer great quotations from all times: Kant, Tucker, Burke, Hume, Voltaire, Hobbes, etc. For instance: "The principal spring from which the actions of men take their rise, the rule they conduct them by, and the end to which they direct them, seems to be credit and reputation" (Locke, 1678).
14Other popular references are: Campbell (1981), Coleman (1990) and Tangney (2002).
which gathers many of the world’s leaders. The participants cited "recognition and respect" as the number-one motivating factor in the workplace (Cowen, 2007). That is, people care primarily about being recognized as productive members of society, and accumulating wealth is just one of the most popular ways to achieve that.

The seek for respect and admiration is a universal phenomenon. Over the years some particular activities have developed formal, centralized and public mechanisms to distribute information about personal talents. For instance, in some academic circles members use publications and similar indicators to form beliefs about talent. Many sports have national and international rankings. Indeed, some organizations are founded with the specific purpose of keeping those rankings public and credible (e.g. sports associations, journals). But those technologies and institutions are limited to very small clusters of the population (e.g. economists, soccer players), so they cannot rank people outside or across those clusters. Conspicuous consumption, on the contrary, makes admiration a commodity. And as long as the conspicuous goods are sold in free markets, they extend some of the advantages of markets to the space of non-market goods.

People want to be perceived as productive, intelligent and hard-working members of society. We know this is a great source of happiness, if not the most important, not only by introspection but also from a bulk of scientific evidence (for a review of studies from economics and other disciplines see Frank, 1999). We are a honor-hungry species, and that is a fact that we cannot leave out of our analysis of human action. Specially because it affects central economic issues such as optimal taxation, risk aversion, income inequality, etc.

2.1. Is income observable? The model developed below assumes that the income of one individual is not perfectly observable to all the other individuals. While it is true that some people (e.g. family, close friends) may have very precise information about your stock and flow of wealth, it would be ridiculous to assume that incomes are always known to everyone. Notwithstanding, once we let incomes be endogenous, some of the main results of the model would be present even if we assumed that incomes were perfectly public. We provide the formal argument later in the paper. Intuitively, the conspicuous consumption is just the mirror image of conspicuous production: i.e. people work more than they would if they did not care about non-market goods, because they need to prove that they are talented. Whether people simply stick their paychecks on their foreheads or buy Ferraris is just one aspect of the story. This fact is surprisingly not clear in the literature, probably because models with exogenous income predominate.

In general, economists tend to dismiss conspicuous consumption on the basis of the following argument: if signaling was that important, then the market would have figured out better ways

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15The role of relative concerns extends to monetary economics and even financial crises. Keynes (1936) argued that workers dislike direct wage cuts mainly because they worsen their relative incomes. But when the wage cuts are introduced indirectly through inflation, the relative positions are left intact and then workers are not so unhappy. And Kindleberger (1978) argues that relative concerns play a key role during the formation of asset bubbles.
to disseminate information on incomes (e.g. income certification agencies).\textsuperscript{16} First of all, this is not a valid criticism. If people already did the conspicuous \textit{production}, there is no point in just showing the paychecks and not consuming the money. We do not see such income certification agencies in practice partly because the information on consumption is already out there.\textsuperscript{17}

But there are further reasons why in practice we do not observe people spreading information on incomes directly. First of all, consumption will always be easier to verify: e.g. it may be easy to forge a certificate, but just try deceiving other people with your imaginary Ferrari. Secondly, there are harsh social norms about requesting or spreading information about incomes. For instance, assume individual B tells individual A that he finds driving a Ferrari a very inefficient way to signal talent, and then he prefers to send A a notarized copy of his paycheck (and he may even offer A some money in exchange of simply looking at the document). Such an offer would automatically make individual B no longer worthy of A’s admiration and respect. The social norms actually extends to conspicuous consumption. For instance, if you light a cigar with a $100 bill it is subject to social stigma, but if you light a $1,000 cigar with a match it is acceptable in many social circles, even though in both cases the purpose is to signal wealth.\textsuperscript{18} This is not irrational, because preferences are not rational or irrational. You simply feel good or bad about some goods and services. At most you can say that they are weird preferences. But denying them on the basis of being weird would be a shame, since it would deprive us from rich aspects of the real-world economy.

Finally, note that even though there is no room for income certification agencies, there is room for talent certification agencies. For example, universities play such a role: i.e. going to college does not only signal productivity to potential employers (Spence, 1973), but also to potential providers of non-market goods. Additionally, the remuneration in some public and private organizations relies heavily on non-pecuniary benefits (e.g. Frank, 1999), where signaling unobservable traits is one of them.

The above assumptions hold in different degrees for different conspicuous goods and in different situations. For instance, some people seek the respect of millions of strangers, while other people only care about being admired by their offspring. This and many other practical concerns are discussed in Section 5.

\textsuperscript{16}Indeed, information about incomes is available for everybody at some cost: for instance, if A wants to know about B’s income, she could ask around, and even hire a private investigator. If both parties are interested in making a good match, they should be willing to pay a monitoring cost. However, in many of the non-market goods only one party gets the benefits (e.g. respect, admiration). If individual A thinks that B is talented, the former does not "gain" from holding such beliefs. That gives a radically new interpretation to conspicuous consumption: i.e. individual B is willing to pay for a rudimentary monitoring cost on behalf of individual A by means of "burning money."

\textsuperscript{17}There are a few exceptions for the very rich: e.g. some magazines, like Forbes, release rankings of the wealthiest people in the country or the world.

\textsuperscript{18}Because of this some firms find useful to create conspicuous goods with mottos related to environmentalism, organic food and charity (e.g. Glazer and Konrad, 1996).
3. **Prince Charming’s Model**

We will start with a very stylized model with exogenous income, and later in the Section we will let income be endogenous. In Section 4 we will consider a much richer setup, which unveils new predictions but also confirms the qualitative results from this Section.

3.1. **Exogenous Income.** There are two agents: Prince Charming (hereon, PC) and the maids. The latter get utility from market and non-market goods. In the real world the allocation of non-market goods are decided by many individuals in a decentralized manner, so people sometimes play the role of PC and sometimes the role of maiden. In our model PC will represent the Walrasian auctioneer of the non-market goods. PC face one maiden, and has to decide whether to give her a non-market good or not. The maiden is randomly chosen by Nature from a population of two types: high and low, denoted respectively with subscripts \( l \) and \( h \). The fraction of high-type maidens in the population is \( \lambda \). We let the high type have both high income \( (y_h > y_l > 0) \) and good unobservable traits. Later we will let this link be endogenous.

There are two varieties of market goods that a maiden can consume, referred to as standard goods and conspicuous goods. Let \( x \geq 0 \) be the quantity consumed of the standard good, which has a constant price normalized to 1. Let \( p \) denote the conspicuous expenditures measured in units of standard goods. Sometimes we will refer to \( p \) as the price of the conspicuous good. Only the expenditures in conspicuous goods are observable. For the sake of simplicity, only the standard good gives intrinsic utility to the maiden: \( U(x) \), with \( U'(\cdot) > 0 \) and \( U''(\cdot) < 0 \). The conspicuous good is then equivalent to "burning money" (but without the social stigma). Later we will show a more general case where the conspicuous good does provide intrinsic utility.

As aforementioned, the PC has to choose whether to give or not a non-market good to the maiden (e.g. admire, marry, vote). His utility from giving the non-market good to the high (low) type is \( V_h \) (\( V_l \)), and the reserve utility from not giving the non-market good is \( V_0 \). PC wants to give the non-market good to the rich maiden \( (V_h > V_l) \), not merely because she is rich, but because of her high unobservable traits. Also, PC would prefer not to give the non-market good rather than giving it to the poor type: \( V_l < V_0 \). For instance, people would like to admire (marry) the talented, and they would prefer not to admire (marry) anyone rather than admiring (marrying) someone untalented.

The maiden’s utility from getting the non-market good from PC \( (\theta > 0) \) enters additively into her utility function: \( U(x) + \theta \). The \( \theta \) is larger the more important is the non-market good under consideration (e.g. it is larger for getting married than for going to the cinema). Even though we mention particular examples, \( \theta \) is actually meant to represent all the non-market goods altogether. In other words, people do not buy Ferraris to get a particular date or to be

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19 In the very first version of the model (Perez Truglia, 2006) we threw a coin to decide the gender of the sender and the receiver.

20 The actual bundle of conspicuous goods that is chosen is irrelevant. However, there are some practical concerns that may favor some goods over others, and even encourage the emergence of social norms. We will discuss those issues in Section 5.
admired by a particular person, but because of an whole stream of non-market goods that is expected to follow.

In this simple signaling game we have multiple Perfect Bayesian Equilibria. There is always a separating equilibrium where the maiden of the rich type buys the conspicuous good and PC gives the non-market good iff the maiden bought the conspicuous good. We will assume that PC prefers not to provide the non-market good rather than providing it to a random individual: \( \lambda V_h + (1 - \lambda) V_l \leq V_0 \). This seems to be reasonable for many non-market goods: e.g. people would prefer not to admire anyone rather than admiring people at random. In practice maidens play this game for many different non-market goods, so this assumption should apply in an average sense. In Perez Truglia (2010) we allow for multiple non-market goods as to make this argument more clear.

If the above condition is satisfied, there is a pooling equilibrium with no matching: i.e. neither maiden buys the conspicuous good and PC does not give the non-market good regardless of the conspicuous consumption\(^{21}\). Note that the separating equilibrium pareto-dominates the pooling equilibrium, since both PC and the rich type are better off without any harm to the poor type.\(^{22}\) For most signaling games the pooling equilibriums are eliminated by means of similar arguments, which impose restrictions on the off-the-equilibrium-path beliefs. The most popular is the Intuitive Criterion (Cho and Kreps, 1987), whose motivation underlies other refinements such as the Perfect Sequential Equilibrium (Grossman and Perry, 1986), Undefeated Equilibrium (Mailath et al., 1993), and Reactive Equilibrium (Riley, 1979). Just for this Section, we will focus on the the pareto-best pure-separating equilibrium (i.e. the one that minimizes conspicuous waste; see Bagwell and Bernheim, 1996). In Section 4 we take into account the endogenous and exogenous sources of income randomness, and we show that the pure-separating equilibrium breaks down and has to be replaced by a more realistic and intuitive semi-separating equilibrium. This is the first paper to acknowledge this.\(^{23}\)

Assume for a second that PC will provide the nonmarket good iff he observes conspicuous consumption \( p \). In order to sustain a separating equilibrium:

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\begin{align*}
\text{(IC)} & \quad U(y_l - p) + \theta \leq U(y_l) \\
\text{(IR)} & \quad U(y_h - p) + \theta \geq U(y_h)
\end{align*}
\]

\(^{21}\)If \( \lambda V_h + (1 - \lambda) V_l \geq V_0 \) there is a pooling equilibria where neither maiden buys the conspicuous good and yet PC gives the non-market good, and one where both types buy the conspicuous good and PC gives the non-market good iff the maiden bought the conspicuous good. There are also PBEs in mixed strategies.

\(^{22}\)Not that the other pooling equilibria is not pareto-ranked with respect to the separating equilibria: PC is better off, but the maidens of both types are worse. For welfare comparisons we would have to weight the utilities of PC and the maidens.

\(^{23}\)Not allowing for lotteries is actually a serious omission of the model in this Section. Nevertheless, the qualitative results are similar to those in the more rigorous model of Section 3.
In the mechanism-design jargon they are called the Incentive Compatibility (IC) and Individual Rationality (IR) constraints, respectively. First, take $p$ as given. For a pair of incomes $(y_l, y_h)$ we can re-write the conditions as:

$$\theta \leq \bar{\theta} \equiv U(y_l) - U(y_l - p)$$

$$\theta \geq \bar{\theta} \equiv U(y_h) - U(y_h - p)$$

The concavity of the utility function guarantees that $\bar{\theta} > \bar{\theta}$ (see A1, in the Appendix). For a pair of incomes $(y_l, y_h)$ and a price of the conspicuous good $p < y_l$ there is a range of non-market goods $\theta \in [\theta, \bar{\theta}]$ that comprise a PB separating equilibrium in pure strategies.\(^{24}\) Keeping up the romantic atmosphere, the non-market goods that can be allocated range from going to the cinema ($\theta = \bar{\theta}$) to getting married ($\theta = \bar{\theta}$).\(^{25}\) Also, notice that $\partial \bar{\theta}/\partial p > 0$ and $\partial \bar{\theta}/\partial p > 0$: i.e. more expensive conspicuous goods can rationalize better non-market goods, although at the same time worse non-market goods are being ruled out (e.g. the purchase of diamonds can rationalize getting married, but it cannot rationalize going to the cinema). Notice also that $\partial \bar{\theta}/\partial y_l < 0$ and $\partial \bar{\theta}/\partial y_h < 0$: i.e. increasing income inequality makes achievable both something worse than going to the cinema and something better than getting married (A8).

Now fix $\theta$. For a pair of incomes $(y_l, y_h)$ we have:

$$p \geq \bar{p} \equiv y_l - U^{-1}(U(y_l) - \theta)$$

$$p \leq \bar{p} \equiv y_h - U^{-1}(U(y_h) - \theta)$$

Once again, the concavity of the utility function guarantees that $\bar{p} > \bar{p}$ (A1). For a given $\theta$ and a pair of incomes $(y_l, y_h)$ there is a set of prices $p \in [p, \bar{p}]$ that comprise a separating equilibrium. If the value of the non-market good increases then the set of prices that sustains a separating equilibrium moves to the right: $\partial \bar{p}/\partial \theta > 0$ and $\partial \bar{p}/\partial \theta > 0$. Also, since $\partial \bar{p}/\partial y_l > 0$ and $\partial \bar{p}/\partial y_h > 0$, an increase in income inequality expands in both directions the set of prices that sustain a separating equilibrium (A3). In order to get the non-market good the rich type is willing to spend up to $\bar{p}$, but she has to pay at least $p$. Therefore, $\bar{p} - p$ is the maximum consumer gain from conspicuous consumption (in units of the standard good).

3.1.1. A disgression: conspicuous goods with intrinsic utility. To represent this case, we can think of the conspicuous good as a damaged good: each unit of observable good $z$ has the same price than the standard good, but in utility terms it only provides a proportion $\gamma \in [0,1)$ of the benefits from the standard good. Then the IC constraint becomes:

\(^{24}\)For each particular problem at hand there is probably a maximum non-market good that the PC can offer, denote it $\hat{\theta}$, so $\theta = \min \left\{ U(y_l) - U(y_l - p), \hat{\theta} \right\}$.
If we replace \( p = z(1 - \gamma) \), this is the same condition than before. However, if the PC observes \( z \geq y_l \), he should realize that he is dealing with a rich maiden. PC’s cutoff rule is then: \( z \geq z^* \equiv \min \left\{ \frac{p}{1 - \gamma}, y_l \right\} \). The \( \min \{ \cdot \} \) is not binding iff \( \gamma < \exp(-\theta) \). If that is the case, it does not matter whether the conspicuous good gives some intrinsic utility or not. The only important object is the total waste in observable goods, \( p = z(1 - \gamma) \).26

3.1.2. Social Planner. Let’s make some assumptions to simplify the notation. First, assume maidens have unit measure and both types are equally likely. Secondly, each maiden face exactly one PC. Define SW as the sum of expected utilities of the maidens. Since they always play the separating equilibrium:

\[
SW = U(y_l) + U(y_h - p) + \theta
\]

We do not include the utility of PC because in the separating equilibrium he always gets the same expected utility. On the one hand, by rising inequality (e.g. decreasing \( y_l \) and increasing \( y_h \) by the same amount) there is an obvious welfare loss due to diminishing marginal utility. On the other hand, there are some gains from the conspicuous consumption channel. If \( p \) was fixed, the rich type would be able to achieve a larger \( \theta \), since \( \tilde{\theta} \) would increase. If \( \theta \) was fixed, the rich type would be able to spend less in conspicuous goods, since \( p \) would decrease. We will show that under weak conditions the second (positive) effect can prevail over the first (negative). Because of space limitations, we show here the case for fixed \( \theta \) and we show the case of fixed \( p \) in A2.

It seems natural to think of \( \theta \) as being fixed, even in the long run. For instance, admiration and respect are universal feelings, just like being a fan of an sport team or feeling pity for the disadvantaged. Those pleasures are probably determined to a great extent by deep evolutionary roots, so we can treat them as exogenously given.27 As discussed before, we will focus on the pareto-best separating equilibrium: \( p = \bar{p} \). The conspicuous good is just an intermediate step to acquire the non-market good, so \( p \) is the shadow price of the non-market good. The corresponding non-market expenditure function (i.e. how much a high-type has to spend to attain a non-market utility \( \theta \)) is: \( \pi(\theta) = y_l - U^{-1}(U(y_l) - \theta) \), with \( \pi'(\theta) > 0 \) and \( \pi''(\theta) < 0 \). Notice that expenditure functions for standard goods are usually convex, not concave. Intuitively, high prices are meant to yield advantageous selection (i.e. the opposite of adverse selection), which generates an upward-sloping demand.28 The utilitarian Social Welfare is:

---

26 The restriction \( \gamma < \exp(-\theta) \) can be relaxed when lotteries are available and/or income is endogenous.

27 The same argument applies to many other non-market goods: e.g. having a role model. Cases where we may want to let \( \theta \) be endogenous are for example authority or business proposals: e.g. if everybody works harder we expect more and better business proposals to appear.

28 To illustrate this, assume that PC is organizing the annual gala. Maidens enjoy \( \theta \) utils when being complimented by PC. PC would strictly prefer to compliment only rich maidens. The entire kingdom is going to the gala, but each maiden can choose whether to rent an expensive limousine or take a cab, which is observed by PC. For simplicity, cabs are exactly as comfortable as limousines. The demand for limousines in the kingdom will be
CONSPICUOUS CONSUMPTION

\[ SW = U(y_l) + U(y_h - p) + \theta \]

With \( p = y_l - U^{-1}(U(y_l) - \theta) \). Let’s introduce a symmetric and regressive income transference (i.e. \( dy_h = -dy_l > 0 \)):

\[ dSW = [U'(y_l) - U'(y_h - p)]dy_l - U'(y_h - p)\frac{dp}{dy_l}dy_l \]

The first term is negative, due to the decreasing marginal utility. The second term is positive, since the rich type can now achieve the same non-market good with a lower conspicuous expenditure:

\[ dp = \frac{U'(y_l - p) - U'(y_h)}{U'(y_l - p)}dy_l < 0 \]

The benefits from a regressive redistribution, \(-U'(y_h - p)dp\), are increasing in \( \theta \). If \( \theta \) is high enough (i.e. if non-market goods are an important source of happiness) then utilitarian welfare will increase after a regressive redistribution (A6). Figure 1 illustrates the result. After the redistribution the rich type gains \( b \) from the standard consumption, while the poor loses \( a \). The concavity of the utility function guarantees that \( b - a < 0 \). Notice that by construction the curve \( U(x - p) + \theta \) crosses \( U(x) \) at \( x = y_l \). When we reduce \( y_l \) then \( p \) goes down and the curve \( U(x - p) + \theta \) moves to the left. The difference between the new and the old curve at \( x = y_h \) gives the utility gain for the high type from savings in conspicuous consumption (\( c \)). If \( \theta \) is high enough then \( c > a - b \).

\[ \text{initially upward-sloping: demand is zero for } p < p_c, \text{ every rich maiden wants a limousine if } p \in [p_c, \overline{p}], \text{ and demand drops to zero if } p > \overline{p}. \]
We can dispense of the functional form for the Social Welfare and obtain the Utility Possibility Frontier (UPF) instead. The utility of the high (low) type will be in the $y$ ($x$) axis. In the absence of non-market goods, the UPF is given by the following set:

$$\{(U(x_l), U(y_l + y_h - x_l)) : \forall x_l \in [0, y_l + y_h]\}$$

This is depicted in the left panel of Figure 13. The UPF is both symmetric and strictly convex, so any reasonable social preference will select perfect income equalization, as shown by the social indifference curves. But when we introduce non-market goods the UPF becomes:

$$\left\{\left(U(x_l), U(y_l + y_h - 2x_l + U^{-1}(U(x_l) - \theta)) + \theta\right) \forall x_l \in \left[0, \frac{y_l + y_h}{2}\right]\right\}$$

An example is given in the right panel of Figure 2. The UPF is not symmetric nor convex, and the utilitarian optimal redistribution departs from complete income equalization. Indeed, other papers on status concerns that take income as exogenous also found that less income inequality can lead to less social welfare (e.g. Hopkins and Kornienko, 2004). However, when incomes are endogenous taxes can actually relax the IC constraint, as discussed in the following subsection.

3.2. Endogenous Income. We took as given that a maiden has good unobservable traits iff she is rich. If we let income be endogenous we can close the model. There are two types: high productivity ($\mu_h$) and low productivity ($\mu_l < \mu_h$). PC likes productive partners: i.e. he wants to perform the activity only with people of the high type. If maiden $i$ exerts effort $e_i$ then her income will be $y_i = \mu_i \cdot e_i$, and her disutility from working will be $c(e_i) = e_i$. Intrinsic utility from standard consumption is logarithmic, $U(x_i) = \ln(x_i)$, and the conspicuous good gives no intrinsic utility. For the sake of simplicity, maidens will make effort and consumption choices simultaneously (if the decisions were sequential, the PBNE below still survives). We

However, some refinements may be in conflict with the off-the-equilibrium beliefs. Intuitively, if the low-type made a low effort in the first period, the high-type would like to try to lower the planned conspicuous consumption in the second period. The problem is due to the discreetness of the type space. Indeed, it disappears in the more general version of the model given in Section 4.
are looking for a symmetric separating Perfect Bayesian Equilibrium. Let’s begin with the optimization problem for an individual of low type. Since in equilibrium they will not get the non-market good, they will choose conspicuous expenditure $p_l^* = 0$ and effort:

$$\max_{e_l} \ln(\mu_l \cdot e_l) - e_l$$

From the FOC: $e_l^* = 1$. This does not depend on $\mu_l$ because of the well-know property of the logarithmic utility function that income and substitution effects cancel each other out. Notice that if non-market goods were absent, then the high type would work one unit as well. But individuals of the high type want to get $\theta$, so they incur in the conspicuous consumption that makes the IC condition binding. Take the cutoff decision of PC ($\mu_l$) as given. If a low-type maiden wanted to get $\theta$, she would choose an effort:

$$\max_{e_l} \ln(\mu_l \cdot e_l - p) + \theta - e_l$$

From the FOC: $\ddot{e}_l = 1 + \frac{\theta \mu_l}{p_l}$. The pareto-best separating equilibrium ($p^*$) has to be such as no individual of the low-type wants to deviate:

$$\ln \left( \mu_l \cdot \left(1 + \frac{p^*}{\mu_l}\right) - p^* \right) + \theta - \left(1 + \frac{p^*}{\mu_l}\right) = \ln(\mu_l) - 1$$

From this condition we get: $p^* = \theta \mu_l$. This is very intuitive: if $\theta$ is greater then the low-type maidens have higher incentives to get the conspicuous good, so $p$ must increase to deter them from doing so. Similarly, a higher $\mu_l$ would imply a lower cost of imitating the high-type. We can finally write down the optimization problem of an individual of high-type:

$$\max_{e_h} \ln(\mu_h \cdot e_h - \theta \mu_l) + \theta - e_h$$

From the FOC: $e_h^* = 1 + \theta \frac{\mu_l}{\mu_h} > 1$. The standard consumptions are independent from $\theta$: $x_l^* = \mu_l$ and $x_h^* = \mu_h$. The effort of the high-type above 1 ($\theta \frac{\mu_l}{\mu_h}$) is entirely destined to buy the non-market good: i.e. the conspicuous production.\(^{30}\) As expected, both $\theta$ and $\mu_l$ increase conspicuous production.

3.2.1. A disgression: observable income. If income was observable or, equivalently, all the consumption goods were observable, then the model would still capture similar effects. Instead of using a cutoff rule based on $p$, PC would simply use a cutoff rule based on $x$. People would not burn money, but they would still work (and consume) much more than in absence of the non-market good, which is also wasteful.\(^{31}\) Imagine that $x^*$ was the cutoff rule used by PC. If a low-type maiden wanted to deviate in order to get $\theta$, she would choose $\tilde{e}_l = \frac{x^*}{\mu_l}$. From the IC constraint we can solve for $x^*$:

\(^{30}\)Because of the choice of logarithmic utility it also coincides with the leisure inequality. Many authors have documented a growing leisure inequality (e.g. Aguiar and Hurst, 2007). One explanation would be that non-market goods ($\theta$) have increased. For instance, the decrease in communication costs might have increased the role of respect, admiration, etc. Nevertheless, we would need more general functional forms to address this question.

\(^{31}\)One of the practical advantages of the approach we chose is that the total waste is measured directly by $p$. 
\[ x^* = \min \{ \exp(-W(-1, -\exp(-\theta) - \theta - 1) \mu_h, \mu_h) \} \]

Where \( W \) is the Lambert-W function. The high-type would attain a utility: \( \ln(x^*) + \theta - \frac{z}{\mu_h} \). This utility is higher than that attained when standard consumption is not visible, although the differences can be quite small.\(^{32}\) The model where all consumption goods are observable does not seem even remotely plausible. But even if we made that assumption, we would still have a model of conspicuous production.

\[ 3.2.2. \text{First-best taxation.} \] Let’s solve the problem of the social planner. To make the exercise interesting, the social planner cannot control directly the allocation of non-market goods. Indeed, it would be much easier to control people’s choices regarding work and consumption than regarding respect, admiration, marriage, etc. We will solve the problem for a non-market good of size \( \theta \), and then we will represent the absence of non-market goods by letting \( \theta = 0 \). Once again, assume that maidens have unit measure and high and low types are in equal proportions. Let \( \tau_l \) be the per-capita transference from the rich to the poor. The social planner maximizes utilitarian welfare:

\[ SW = \ln(y_h - \tau_l - p) + \ln(y_l + \tau_l) + \theta - e_l - e_h \]

Because of the concavity in intrinsic utility, we can focus directly on \( \tau_l \leq \frac{y_h + y_l}{2} \). Since the cost function is linear, the planner will force the high-type to make all the effort: \( e_l = 0 \).\(^{33}\) The maximization problem is then:

\[ \max_{\{e_h \geq 0, \tau_l \leq \frac{y_h + y_l}{2} \}} \ln(\mu_h \cdot e_h - \tau_l(2 - \exp(-\theta))) + \ln(\tau_l) - e_h \]

We will get a FOC for optimal consumption smoothing and a FOC for optimal effort. Respectively:

\[ \tau_l = \frac{\mu_h e_h}{2(2 - \exp(-\theta))}, \quad e_h = 1 + \frac{\tau_l(2 - \exp(-\theta))}{\mu_h} \]

We combine the conditions to get \( \hat{e}_h = 2 \) and \( \hat{\tau}_l = \mu_h (2 - \exp(-\theta))^{-1} \). Since \( \hat{e}_h \) does not depend upon \( \theta \), we conclude that the allocation of effort is not distorted by the presence of non-market goods. The first-best taxation would then have a similar texture than that presented for the case where income was exogenously given. We can express redistribution it in a more intuitive way. For instance, let \( \rho \) be the proportion of total income that goes to the high type:

\[ \rho = 1 - \frac{1}{2(2 - \exp(-\theta))} \geq \frac{1}{2} \]

\(^{32}\)Note that if all consumption goods were observable then maidens would not want to use the good with no intrinsic utility.

\(^{33}\)If the cost function was convex, the low-type would work something. However, this property does not drive the results.
In absence of non-market goods $\rho = \frac{1}{2}$ (i.e. perfect income smoothing). The more important the non-market good, the less heavily the government is going to redistribute: $\frac{\partial p}{\partial \theta} < 0$. Note that $\rho \leq \frac{3}{4}$, due to the log-utility assumption. Intuitively, if $\rho = \frac{3}{4}$ the income of the high-type is two times the income of the low-type, so the high-type can make the conspicuous expenditure (almost) equal to the disposable income of the low type and then achieve a separating equilibrium with $\theta$ as high as desired (this particular property disappears when lotteries are available).

According to the baseline economic models, if redistribution did not distort efforts then governments should prefer complete income smoothing. However, the attention has always been limited to market goods. The efficiency in non-market goods depends directly upon the after-tax income distribution. As a result, even if redistribution did not distort efforts, the government would not choose full income smoothing. The more important the non-market goods are, the more willing the government is to let room for income inequality in the economy.

3.2.3. Second-best taxation. Consider now the usual proportional income tax, $0 \leq \tau \leq 1$, which is subject to moral-hazard. As before, we represent the absence of non-market goods by letting $\rho = 0$. In equilibrium the low-type will choose $p_l^* = 0$ and the following effort:

$$\max_{e_l \geq 0} \ln((1 - \tau)\mu_l \cdot e_l + \frac{\tau}{2} \mu_l \cdot e_l^* + \frac{\tau}{2} \mu_h \cdot e_h^*) - e_l$$

As before, we restrict attention to the symmetric equilibria. From the FOC:

$$e_l^* = \max \{\hat{e}_l, 0\}, \hat{e}_l = \frac{1}{2} \frac{\tau}{2 - \tau} - \frac{\tau}{2 - \tau} \mu_h e_h^*$$

We want to obtain the IC constraint. If a low-type maiden wanted to deviate to get $\theta$, she would choose an effort:

$$\max_{e_l \geq 0} \ln((1 - \tau)\mu_l \cdot e_l + \frac{\tau}{2} \mu_l \cdot e_l^* + \frac{\tau}{2} \mu_h \cdot e_h^* - p) + \theta - e_l$$

From the FOC:

$$\hat{e}_l = \begin{cases} e_l^* + \frac{p}{(1 - \tau)\mu_l}, & \text{if } e_l^* > 0 \\ \max \{\hat{e}_l^*, 0\}, & \text{if } e_l^* = 0 \end{cases}, \hat{e}_l^* = \frac{(1 - \tau)\mu_l - \tau \mu_h e_h^* + p}{(1 - \tau)\mu_l}$$

Notice that if $e_l^* > 0$ then $\hat{e}_l > 0$. The conspicuous expenditure has to be such as no individual of the low-type wants to deviate:

$$\ln((1 - \tau)\mu_l \cdot \hat{e}_l + \frac{\tau}{2} \mu_l e_l^* + \frac{\tau}{2} \mu_h e_h^* - p) + \theta - \hat{e}_l$$

$$= \ln((1 - \tau)\mu_l e_l^* + \frac{\tau}{2} \mu_l e_l^* + \frac{\tau}{2} \mu_h e_h^*)$$

If $e_l^* > 0$ (so $\hat{e}_l > 0$), this condition becomes: $p^* = \theta(1 - \tau)\mu_l$. Thus, progressive redistribution decreases the waste in conspicuous consumption: $\frac{\partial p^*}{\partial \theta} < 0$, which is beneficial to society.

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34For instance, in the complete-equalization case the high type has to spend so much in conspicuous consumption that in net terms she does not gain any utility at all from the non-market good.
Intuitively, if a low-type wanted to imitate the high-type she could only use a share \((1 - \tau)\) of the additional income she gets from working harder \(\hat{e}_l\), so by raising \(\tau\) the IC constraint is relaxed. The other extreme case is \(e^*_l = 0\) and \(\hat{e}_l = 0\):

\[
p^* = \frac{\tau}{2} \mu_h e^*_h (1 - \exp(-\theta))
\]

Since the low type do not work, not even if they wanted to buy the conspicuous good, they rely completely on the redistribution from the high type to imitate them. By increasing \(\tau\) the IC constraint is tightened, not relaxed, and then conspicuous consumption increases. Finally, if \(e^*_l = 0\) and \(\hat{e}_l > 0\):

\[
p^* = \left\{-\ln \left(e^*_h \frac{1}{2} \frac{\tau}{1 - \tau} \frac{\mu_h}{\mu_l} \right) + \theta - 1 \right\} (1 - \tau)\mu_l + \frac{\tau}{2} \mu_h e^*_h
\]

In this intermediate case there is a combination of the effects from the two previous cases, so the net effect of taxation on conspicuous expenditure (holding \(e_h\) fixed) is ambiguous. Finally, we can write down the optimization problem of the high type:

\[
\max_{e_h \geq 0} \ln((1 - \tau)\mu_h \cdot e_h + \frac{\tau}{2} \mu_l \cdot e^*_l + \frac{\tau}{2} \mu_h \cdot e^*_h - p^*) + \theta - e_h
\]

From the FOC for the interior solution, and restricting to symmetric equilibria:

\[
e^*_h = \frac{1 - \tau}{2 - \tau} - \frac{\tau}{2 - \tau} \frac{\mu_l}{\mu_h} e^*_l + \frac{1}{2 - \tau} \frac{2}{\mu_h} p^*
\]

We will analyze the case where \(e^*_l > 0\) (you can find the other cases in A9):

\[
e^*_h = \frac{2 - \tau}{2} - \frac{\tau}{2} \frac{\mu_l}{\mu_h} + \frac{2 - \tau}{2} \frac{\mu_l}{\mu_h} \theta (1 - \tau)\mu_l
\]

\[
e^*_l = \frac{2 - \tau}{2} - \frac{\tau}{2} \frac{\mu_h}{\mu_l} - \frac{\tau}{2} \theta (1 - \tau)\mu_l
\]

It follows immediately that \(e^*_h > 0\). To check that \(e^*_l > 0\) in the first place:

\[
\tau < \tau_1 \equiv \frac{\mu_h \theta \mu_l^2 + \mu_l - \sqrt{\mu_h^2 + 2\theta \mu_h \mu_l^2 + 2\mu_h \mu_l + \theta^2 \mu_l^4 - 6\theta \mu_l^3 + \mu_l^2}}{2\theta \mu_l^2}
\]

Also, we implicitly assumed that the high type finds optimal to work hard and buy the conspicuous good. That might not be true, in which case we need to consider an alternative equilibrium. You can find the results in A10. Since incomes are deterministic, in absence of non-market goods the high type would be strictly worse off with a higher tax rate. However, when non-market goods are present the high type may benefit from higher taxes through savings in conspicuous expenditures:

**Proposition 1.** If non-market goods are sufficiently valuable, introducing a proportional income tax is pareto-improving (Proof in A11).
Intuitively, without taxes the high type work too much in order to deter the low type from imitating them. By introducing taxes we make people work less. That would be inefficient without non-market goods, but with non-market goods it is actually efficient. In other words, the income tax works as a Pigou tax on conspicuous production.

But the pareto-improvement is just one of the ways in which to measure the benefits from income taxation. The presence non-market goods alleviates the usual moral-hazard problem from income taxation, so the optimal tax rates should be increasing in $\theta$ for every choice of Social Welfare function. We can show the effects quantitatively with an example, setting $\mu_l = 1$ and $\mu_h = 2$. In Figure 3 we show the optimal taxes for $\theta \in [0, 2]$. The left panel shows the tax rate that maximizes $U_h$ (lighter), $\frac{3}{4} U_h + \frac{1}{4} U_l$, $\frac{1}{2} U_h + \frac{1}{2} U_l$, $\frac{1}{4} U_h + \frac{3}{4} U_l$, and $U_l$ (darker).\footnote{Note that $\frac{1}{2} U_h + \frac{1}{4} U_l$ corresponds to the utilitarian social welfare, and $U_l$ to the Rawlsian social welfare.} As predicted by the Proposition, introducing an income tax is pareto-improving when $\theta > 1$. However, looking at how $\tau^*$ changes with $\theta$ is not very informative about the after-tax distribution of incomes, since efforts (and then outcomes) are responding to $\tau$. The right panel in Figure 3 shows the disposable income of the high type as a share of total income, $\rho$, which is a measure of income inequality. The optimal income inequality is increasing in $\theta$ for all the welfare criteria: i.e. the more important the non-market good the more income inequality a social planner (even a Rawlsian one) will allow. This idea of endogenous inequality will become clearer in the model of Section 4.

You can see how the income tax works in Figure 4, where the equilibrium allocations are shown for $\theta = 0$ (left) and $\theta = 1.5$ (right). Notice that $\theta = 1.5$ is a relatively large value: at $\tau = 0$ the high type are spending about 40% of their disposable income on conspicuous goods. From the case with $\theta = 0$ you can infer that the high type would like to work only 1. But they work almost three times as much when $\theta = 1.5$. Even with a tax rate of 0.4 they still work substantially more than 1. As a mirror image, conspicuous waste is decreasing in the tax rate. Thus, it is not surprising that utilitarian optimal tax rate is substantially larger for $\theta = 1.5$ than $\theta = 0$. Income taxation seems an attractive policy. However, it can be a two-edged knife, since it
may make the separating equilibrium collapse (see A10). Conspicuous goods are informational goods: i.e. they have value as long as they contain information about talents. We will elaborate on this in Section 4, simply because that model is more appropriate.

Even though the model is overly simple, it is very useful to perform some basic calculations. For instance, suppose there was a public good with separable utility. If some of the tax revenues went to the public good instead of the low type individuals, the latter would not be able to use them to buy conspicuous good and the IC constraint is relaxed. As a result, the optimal tax rate will go up. An specific tax on conspicuous goods (i.e. luxury tax) may also be beneficial. In the extreme case, we could tax conspicuous goods at a 100% rate, so the conspicuous good becomes a "certificate" from the government for paying taxes. Instead of being wasted, the conspicuous expenditures are spent in public goods or transferred to the poor. However, there are plenty of practical reasons that may hinder such a policy, which we discuss in Section 5.

Finally, there are additional reasons to introduce a non-linear income tax. Intuitively, in the model without non-market goods the social planner chooses the tax scheme (in the linear case, \( \tau \)) as to influence two endogenous variables (\( e_l^* \) and \( e_h^* \)). But in presence of non-market goods the tax scheme also affects the low-type best deviation (\( \hat{e}_l \)), which in turn determines \( p^* \) and can potentially reduce wasteful consumption.

Some of these results are not novel in the literature. For instance, Ireland (1998) provides a model with endogenous income where people care directly about how happy other people think they are, and conclude that taxes may be pareto-improving. As aforementioned, the

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36 A higher provision of the public good should not affect choices over the rest of the goods. This is close to true for national defense, but far from true for education.
reduced-form approach to relative concerns have generated a wide variety of policy conclusions (Hopkins, 2008). The ambiguities in the policy analysis do not arise between papers, but also within papers. On the contrary, in our model relative concerns arise endogenously from the supply and demand of non-market goods. The results do not depend upon the utility functions being a function of income ranking or a function of the happiness of other people. They emerge from the heart of the problem: i.e. people trying to signal their unobserved traits. However, this model did not allow for endogenous and exogenous sources of income randomness. We did not incorporate them from the beginning for a simple reason: for that we need a richer model of PC’s preferences, which complicates the equilibrium substantially. The more complete and rigorous model of Section 4 unveals new predictions, but it also confirms the basic qualitative results from this Section.

4. INTEGRATING LOTTERIES AND LUCK

"Get Rich or Die Tryin’" 50 Cent (American rapper)

Friedman (1953) and Friedman and Savage (1948) first introduced the idea of a partially convex utility function. They suggested that the convexity could be explained by discontinuities in the choice set, which was later developed by Rosen (1997). Few papers have explored this line of research. Robson (1992) is one notable exception, who elaborated on the assumption that utility is concave in money but convex in income rank (e.g. being first rather than second is more satisfying than being second rather than third). Becker et al. (2005) took a similar approach by assuming that higher status raises the marginal utility from income. However, in all those papers the source of the convexity is assumed in a reduced-form fashion. On the contrary, our source of convexity emerges in a general-equilibrium model with market and non-market goods. In other words, because of the signaling nature of the game, the very concavity of the intrinsic-utility function will end up generating the demand for risk.

4.1. EXOGENOUS INCOME. Figure 5 shows the $p$ that makes the IC constraint binding: i.e. such as the curve $U(x - p) + \theta$ crosses $U(x)$ at $x = y_1$. For that $p$ people would like to take advantage of the upper envelope of the utility function: max $\{ U(y - p) + \theta, U(y) \}$. Such envelope is by construction convex around $y_1$, so the poor type would be better off buying a lottery. Let $y_1$ denote the point where the envelope becomes concave again (see Figure 5). If $y_h < y_1$ then the rich type will also like to buy risk. But if the rich or the poor type buys a lottery, then PC would like to revise his strategy. Otherwise, he would end up performing the action with some maidens of the low type with positive probability, and performing the action with maidens of the high type with probability less than one. As a consequence, we must abandon the pure-separating equilibrium and replace it by a more realistic and intuitive semi-separating equilibrium. Take $p$ as given. Now maidens must decide both whether to participate in a lottery and whether to buy the conspicuous good (contingent on the outcome of the lottery). A maiden with $y \in [y_0, y_1]$ would buy the following fair lottery:

\[37\]The analysis is very similar if lotteries are unfair.
\[
V_a(y) = \begin{cases} 
U(y) & \text{if } y < y_0 \\
(1 - q)U(y_0 - p) + q[U(y_1 - p) + \theta] & \text{if } y_0 \leq y \leq y_1 \\
U(y - p) + \theta & \text{if } y > y_1 
\end{cases}
\]

The value function will be linear in the region \([y_0, y_1]\) (i.e. the dotted line in Figure 5). We can compute \(y_0\) and \(y_1\). By construction, the slopes of the value function at \(y_0\) and \(y_1\) must be the same: i.e. \(y_1 - y_0 = p\). Also by construction:

\[
U(y_0) + U'(y_0)(y_1 - y_0) = U(y_1 - p) + \theta
\]

Combining both conditions:

\[
y_0 = U'\left(\frac{\theta}{p}\right); \quad y_1 = U'\left(\frac{\theta}{p}\right) + p
\]

A maiden with income \(y\) will buy the conspicuous good with probability:

\[
q(y; p) = \begin{cases} 
0 & \text{if } y < y_0 \\
\frac{y - U'(\frac{\theta}{p})}{p} & \text{if } y_0 \leq y \leq y_1 \\
1 & \text{if } y > y_1 
\end{cases}
\]

Conditional on observing the conspicuous consumption \(p\), PC must infer that the probability of coming from a high type is:

\[
P(p) = \frac{q(y_h; p)}{q(y_h; p) + q(y; p)}
\]
If PC’s utility has the von Neumann-Morgenstern form we can normalize the utility from not providing the non-market good to zero, and denote $\kappa_H > 0$ and $\kappa_L < 0$ to the utilities from providing the non-market good to a maiden of high and low type, respectively. Recall that we are interested in the case $\kappa_L < -\kappa_H$: i.e. PC would prefer not to provide the non-market good rather than provide it to a random maiden. We have a continuum of semi-separating\textsuperscript{38} PBE indexed by $p^*$:

I. A maiden of type $j$ buys the conspicuous good $p^*$ with probability $q(y_j; p^*)$.

II. PC performs the activity iff $p \geq p^*$, and if he observes $p \geq p^*$ his belief that the maiden is of the high type is $P(p)$, and zero otherwise.

III. The $p^*$ is such as $P(p^*) \cdot \kappa_H + (1 - P(p^*)) \cdot \kappa_L \geq 0$.

The last condition is the IR constraint for PC. As usual, not all the refinements point to the same equilibrium. The reason why the rest of the models in the signaling literature point to a unique equilibrium is by disregarding equilibriums in mixed strategies, which is misleading. We can still use the refinements to get boundaries for $p^*$, which (fortunately) will end up being very tight. Intuitively, think about a repeated game between PC and the maidens. On the one hand, PC could have all the bargaining power (e.g. he is sufficiently patient as to build reputation) and then he would let $p^*$ be the price that maximizes his per-period utility. We can represent this limiting outcome in the static game by focusing on the equilibrium from the screening version of the game (i.e. by inverting the timing of the game). The corresponding $p^*$ would be:

$$p^*_s = \arg \max_p q(y_h; p) \kappa_H + q(y_l; p) \kappa_L$$

It is straightforward to show that $p^*_s$ exists and is unique. Indeed, the (pareto-best) screening equilibrium is the one we chose in the model of Section 3. If $p^* > p^*_s$, both maidens and PC would benefit from a lower $p^*$, so $p^*_s$ is an upper bound. On the other hand, if maidens had all the bargaining power they would like to squeeze as many non-market goods as possible from PC, which we call the "equalizing" equilibrium:

$$p^*_e = \{ \min p : q(y_h; p) \kappa_H + q(y_l; p) \kappa_L = 0 \}$$

It is easy to show that $p^*_e$ exists and is unique. This equilibrium appeared as a mixed-strategy equilibrium in the game of Section 3. It gives a lower bound for $p^*$: i.e. if $p^* < p^*_e$, it would violate PC’s IR constraint. It is very important to notice that the above formulas for $p^*$ are equivalent to the IC constraints of Section 3. We cannot discuss specific arguments in favor of one or the other equilibrium because those vary across different non-market goods. Since this model is meant to aggregate over all of them, we would need to pin down the "average" argument. However, in practice factors like taxation and luck make the boundaries relatively tight, so the equilibrium choice is not a major issue. In the model with endogenous income we will provide results with both equilibrium definitions. For obvious space limitations, in the model with exogenous income we will only show the results for the screening equilibrium.

\textsuperscript{38}It is semi-separating because a maiden of a given type will not always buy (or not buy) the conspicuous good.
Let's incorporate richer assumptions. Firstly, there are two types but a continuum of incomes distributed \( g(y) \) on the interval \([y, \bar{y}]\). Secondly, the mapping between types and incomes is stochastic: the probability of being of the high type conditional on income \( y \) is \( f(y) \), where we only assume \( f'(\cdot) > 0 \). In the screening equilibrium, \( p^* \) is given by:

\[
\max_{p \geq 0} \kappa_H \int_0^\bar{y} q(y; p) f(y) g(y) dy + \kappa_L \int_0^\bar{y} q(y; p) (1 - f(y)) g(y) dy
\]

For the sake of simplicity, let intrinsic utility be logarithmic:

\[
q(y; p) = \begin{cases} 
0 & \text{if } y < \frac{p}{\theta} \\
\frac{y}{p_0} - \frac{1}{\theta} & \text{if } \frac{p}{\theta} \leq y \leq \frac{p_0 + 1}{\theta} \\
1 & \text{if } y > \frac{p_0 + 1}{\theta}
\end{cases}
\]

Maidens with \( y \in \left[\frac{p}{\theta}, \frac{p_0 + 1}{\theta}\right] \) will make bets to each other, so the market for risk clears. The inequality due to those bets is "self-generated." Finally, assume \( \kappa_L = -\kappa_H = \kappa \):

\[
\max_{p \geq 0} \kappa \int_{\min \left\{ \frac{p_0 + 1}{\theta}, \bar{y} \right\}}^{\min \left\{ \frac{p_0 + 1}{\theta}, \bar{y} \right\}} \left( \frac{y}{p} - \frac{1}{\theta} \right) (2f(y) - 1) g(y) dy + \int_{\min \left\{ \frac{p_0 + 1}{\theta}, \bar{y} \right\}}^{\frac{p_0 + 1}{\theta}} (2f(y) - 1) g(y) dy
\]

Assume \( y \) is uniformly distributed on \([0, 1]\). And let \( f(y) = a + by \), where \( 0 < a < \frac{1}{2} \) and \( 0 < b < 1 - a \) so \( f(y) \in (0, 1) \). We also let \( a + b < \frac{1}{2} \), so PC would prefer not to provide the non-market good rather than providing it at random. We also need \( a + b > \frac{1}{2} \), otherwise PC would not like to provide the non-market good to anyone. We will show the results for \( a = 0 \), with \( b \in \left(\frac{1}{2}, 1\right) \), simply because of the notational simplicity. For any \( p > \theta \) not even the richest maiden will buy the conspicuous good, so PC would attain zero expected utility. We have two cases left. First:

\[
\max_{p \in \left[0, \frac{\theta}{\theta + \frac{2}{3}}\right]} \left( b - 1 + p \frac{1}{2} \frac{\theta + 2}{\theta} - p^2 \frac{b}{\theta^2} \left( 1 + \frac{1}{3} \frac{\theta^2}{\theta^2} \right) \right)
\]

From the FOC:

\[
p^* = \frac{1}{4b} \frac{\theta^2 + 2\theta}{1 + \theta + \frac{b}{\theta}}
\]

We need to see if \( p < \frac{\theta}{\theta + \frac{2}{3}} \) in the first place. That happens whenever \( \theta < \tilde{\theta} \), where:

\[
\tilde{\theta} = \begin{cases} 
\frac{-12b - 9 + \sqrt{-48b^2 - 24b + 9}}{-6 + 8b} & \text{if } b < \frac{3}{4} \\
\infty & \text{if } b \geq \frac{3}{4}
\end{cases}
\]

The case left is:

\[
\max_{p \in \left[\frac{\theta}{\theta + \frac{2}{3}}, \theta\right]} \left( \frac{1}{\theta} \left( 1 - \frac{p}{\theta} \right) - \left( \frac{1}{2p} + \frac{b}{\theta} \right) \left( 1 - \frac{p^2}{\theta^2} \right) + \frac{2b}{3p} \left( 1 - \frac{p^3}{\theta^3} \right) \right)
\]

From the FOC:
Figure 6. Equilibrium for $\theta \in [0, 2]$, with $b = 0.65$.

\[ p^* = -\frac{3 + 4b - \sqrt{9 + 24b - 48b^2}}{8b} \]

Where it is straightforward to obtain the conditions for $p^* \in \left[ \frac{\theta}{\theta+1}, \theta \right]$. From both cases you can see that $p^*$ is decreasing in $b$ and increasing in $\theta$, as expected. The greater $b$ the greater the proportion of individuals that are talented, so PC will want to reach a higher share of the population by reducing the required conspicuous consumption. The greater $\theta$ the more incentives for the poor maidens (which are relatively more likely to be of the low type) to buy the conspicuous good, so $p^*$ must increase to maintain deterrence.

The share of individuals of high type buying the conspicuous good is given by:

\[ c_h = \frac{b}{3p} \min \left\{ \frac{p \theta + 1}{\theta}, 1 \right\} - \frac{b(\theta + 1)}{2\theta} \min \left\{ \frac{p \theta + 1}{\theta}, 1 \right\}^2 + \frac{b p^2}{6\theta^2} + \frac{b}{2} \]

We are also interested in the share of individuals buying risk, which is given by $p^*$ if $\theta < \tilde{\theta}$, and by $\frac{\theta - p^*}{\theta}$ otherwise. As before, we want a behavioral measure of how large $\theta$ is. We do so by measuring $\hat{p}$, which is the average income share spent in conspicuous goods (for those who buy some):

\[ \hat{p} = \frac{\frac{\theta}{\theta+1} \frac{a}{2} - p \ln(\min \left\{ \frac{p \theta + 1}{\theta}, 1 \right\})}{\frac{a}{2} + 1 - \min \left\{ \frac{p \theta + 1}{\theta}, 1 \right\}} \]

The results are illustrated by Figure 6, where we fix $b = 0.65$ and $\theta \in [0, 2]$. Notice that a higher $\theta$ decreases PC’s utility. Intuitively, the non-market good becomes more attractive and then it is more difficult for PC to identify maidens of the high type. Both types benefit from
Figure 7. Equilibrium for $\theta \in \{0,1\}$, with $\tau \in [0,1]$ and $b = 0.8$.

A higher $\theta$. Some of the increase in $\theta$ cannot be enjoyed because of the waste in conspicuous goods (indeed, there is an endogenous upper limit to how much $\theta$ can benefit maidens). Also, we measure income inequality as the variance of the final income distribution (the mean is always the same, so we do not need to normalize). The greater $\theta$ the greater share of the population that trade risk. As a direct result, income inequality goes up with $\theta$, which we call self-generated inequality.

4.1.1. First-best Taxation. As before, the social planner can impose efforts and consumptions but cannot directly allocate the non-market goods. Just assume that the optimal allocation of efforts chosen by the planner generated the distribution of incomes given above. If we introduce a proportional income tax ($\tau$) the setup is exactly the same, except that incomes will be uniformly distributed between $\tau$ and $1 - \tau$. You can find the calculations in A12. The qualitative results are exactly the same than in Section 3. The extent to which the high type can benefit from the non-market goods depends directly upon the degree of income inequality, so in presence of non-market goods the social planner prefers to allow for a substantial deal of inequality (see left panel of Figure 7). Utilitarian optimal taxation is further away from complete income equalization the more valuable the non-market goods are.

In the right panel of Figure 7 we show the equilibrium after-tax income inequality. Inequality is always greater with than without non-market goods, because of the self-generated inequality. This source of inequality is of first order. As a result, in absence of non-market goods inequality is strictly decreasing in the tax rate, but when non-market goods are present there is a U-shape relationship between the tax rate and the after-tax income inequality.

4.1.2. Continuum of non-market goods. One key implication of the model is that the rich are buying risk but the poor are not. This is actually a poor prediction, product of an overly simple model. In the next sub-section there is a continuum of types, so people with "middle-incomes" will be the ones willing to buy risk. This is consistent with the first proposal of Friedman (1953) and Friedman and Savage (1948), where the utility function is concave-convex-concave,
so people with middle incomes buy risk. This is a better prediction, but still far from realistic. As a shortcut, the reader should think of the model as taking place within a given reference group (i.e. a neighborhood), so people with "middle incomes" within each reference group (who in absolute terms can be rich or poor) are trading risk. However, in practice people form reference groups through conspicuous consumption (e.g. housing expenditures). We need a more realistic model to provide more accurate predictions about attitudes towards risk and the equilibrium distribution of income (see Perez Truglia, 2010).

One problem with the above model is that part of the demand for risk is coming from the discreetness of PC’s action space. In this subsection we will show that the demand for risk does not rely on the discrete nature of PC’s action space, nor on the discrete nature of the maidens’ type space.

There is a continuum of non-market goods. Instead of facing one PC with certain probability, the maidens have a density distribution over a continuum of Princes Charming (PCs), one for each non-market good. When facing a maiden, each PC must take a (continuous) action $a_j$. The action can be conditioned on the only observable information: total conspicuous consumption by the maiden ($p$). There are two things that differentiate PCs from each other. On the one hand, different PCs may have different preferences over the types of maidens they want to provide the non-market goods: i.e. the utility of PC $j$ from providing the non-market good $a$ to a maiden of type $t$ is $G(a,t)$. Let $y = g(t)$ represent the deterministic one-to-one mapping between income and types. Let $p = f^{-1}(y)$ be the conspicuous expenditure of the maidens as a function of income in equilibrium. We can then obtain PC’s optimal action as a function of conspicuous consumption:

$$a_j^*(p) = \arg \max_{a} G(a, g^{-1}(f^{-1}(p)))$$

The second dimension that may differentiate PCs from each other is how valuable their non-market goods are. For the maiden, the utility from getting non-market good $a$ from PC $j$ is: $R(a, v_j)$, where $v_j$ is a PC-specific parameter. We expect $R_a > 0$ and $R_v > 0$. If PCs are expecting the maidens to act according to $p = f^{-1}(y)$, then the expected utility from non-market goods for a maiden with income $y$ is: $\theta(p) = E[R(a_j^*(p), v_j)]$, where the expectation is over $j$. The function $\theta(p)$ is the indirect utility from conspicuous expenditure. With this formulation we can highlight how misleading it is to make reduce-form assumptions about $\theta(p)$, since its shape depends heavily on endogenous variables: e.g. effort choices (which determine $g(\cdot)$) and consumption choices (which determine $f(\cdot)$). Also, the curvature of $\theta(p)$ does not depend exclusively on the preferences of PC (e.g. the curvature of $G(\cdot)$), but it also depends to a great extent on the curvature of $U(\cdot)$ (i.e. through $f(\cdot)$).

We want to keep this as a stylized example, so we will not provide an explicit model for PC’s problem. Let $\theta(p)$ be a candidate for a separating equilibrium. The problem of a maiden with income $y$ is:

$$\max_p U(y - p) + \theta(p)$$

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39 A simple version of the model with endogenous formation of reference groups is available upon request.

40 Note that in the first model $\theta(p)$ was a step-function: $\theta$ if $p \geq p_b$ and $0$ otherwise.
From the FOC: \( y = f(p) = U''(\theta'(p)) + p \). Denote the value function:

\[
V(y) = U(y - f^{-1}(y)) + \theta(f^{-1}(y))
\]

Take the second derivative:

\[
V''(y) = U''(y - f^{-1}(y)) (1 - f^{-1}(y))^2 - f^{-1}(y)U'(y - f^{-1}(y)) + \\
+ \theta''(f^{-1}(y)) f^{-1}(y)^2 + \theta'(f^{-1}(y)) f^{-1}(y)
\]

The SOC of the maximization problem can be satisfied and still \( V(y) \) can be very convex. We will prove this by providing a simple counter-example. Consider logarithmic intrinsic utility and \( y \in [1, 1.25] \). If incomes were public information, then the optimal actions of the PCs would generate the following expected utility from non-market goods:

\[
\Psi(y) = \frac{1}{8} \left(1 + y + \sqrt{-3 + 2y + y^2}\right)^2
\]

Notice that \( \Psi(\cdot) \) is monotonically increasing and strictly concave. Since incomes are not observable, maidens must incur in conspicuous consumption to signal them. Let \( p = f^{-1}(y) \) be the optimal conspicuous consumption as a function of income. Then the PCs will use \( y = f(p) \) as a revelation mechanism, resulting in:

\[
\theta(p) = \Psi(f(p))
\]

The consumption problem for a maiden with income \( y \) is:

\[
\max_p \ln(y - p) + \Psi(f(p))
\]

FOC: \( y = \frac{1}{\Psi'(f(p))f'(p)} + p \)

Since this must be true for every \( y \):

\[
f(p) = \frac{1}{\Psi'(f(p))f'(p)} + p
\]

Since 1 is the minimum income, we should have \( f(0) = 1 \). It is straightforward to verify that \( f(p) = \frac{1}{1+p} + p \) is a solution to this differential equation. It is also straightforward to check that the SOC of the maximization problem is satisfied. Finally, we can compute the value function:

\[
V(y) = \ln(y - f^{-1}(y)) + \Psi(y)
\]

Which is a convex function of \( y \), as we anticipated. This means that the above cannot be a separating equilibrium: if the PCs were to keep the \( a_j^*(p) \) that led to \( \theta(p) \), all maidens would

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41 This and other very particular normalizations serve the only purpose of making the notation as concise as possible.

42 In the discrete model \( \Psi(\cdot) \) was a step function (and then convex).
invest their entire incomes in lotteries giving the extreme outcomes 1 and 1.25, so the joint distribution of talents and incomes would change dramatically and $a^*_j(p)$ would not be a best response. We hope it is now clear that the continuous model is much less tractable, the intuitions are harder to grasp, and we are restricted to functional form assumptions that have to do with the system of differential equations being solvable and not with the economic nature of the problem.

4.1.3. **On risk aversion.** The key result above is that the value function can be much less concave than the intrinsic utility function, and even convex. This can explain the discrepancy between measures of risk aversion from small-stake and large-stakes gambles. In the spirit of Chetty and Szeidl (2007), it is very difficult and costly to make temporary adjustments in the consumption of conspicuous goods (e.g. gold watches and Ferraris). As a consequence, when people face a small-stakes lottery, they only consider using the winnings (looses) to increase (decrease) standard consumption. The measure of risk aversion will then correspond to the risk aversion of the intrinsic utility function, which can be very high. On the contrary, when stakes are large people can adjust both standard and conspicuous consumption, so the risk aversion will be much lower, and even negative.\(^3\)

We can use these kinds of by-products to generate tests of the model. Indeed, there is substantial evidence on risk-loving behavior. The typical example is that of raffles.\(^4\) However, there are much more important choices regarding risk, such as the choice of career. For instance, Moskowitz and Vissing-Jorgensen (2002) estimated the return to entrepreneurial investment using data from the Survey of Consumer Finances and the Flow of Funds Accounts and National Income and Product Accounts. They found that the average return to all private equity is similar to that of the public market equity index, despite the private equity of being much riskier.\(^5\) In a similar spirit, Hamilton (2000) uses data from Survey of Income and Program Participation. He estimates that earnings of the self-employed are substantially smaller than earnings of workers (the median earning differential in 10 years is 35%), yet they have a higher variance.

4.2. **Endogenous Income.** There is a continuum of individuals with types $\mu_i$ uniformly distributed in $[\mu_l, \mu_h]$. Intrinsic utility is logarithmic. An individual that makes an effort $e_i$ pays a utility cost $-e_i$ and gets a random income uniformly distributed in $[0, e_i\mu_i]$. The maiden gets an extra $\theta$ if he performs the activity with the PC. PC’s utility is normalized to zero if he does not perform the activity, and he gets $\kappa (\mu - \bar{\mu})$ if performing the activity with a maiden of type $\mu$, where $\bar{\mu} \in [\mu_l, \mu_h]$. PC will then choose a threshold $p^*$: i.e. he provides the non-market good iff the maiden spends $p \geq p^*$. We will restrict attention to symmetric equilibria: i.e. an

---

\(^3\)An equivalent argument would be that there are cognitive cost from solving the utility maximization problem. When stakes are small people just maximize locally (i.e. revise only standard consumption), and when stakes are large they want to move over the envelope (i.e. revise also conspicuous consumption).

\(^4\)Even the most conservative life choices are subject to substantial randomness. Even if individuals were risk-lovers it would not necessarily follow that they would buy lotteries: they could simply not buy as much insurance as they could.

\(^5\)This is not a minor puzzle: they report that the total value of private equity is similar in magnitude to the public equity market.
individual of type $\mu$ will choose an effort $e(\mu)$, a fair lottery, and whether to buy the conspicuous good $p^*$ or not (conditional on the outcome of the lottery). Begin by taking $p$ as given, and recall $q(y)$ from before. Now let $\phi_1 = \min \{ \frac{p}{\theta}, e_i \mu_i \}$, $\phi_2 = \max \{ \frac{p}{\theta}, \min \{ p^{\frac{\theta+1}{\theta}}, e_i \mu_i \} \}$ and $\phi_3 = \max \{ p^{\frac{\theta+1}{\theta}}, e_i \mu_i \}$. The problem for maiden $i$ is:

$$\max_{e_i \geq 0} \int_{p}^{\phi_2} \frac{\ln \left( \frac{y}{p} \right)}{e_i \mu_i} \left( 1 - \frac{y}{p} + \frac{1}{\theta} \right) + \left( \ln \left( p^{\frac{\theta+1}{\theta}} - p \right) + \theta \left( \frac{y}{p} - \frac{1}{\theta} \right) \right) dy + \int_{0}^{\phi_1} \frac{\ln \left( \frac{y}{e_i \mu_i} \right)}{e_i \mu_i} dy + \int_{p^{\frac{\theta+1}{\theta}}}^{\phi_3} \frac{\ln \left( \frac{y - p}{e_i \mu_i} + \theta \right)}{e_i \mu_i} dy$$

The problem can be decomposed into three different sub-problems. The first sub-problem:

$$\max_{e_i \in \left[ 0, \frac{1}{\theta} \right]} \int_{0}^{\phi_1} \frac{\ln \left( \frac{y}{e_i \mu_i} \right)}{e_i \mu_i} dy - e_i$$

From the FOC: $e_i^* = 1$. The second sub-problem:

$$\max_{e_i \in \left[ \frac{1}{\theta}, \frac{\theta+1}{\theta} \right]} \frac{p^2 - \theta^2 e_i^2 \mu_i^2 - e_i \mu_i 2 \theta p \left( \ln \left( \frac{p}{\theta} \right) - 1 \right) + 2 \theta e_i^2 \mu_i p}{2p \theta e_i \mu_i}$$

Which also has an explicit solution. For the third sub-problem, $e_i > \frac{1}{\theta} p^{\frac{\theta+1}{\theta}}$, we cannot provide an explicit solution but we can show the solution exists and is unique. In summary, we have:

$$e_i = \begin{cases} 1 & \text{if } \mu_i \leq \hat{\mu}(p) \\ e(\mu_i) & \text{if } \mu_i > \hat{\mu}(p) \end{cases}$$

Now we need to determine $p^*$. In the screening equilibrium PC solves:

$$\max_{p} \frac{\kappa}{\mu_h - \mu_l} \int_{\mu_l}^{\mu_h} (\mu - \overline{\mu}) \int_{\overline{\mu}}^{g(\mu)} \frac{g(y)}{e(\mu)} dy d\mu$$

Where $g(\cdot)$ is given by the usual formula. The objective function is continuous and globally concave in $p$, so it has a unique global maximum. In Figure 8 we show the results for $\theta \in [0, 2]$, with $\mu_l = 1$, $\mu_h = 2$ and $\overline{\mu} = 1.65$. The intuitions are the same than the ones we saw for the model with endogenous income in Section 3.\footnote{There is only one significant difference. In the former model maidens of the low type never got the non-market good, so they could not benefit from an increase in $\theta$ (unless there was taxation). On the contrary, in this model some $\mu_i < \overline{\mu}$ get the non-market good with positive probability.} Finally, if we compute the equalizing instead of the screening equilibrium, we get an extremely similar picture.

4.2.1. Second-best taxation. Now we have to repeat the procedure, but incorporating a proportional income tax, $\tau$. Let $\overline{y}$ be the (expected) mean income. Denote:
The problem for maiden $i$ is:

\[
\phi_1 = \max \left\{ \min \left\{ \frac{p}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau) \right\}, 0 \right\}
\]

\[
\phi_2 = \max \left\{ \frac{p}{\theta} - \tau \mathbb{Y}, \min \left\{ \frac{\theta + 1}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau) \right\}, 0 \right\}
\]

\[
\phi_3 = \max \left\{ \frac{\theta + 1}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau), 0 \right\}
\]

We can split up this problem into sub-problems, as we did before. Denote $e(\mu, \mathbb{Y})$ to the solution. A symmetric equilibrium is defined by the following fixed point:

\[
\mathbb{Y} = \int_{\mu_i}^{\mu_h} \frac{\mu e(\mu, \mathbb{Y})}{2(\mu_h - \mu_i)} d\mu
\]

Which is straightforward to compute, since $e(\mu, \mathbb{Y})$ is monotonically decreasing in $\mathbb{Y}$. In general the addition of more realistic assumptions makes a model more difficult to deal with. This is the opposite case: in sharp contrast to the model in Section 3, now the equilibrium outcomes change "smoothly" with $\tau$. 

**Figure 8.** Equilibrium for $\theta \in [0, 2]$, with $\mu_i = 1$, $\mu_h = 2$ and $\mathbb{Y} = 1.65$. 

\[
\phi_1 = \max \left\{ \min \left\{ \frac{p}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau) \right\}, 0 \right\}
\]

\[
\phi_2 = \max \left\{ \frac{p}{\theta} - \tau \mathbb{Y}, \min \left\{ \frac{\theta + 1}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau) \right\}, 0 \right\}
\]

\[
\phi_3 = \max \left\{ \frac{\theta + 1}{\theta} - \tau \mathbb{Y}, e_i \mu_i (1 - \tau), 0 \right\}
\]
In Figure 9 we show the results for the screening equilibrium with $\theta \in \{0, 2\}$ and $\tau \in [0, 0.95]$, with $\mu_l = 1$, $\mu_h = 2$, and $\overline{\mu} = 1.65$.

We reproduce the results for the equalizing equilibrium in Figure 10. As you can see, the qualitative results are very similar. Notice that income taxation increases utilitarian welfare even when $\theta = 0$, since it provides social insurance. When $\theta > 0$ the tax rate that maximizes utilitarian welfare is substantially greater. Just like in Section 3, the high type need to work much harder as to deter the low type from imitating them. The income tax give them incentives to work less, which is actually efficient. In other words, the presence of non-market goods relaxes the usual moral-hazard problem from income taxation.

However, just like in the model of Section 3, a high tax rate can compromise the provision of non-market goods. Intuitively, the separating equilibrium relies on differences in marginal utilities from standard consumption (i.e. from the concavity of the intrinsic utility function). When the income distribution approaches complete equalization, it becomes impossible to sustain a separating equilibrium. As you can see from Figures 9 and 10, the provision of non-market goods collapses when $\tau$ is very high. As aforementioned, this is the first paper to acknowledge that the conspicuous market is fragile: i.e. if income inequality is not allowed to be sufficiently high, non-market goods will not be provided in equilibrium, which is bad for both maidens and

47 As expected, the collapse starts at a higher tax rate in Figure 10 than in Figure 9.
PC. This is a key aspect of the real world that is completely missing in the rest of the literature (hopefully, up to now).

The optimal tax, from utilitarian to Rawlsian, will depend upon the strength of the structural link between income and talents. In the particular calibration of the model given above the link is strong, so the optimal tax rate is very high. In the real world there are many confounding factors that may deteriorate such link, such as bequests, non-pecuniary occupational benefits, etc. On the other hand, the link would be stronger if we took into account that people can condition the conspicuous signal on other observable information, and even combine more than one signaling strategy. Some of these practical concerns are discussed in Section 5.

Finally, there are some remarks we would like to make. First of all, in the equalizing equilibrium PC’s utility is zero by construction. But if we want to do welfare analysis in the screening equilibrium, we should include PC’s utility into the Social Welfare. We did not consider that basically because we do not know a priori how to compare utils of maidens with utils of PC. Fortunately, PC’s utility peaks at about the same tax rate than maidens’ utility, which you can see from Figure 11. Also, PC’s utility also falls dramatically for high $\tau$ (i.e. when the conspicuous market collapses), which reinforces the idea that the benefits from taxation are limited.

\footnote{We do know that people play the role of both maiden and PC. However, we do not know: i. How much more (or less) frequently people act as PC than as maidens; ii. The magnitude of $\kappa$ relative to $\theta$.}

\textbf{Figure 10.} Reproduction of Figure 9, but for the equalizing equilibrium.
Finally, for the welfare analysis with the equalizing equilibrium a key assumption is that $\bar{\mu}$ is greater than the median $\mu$. Intuitively, this is solely meant to represent that a great deal of the conspicuous goods would not be provided if the matching mechanism was random or close to random$^{49}$: e.g. if people could not distinguish talented from untalented people, they would not admire$^{50}$ or marry at random. We can dispose of the assumption about $\bar{\mu}$ by simply using a model with a continuum of non-market goods.

4.2.2. Positive externalities. According to the welfare calculations, taxation is welfare-improving because some people would otherwise work too much in the struggle for non-market goods. Nevertheless, the production of conspicuous goods may not be a complete waste of resources. More generally, the model above assumes that there are no spillovers from one individual to another besides the tax revenues. If there were other spillovers apart from taxation, we would probably need to revise the optimal tax rate downwards. The point is particularly obvious for conspicuous production in academia: i.e. people work too hard in the competition for admiration and respect, but in the process they generate social benefits that probably more than compensate the utility losses from the long working hours. But a similar case can be made about almost every economic activity. For instance, if conspicuous consumption meant literally burning $100 bills, then it would not be wasteful at all (making its social stigma ironic). On the other extreme, if conspicuous goods required many valuable resources that do not generate positive spillovers to the rest of the economy (e.g. mining for diamonds), they would be mostly waste. But in reality most conspicuous goods are somewhere in the middle.

For instance, when BMW pays expensive advertisements for the Super Bowl, it is actually financing the game for the spectators (a genuine source of happiness) in exchange of being

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$^{49}$Actually, they would not allocate them at random, but using the next best allocation mechanism.

$^{50}$If the model was only about admiration, then we could get rid of PC and make the non-market good a mere function of other people’s beliefs about $i$’s type. The equivalent assumption would be some convexity in this admiration function, or even discontinuities (e.g. prizes). Similar convexities appear in the literature: e.g. Robson (1992) assumes that being first rather than second is more satisfying than being second rather than third.
informed about the exorbitant prices of its cars. Indeed, technologic goods are ideal for conspicuous consumption. If someone is wearing a $10,000 shirt you might not tell the difference from a $10 shirt without knowledge about fashion. But if someone shows up in a flying car, you will be very confident that she is extremely rich. If conspicuous expenditures go to technological R&D, then they imply major positive spillovers for future generations. In other words, the engineering of the best BMW in the present will improve the comfort and cost structure of the cheapest cars in the future. If the spillovers from conspicuous consumption are sizable, then you may want to think twice about taxing heavily. The quest for respect and admiration has played a crucial role in capitalism. It made the great entrepreneurs keep working harder and harder, even when they already accumulated a fortune. And their hard work, sooner or later, directly or indirectly, will benefit the poor.

5. Extensions

We feel the model is exactly as simple as to capture the key effects at the macro level in an elegant manner. However, some further developments would be necessary to address questions outside the basic welfare and policy implications covered in this paper. For instance, we already mentioned that we need a continuum of non-market goods to get more precise predictions about the attitudes towards risk and the equilibrium distribution of income (Perez Truglia, 2010). In this section we will look at the micro-level details about conspicuous consumption. Working out those details in future research would not only test the robustness of the macro model, but it would also make room for its structural estimation.

5.1. What is conspicuous consumption? We already pointed out that the object that matters is not the consumption of a particular conspicuous good, but the total expenditure in observable goods. In principle, different societies could use very different conspicuous goods. In practice, some goods seem to be particularly good at being noticed, so they are very popular across societies: e.g. clothing, clothing accessories, housing, cars. Recall the characterization of a conspicuous good as a damaged good. The signal from a visible good is stronger the less the intrinsic utility derived from the good. As a general rule to determine how conspicuous a good is, you should ask the following question: if the consumption was not observable, how much of the good would the individual consume? For instance, if burning money was not observable, then nobody would ever want to burn money. We can confidently conclude that burning money is entirely conspicuous consumption. On the other hand, if we gave you a spell that makes your car invisible for the rest of the population, you would still want to spend a substantial amount of money in your car (e.g. transportation, safety). Thus, your conspicuous expenditure equals the difference between how much you would spend if the car was visible rather than invisible.\footnote{Note that observability is sometimes part of the intrinsic utility: e.g. a sign. Also, there may be heterogeneity in the intrinsic utility derived from a particular observable good. For instance, some people may like cars more, so the "signal" from their expenditure in cars should be weaker. If there are many possible conspicuous goods then we can re-define the equilibrium to let PC account for this.}
But being visible is not a sufficient condition to qualify as a conspicuous good. Ideally, the price should be either public or easy to estimate. Since PC also acts as a maiden, he should know the prices of the conspicuous goods used in his community. For obvious memory and cognitive limitations, some conspicuous goods are particularly good in this respect. For instance, the price of a diamond ring is approximately proportional to its size and clarity. There is plenty of evidence on the importance of publicity of price. For instance, Cartier has one person in Paris whose sole responsibility is to keep tabs on its watches (Bagwell and Bernheim, 1996). Also, luxury brands restrict sales outside their own stores to prevent discounts in secondary markets. For instance, Christian Dior sued supermarkets for carrying its products, and luxury goods manufacturers are advised not to sell their products over the Internet (Amaldoss and Jain, 2005).

Also, luxury brands should find it convenient to inform non-customers about the (exorbitant) prices of their products: e.g. by means of advertisement to non-consumers. Even though offering a product cheaper than the competition would send the wrong signal, the marketing team of one jewelry firm found the way around: "Only Cardow knows you paid less." Recognizing prices implicitly means that people should be able to spot fake copies. Firms invest a significant amount of money in developing authenticity marks. Many examples come from the clothing industry, like sophisticated authenticity marks in sportswear, or Louis Vuitton’s bags with tags that do not come off. We have an interesting anecdote about fakes. In the poor areas of Argentina there are big "street shoppings" to buy fake copies of high-brow clothes and clothing accessories. Faking authenticity marks is very costly to the forfeiters, since they are small firms operating in the shadow economy and the authenticity marks involve sophisticated technology that also changes frequently. When purchasing deliberately fake cloths of well-known brands, people are willing to pay up to 50% extra for falsified authenticity marks.

Social norms may play an important role regarding fakes. Ng (1987) notices that a carat of diamond can be worth thousands of dollars, while imitation diamonds look virtually the same (i.e. it takes experts with fine instruments to tell the difference) but cost only a few dollars. In spite of this, people seem to restrain from wearing fake diamonds, at least when interacting with people from their own social circle. This indicates the presence of a harsh social norm against the use of fake products. In the end, wearing a fake diamond to get an unearned non-market good is a form of stealing. Indeed, people usually associate conspicuous goods with snobism. This is not surprising, because snob goods have as an advantage that consumers invest time and effort in identifying them: i.e. spotting fakes and learning their prices. As we mentioned before, in practice every maiden is also a provider of non-market goods. Using snob goods introduces a non-pecuniary cost: even if you had the money to buy the conspicuous good, you would not know which one to buy. Snobism is then a finer mechanism that incorporates transaction and information costs to the overall cost of the conspicuous good.

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52 The following manager, cited by Bagwell and Bernheim (1996), illustrates the point: "Our customers do not want to pay less. If we halved the price of all our products, we would double our sales for six months and then we would sell nothing."
Also, there are practical reasons why people would like to "coordinate" to buy a small set of conspicuous goods. For instance, cognitive limitations: e.g. you cannot keep track of all the goods consumed by all of the people you know, so you just focus on some items (e.g. car, housing, clothing). And even if you could memorize all the consumption portfolios, you would find it very costly to gather all that information (i.e. monitoring costs). Social norms can make the signaling equilibrium much more efficient. For instance, some American women learn a lot about diamond engagement rings from an early age. There is an informal rule that a man should spend two to three months' of salary for the engagement ring. If people above the rule are punished (e.g. their friends may think that they tried to appear as richer than they are), then the engagement-ring norm would be a great income-revelation mechanism, at least within a narrow reference group.

Coordinating to use a single conspicuous good may only be reasonable in small communities. However, there is an historic event which may be accounted as an (eventually failed) attempt to create a ultimate conspicuous good: the Tulip Mania during the Dutch Golden Age, better known as the first recorded financial bubble (see MacKay, 1980). The tulip arrived to Europe in the XVI century and became very popular in the United Provinces. The flower rapidly became a status symbol, and it could cost more than 10 times the annual income of a skilled craftsman. The tulips seem to satisfy many desirable conditions for a conspicuous good: intrinsic utility is homogeneous and close to zero, trading was widespread so prices were public information and fake tulips were not a viable option, people should simply monitor the tulips and not many different status items, etc.

Also, different people observe different goods in different situations. For instance, only your close friends and neighbors may visit your home (even though other people may learn in which city or area you live). As a consequence, people want to smooth conspicuous consumption over thousands of possible interactions with different PCs, which explains some of the demand for variety of conspicuous goods (i.e. why nobody spends the entire conspicuous budget on a single item). But even conditional on a particular interaction, people may still want to diversify the conspicuous portfolio over many goods. For instance, if people wanted to spend their entire conspicuous budget in a single good, say a gold watch, people should be able to tell the difference between a $5,000 and a $100,000 watch. Or the cost of making a fake may be concave in its price (i.e. faking a $5,000 watch costs $500, but faking a $100,000 watch may cost only $1,000).\footnote{Similarly, the probability of getting robbed may be convex on the price, the social stigma may be convex in its price, etc. Additionally, we mentioned that intrinsic utility may be heterogenous (e.g. some people may like cars more). If that is the case, using many conspicuous goods will "average out" the heterogeneity: i.e. PC would require the maiden to spend \( p \) over many conspicuous goods.}

In addition, for durable conspicuous goods we must be careful about computing the relevant price. For instance, imagine that you are playing a one-shot signaling game. Since you can use a gold watch and sell it the day after, the relevant price of the conspicuous good would be the one-night opportunity cost of the capital including insurance, the losses in the buy-and-sell
transaction and the (pecuniary and non-pecuniary) transaction costs.\textsuperscript{54} Also, in our model \( p (\theta) \) represented conspicuous expenditures (non-market goods) over an entire lifetime. One could argue that the conspicuous expenditure in housing should not be the actual price of the property, but the opportunity cost of the capital during the lifetime. However, people do not consume their assets completely during life because they want to leave bequests. But bequests are just a particular form of consumption. Therefore, the visible assets that are transferred post-mortem should also count as conspicuous consumption when living.

Finally, the difference between what is intrinsic utility and what is not is actually very subtle. We cannot define intrinsic utility as those consumption activities that elicit immediate rewards in the brain, or we would miss a great deal of the story. After all, non-market goods will ultimately excite reward systems (e.g. dopaminergic neurons). For instance, when people drive a Ferrari they get intrinsic utility from things like transportation, safety and enjoying the ride. But they also savor the prospect of all the non-market goods that the conspicuous good will bring.\textsuperscript{55}

There are many other details about conspicuous consumption that we could incorporate into the model. For instance, if lotteries are observable (e.g. betting in a Casino) they may be perfect for conspicuous consumption. Similarly, the conspicuous good may be complementary to standard consumption, or the non-market good may be complementary to the maiden’s type. Since we are not interested on a particular conspicuous good or a particular non-market good, we will not pursue those extensions here (you can find some in Perez Truglia, 2010).

Even though they represent a huge share of the economy in both developed and developing countries, there have only been some isolated empirical papers on conspicuous goods. Our favorite piece of evidence comes from Glazer and Konrad (2006), who studied charitable donations as conspicuous goods. First of all, they show that a minority of personal donations are anonymous. More importantly, they show that for donation records of institutions that report the names of donators in donation categories (e.g. $1000-$1999, $2000-$2999), donations within each category are very close to the lower bound.\textsuperscript{56} Another piece of evidence comes from Mandel (2009), who shows that long-term average returns for art are lower than for equity and, in several cases, the mean real return of "risk-free" government bonds. Art is observable in a special way: i.e. it gives a practical excuse to let your friends know about the expenditures that

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\textsuperscript{54} Indeed, there are websites where you can rent clothes and clothing accessories of exclusive brands. Also, "wardrobing" (the return of used clothing) is a widespread problem in the US: according to the National Retail Federation its cost was around $16 billion during 2002 (Speights and Hilinski, 2005).

\textsuperscript{55} The difference with the rest of the literature is that such pleasure is taken exogenously, while we let it be endogenous. For instance, if we were to estimate demand structurally, we should include moments of the income distribution as the characteristics of the conspicuous good.

\textsuperscript{56} Personal contributions are not a minor issue. In 1991 US universities alone received $10.2 billion in voluntary support, of which $2.3 billion was from alumni.
CONSPICUOUS CONSUMPTION

you can afford.\textsuperscript{57} Unless the intrinsic utility from contemplating the artwork is very high, art expenditures are mostly conspicuous expenditures.\textsuperscript{58}

Jao et al. (1998) chose a group of products with similar use and function, but which vary on the dimension of social visibility. Then they ranked the products by the social visibility dimension through an informal survey. They found that the correlation between price and intrinsic quality is lower for highly visible products (i.e. less intrinsic utility). Also, Heffetz (2007) conducts a nationally-representative survey among US households to rank the visibility of 31 consumption categories. He shows that, on average, higher-income households spend larger shares of their budgets on more visible categories. Finally, some papers measured the "positionality" of particular goods by asking individuals hypothetical questions regarding their choice among alternative outcomes: e.g. which society would you prefer, a society in which everybody has a $100,000 Ferrari, or a society in which you have a $20,000 car but everybody else has a $10,000 car? According to the conspicuous consumption theory, only observable goods should appear as positional. Among others, Carlsson et al. (2003) showed that more observable goods are more positional.

5.2. Social distance. Consider three broad groups of people that may be interested about your personal traits: complete strangers,\textsuperscript{59} close friends (including coworkers and family) and people in-between. The importance of conspicuous consumption for those three groups will depend on many factors. For close friends conspicuous consumption may play a relatively weak informational role, since some of them may observe your income directly. On the other hand, close friends face a stronger conditional correlation between income and talents, since they can condition on other information (e.g. social origin). Also, even though individually you care much less about strangers, as a group you may value their non-market goods more than that of all of your close friends taken together. And there are many other factors to account for.\textsuperscript{60} Because the forces point in different directions, we cannot tell a priori whether conspicuous consumption will be more valuable for non-market goods provided in close or distant interactions.

5.3. Bequests. Adam Smith has a nice quotation on how the unconditional correlation between income and talents may be weaker in the higher class:

"In the middling and inferior stations of life, the road to virtue and that to fortune (...) are, happily in most cases, very nearly the same. In all the middling and inferior professions, real and solid professional abilities, joined to

\textsuperscript{57}Some advertisements say almost explicitly that they sell better excuses to consume luxury goods. For instance: "there are excuses to buy luxury products... and there are reasons."

\textsuperscript{58}If you think that the intrinsic utility is very high, then you should be able explain why the individual does not spend the money instead in visiting museums around the world (and then contemplating a wider variety of artworks).

\textsuperscript{59}Munger and Harris (1989) offer a creative piece of evidence on whether we care about what complete strangers think about us. They show that in New York public washrooms only 35% of women wash their hands after using the toilet when there is no one else present in the washroom, yet nearly 80% do so when there is someone else there.

\textsuperscript{60}For instance, the quantity and quality of non-market goods may be decreasing in closeness.
prudent, just, firm, and temperate conduct, can very seldom fail of success. (....) In the superior stations of life the case is unhappily not always the same" (Smith, 1759)

This can be captured by the randomness in the income generating process. For instance, we can divide the traits behind income prospects in good traits (e.g. talent) and bad traits (e.g. bequests). However, if PC can observe (directly or indirectly) social origin, he can still use conspicuous consumption to back up the earned wealth of the maiden. That is, if PC has a (probabilistic) estimate of the maiden’s bequest, he can simply subtract it from the total wealth inferred from observing conspicuous consumption. Nevertheless, it is not obvious at all that bequests should be completely disregarded. People do not only inherit wealth, but also cultural and genetic traits. And even for the wealth inherited, some people may like to perceive it as a signal of the average traits in the infinitely-lived dynasties.

Ever since Veblen most economists have been looking for conspicuous goods in luxury items from the middle and higher class. Our theory demystifies such link. Poor people like and seek respect and admiration at least as hard as people from the higher classes. On the contrary, conspicuous consumption may be even stronger among poor reference groups, since many of the confounding factors (e.g. bequests) are less important. Indeed, there is some evidence that conspicuous consumption is very strong in poor communities. Charles et al. (2009) use data from the Consumer Expenditure Survey in the US during 1986-2002 to show that, controlling for differences in permanent incomes, blacks and hispanics spend about 30% more on conspicuous consumption than whites. And Bloch et al. (2004) exploit a natural experiment on conspicuous consumption in India, where they report that poor families spend on average four months of family income on a wedding.

5.4. Luxury taxes. Many papers have suggested to use specific taxes on luxury goods: e.g. Ng (1989), Bagwell and Bernheim (1996), Frank (1999); Rege (2008). They argue that since expenditures in luxury goods are wasteful, we can reduce the waste by taxing them. First of all, we need to take into consideration the general-equilibrium effects: i.e. since the taxes are transferred to poorer people, the IC constraint will become tighter and conspicuous consumption will increase. But beyond the theoretical concerns, there are many practical issues that have to be taken into account. Indeed, Frank (1999) gives an excellent account of the historic failure of luxury taxes. For luxury taxes to work, the tax rates should be public information (i.e. form part of the "perceived" price by the population), which may be true for some old luxury taxes but might not be true if we add more and more arbitrary taxes.

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61 For instance, Piketty (1998) offers a model of the theory of reference group comparisons developed by Merton (1953) and Boudon (1973). That is, people evaluate their economic performance by comparing it to the reference group which they come from, so that agents with lower-class origins are more easily satisfied with their performance.

62 We strongly believe that talents are homogeneously distributed across the population. Unfortunately, the fostering of those talents (e.g. nutrition, training, emotional support) is much less homogeneous.
Also, taxes will introduce additional noise: e.g. people may think that dishonest people have access to the black market, which deteriorates the correlation with good traits. We should tax all conspicuous goods equally, but a minority of goods play an exclusive role of conspicuous consumption, or no conspicuous role at all. And even the same good can be more or less conspicuous across different economies and/or over time. Even though demand for luxury goods seem very inelastic in the short run, it may be very elastic in the long run, when people have time to find new ways into which to communicate economic success. In other words, if you think of conspicuous consumption as throwing money to a bonfire, luxury taxation may have benefits, at least in the short run. But conspicuous goods are more like an informational service. For instance, companies that produce expensive clothing spend a great deal of that money in building identity and advertisement, so the rest of the population can "recognize" the conspicuous expenditure. If you tax some conspicuous goods heavily, they will stop being viable as informational services, and people will switch to alternative conspicuous goods outside those referred by the law. Since those goods were not consumed before the law was passed, they will probably be less efficient for the economy as a whole.

5.5. **Political economy of redistribution.** In 1960 the composition of the public sector in OECD countries was 8% of GDP in social spending versus 16% of GDP in public goods. Today the composition is 16% versus 17%, so the growth of the public sector is due mainly to the growth of income redistribution (Alesina et al., 2004). There have been many attempts to explain the disparities between the American and European redistribution styles. For instance, some of the attempts have relied on assuming fairness and altruistic concerns (e.g. Alesina and Angeletos, 2005), or deviations from rational expectations (e.g. Piketty, 1998). By applying the median-voter theorem (e.g. Meltzer and Richard, 1981) it is straightforward to see that the tax rate is monotonically increasing in the size of the non-market good. If we need to explain multiple equilibria, we can try by letting the supply of non-market goods be endogenous.

Additionally, the model can give a better account of the socio-economic realm in developing economies. The social status of entrepreneurs and the perceptions of poor people play a vital role in both the political outcomes and the individual decisions of whether to engage in productive economic ventures. But worse than in Babylon, in some developing countries the unconditional correlation between income and good traits may be even negative. As a result, in some areas of Argentina when people park expensive cars some pedestrians try to damage them (e.g. scratching the paint out with a key). The reason being that, just like in many other developing countries, poor and rich people believe that a significant proportion of rich people got their wealth by "stealing" from their communities (stealing has a colloquial meaning, referring to corruption in the private and public sector).

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63 Nevertheless, the fact that the unconditional correlation between wealth and good traits is weak does not necessarily imply that the conditional correlation is also weak. Far from that, it can be even higher than in the developed world, because many confounding factors (e.g. bequests) are almost absent. That is, once that people know that someone is a doctor (as opposed to a lawyer or a politician), her conspicuous consumption will signal many respectable traits.
Indeed, Di Tella and MacCulloch (2009) suggested the beliefs about the rich as the main explanation for the widespread leftist rhetoric in the developing world. In that spirit, Perez Truglia (in progress) asked people whether they think that rich people are rich because they worked hard, were born in rich families, were just lucky, or "stole." The survey of 1,100 households is representative of the greater Buenos Aires area, which hosts about one third of the Argentine population. Over 20% of the respondents claimed that rich people were rich because they "stole." To be more precise, 25% (15%) among the poor (rich). Furthermore, believing that the rich stole is one of the most important variables for explaining respondents' political ideology, policy preferences and happiness.

6. Conclusions

The literature on relative concerns and conspicuous consumption assumes that people care about wealth directly. Instead, we recognize that people do not want to signal wealth but some unobservable traits that, conditional on other observable information, are correlated with wealth. Since the relationship between unobservable traits and incomes is endogenous, the nature of the equilibrium changes dramatically with respect to the existing literature, as do the welfare implications.

The main objective was to study optimal income taxation. We showed that the presence of non-market goods alleviates the usual moral-hazard problem brought by income taxation, which increases substantially the optimal tax rate. These gains are limited, because a sufficiently high tax will collapse the provision of non-market goods. Moreover, the model can be extended to address other important policy questions: luxury taxes, estate taxes, capital gains taxes, etc. Among other results, we used this new framework to emphasize the dramatic differences in taking income as exogenous rather than endogenous (the one relevant for real-world policy). Also, we showed that the results would survive even if income was perfectly visible to everyone, because conspicuous consumption is just the mirror image of conspicuous production.

Finally, the model offers applications beyond the current reach of the conspicuous consumption literature. For instance, it gives an explanation for the disconnection between measures of risk aversion from small- and large-stakes lotteries, it desmitimizes the link between conspicuous goods and diamonds, and it provides some steps towards a better understanding of the equilibrium distribution of income (see Perez Truglia, 2010). In particular, our model provides a clean and sound theoretical argument for a usual claim that had never been micro-founded: income inequality is not a intrinsically bad property of an economy. On the contrary, some income inequality is a signal of an efficient provision of non-market goods.

References


7. Appendix

A1. Since $U''(\cdot) < 0$:
Then, the difference $\bar{\theta} - \tilde{\theta}$ equals:

$$U(y_h - p) - U(y_l - p) > U(y_h) - U(y_l)$$

Equivalently, note that $U^{-1}(\cdot) > 0$ and $U^{-1'}(\cdot) > 0$. Thus:

$$U^{-1}(U(y_h) - \bar{\theta}) - U^{-1}(U(y_h) - \tilde{\theta}) > U^{-1}(U(y_l)) - U^{-1}(U(y_l)) = y_l - y_h$$

We can use that condition:

$$\bar{p} - p = y_h - U^{-1}(U(y_h) - \bar{\theta}) - y_l + U^{-1}(U(y_l) - \theta) > y_h - y_l + y_l - y_h = 0$$

**A2.** For the simple comparative statics we need to define how $\theta$ is determined for a given $p$. Intuitively, the rich maiden would like the highest $\theta$ that comprises a separating equilibrium in the original game, $\theta = \tilde{\theta}$, as to get as much pleasure as possible from $p$ (A7). That is, we focus on the pareto-best separating equilibrium. It is only in very specific short-run games that $p$ can be treated as fixed. For instance, imagine that people use membership to a club to allocate non-market goods. However, in the paper we always focus on the case where $\theta$ is fixed.

The indirect utility from conspicuous expenditure $p$ is: $V(p) = U(y_l) - U(y_l - p)$, with $V'(p) > 0$ and $V''(p) > 0$. Notice that indirect utility functions for standard goods are concave, not convex (i.e. if your budget is twice as high, your utility will be less than twice as high). The utilitarian Social Welfare is:

$$SW = U(y_l) + U(y_h - p) + \theta$$

Where $\theta = U(y_l) - U(y_l - p)$. Let’s introduce a regressive and symmetric redistribution of income ($dy_h = -dy_l > 0$):

$$dSW = [U'(y_l) - U'(y_h - p)] dy_l + \frac{\partial \theta}{\partial y_l} dy_l$$

The first term represents the usual redistributive arithmetics: since $U''(\cdot) < 0$, we are transferring from an individual with high marginal utility to an individual with low marginal utility, so $SW$ decreases. The second term indicates that greater income inequality would allow the rich maiden to attain a better non-market good:

$$d\theta = dy_l [U'(y_l) - U'(y_l - p)]$$

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64 It is exactly because of the convexity in the expenditure function that maidens would like to use lotteries, as shown later.
Where $d\theta > 0$ because of $U''(\cdot) < 0$. Notice that the RHS is strictly increasing in $p$. If $p$ is high enough then $d\theta$ is so high that more than compensates the loss from the first term, so expected total welfare increases with a regressive redistribution (A4).

Figure 12 shows the results. After the redistribution the rich type gains $b$ in utility from standard consumption, while the poor loses $a$. The concavity of the utility function guarantees that $b - a < 0$. On the other hand, because of the higher income spread the rich type can now get a better non-market good, $\theta'$, which increases her utility in $\theta' - \theta = d - c$ (positive also because of the concavity assumption). The total change in welfare is $b - a + d - c$, which is positive for $p$ high enough.

The utility-possibility frontier (UPF) in the absence of non-market goods is identical to the one obtained for fixed $\theta$, so all social preferences that are symmetric and efficient will choose perfect income equalization. When we introduce non-market goods, the UPF becomes:

$$\left\{ (U(y_l + y_h - x_l - p) + U(x_l) - U(x_l - p), U(x_l)) \right\} \forall x_l \in \left[0, \frac{y_l + y_h}{2}\right]$$

For $x_l \in \left[\frac{w + w_0}{2}, y_l + y_h\right]$ it is the same UPF than without the non-market good.\(^{65}\) Let’s assume a natural upper boundary for the non-market good: $\theta \leq \hat{\theta}$. An example is given in the right panel of Figure 13. The kink in the UPF is given by $\hat{\theta}$. Now the UPF is not symmetric nor convex. As you can see from Figure 13, only a Social Planner with preferences very close to Leontief would choose complete income equalization. Instead, the utilitarian Social Planner allows for enough inequality so the rich type can attain the boundary $\hat{\theta}$ (i.e. the kink).\(^{66}\)

**A3.** Differentiate:

\(^{65}\) PC would like to perform the activity with the rich type, even if after the redistribution she ends up with less disposable income than the poor type.

\(^{66}\) The utilitarian choice can be to the right of the kink (A5).
$U'(y_h - p)(dy_h - dp) = U'(y_h)dy_h$

Rearranging and using $U''(\cdot) < 0$:

$$\frac{dp}{dy_h} = \frac{U'(y_h - p) - U'(y_h)}{U'(y_h - p)} > 0$$

The same procedure yields $dp/dy_l$.

**A4. Differentiate:**

$$dSW = U'(y_l)dy_l + U'(y_h - p)dy_h + U'(y_l)dy_l - U'(y_l - p)dy_l$$

Replace $dy_h = -dy_l$. Since $dy_l > 0$, the condition $dSW < 0$ equals to:

$$2U''(y_l) - U'(y_h - p) - U'(y_l - p) < 0$$

Rearranging:

$$U'(y_l) < \frac{U'(y_h - p) + U'(y_l - p)}{2}$$

Recall $p$ is fixed. First note that the RHS is strictly increasing in $p$. Notice that when $p = 0$ the condition is not satisfied because of $U''(\cdot) < 0$:

$$U'(y_l) > \frac{U'(y_h) + U'(y_l)}{2}$$

Also because of $U''(\cdot) < 0$, the condition is satisfied when $p = y_h - y_l$:

$$U'(y_l) < \frac{U'(y_l) + U'(y_l - (y_h - y_l))}{2}$$

Therefore, the condition is satisfied only for $p > p^*$, where $y_h - y_l > p^* > 0$ is defined as:
The intuition is simple: if \( p \) is too small then there are no gains from signaling and therefore a regressive transference cannot be welfare-improving.

**A5.** We know the utilitarian social planner would not choose \( x_l \) below the one that let the rich type attain the maximum non-market good: \( x_l \geq x_l^{\text{min}} \), where \( U(x_l^{\text{min}}) - U(x_l^{\text{min}} - p) = \Theta \).

The utilitarian social planer solves:

\[
\max_{x_l \geq x_l^{\text{min}}} U(y_l + y_h - x_l - p) + U(x_l) - U(x_l - p) + U(x_l)
\]

\[
\frac{\partial \text{SW}}{\partial x_l} = U'(x_l) - U'(y_l + y_h - x_l - p) + U'(x_l) - U'(x_l - p)
\]

The problem is not globally concave. Note that if \( x_l > \frac{1}{2}(y_l + y_h - p) \) then \( \frac{\partial \text{SW}}{\partial x_l} < 0 \). If \( x_l^{\text{min}} \geq \frac{1}{2}(y_l + y_h - p) \):

\[
U(\frac{1}{2}(y_l + y_h - p)) - U(\frac{1}{2}(y_l + y_h - 3p)) < \Theta
\]

Then the social planner will choose the corner solution \( x_l^* = x_l^{\text{min}} \). Otherwise, the solution will be interior: \( x_l^* \in [x_l^{\text{min}}, \frac{1}{2}(y_l + y_h - p)] \).

**A6.** The effect on social welfare will be positive if and only if:

\[
[U'(y_l) - U'(y_l - p)] dy_l - dpU'(y_l - p) > 0
\]

Just replace \( dp \):

\[
\frac{\frac{1}{2}U'(y_l - p) + \frac{1}{2}U'(y_l - p)}{2} < \frac{1}{U'(y_l)}
\]

First, notice that the LHS in strictly decreasing in \( p \). When \( p = 0 \) the condition above is not satisfied:

\[
\frac{\frac{1}{2}U'(y_l) + \frac{1}{2}U'(y_l)}{2} > \frac{1}{U'(y_l)}
\]

When \( p = y_h - y_l \) it is satisfied:

\[
\frac{\frac{1}{2}U'(y_l) + \frac{1}{2}U'(y_l - (y_h - y_l))}{2} < \frac{1}{U'(y_l)}
\]

Therefore, the condition is satisfied only for \( p > p^* \), where \( y_h - y_l > p^* > 0 \) is defined as:

\[
\frac{\frac{1}{2}U'(y_l - p^*) + \frac{1}{2}U'(y_l - p^*)}{2} \equiv \frac{1}{U'(y_l)}
\]

Notice that in this exercise \( p \) is endogenous and \( \theta \) is fixed. Then we have to write the condition as a function of \( \theta \) instead:
\[ \theta^* = U(y_l) - U(y_l - p^*) > 0 \]

So the welfare improvement exists iff \( \theta > \theta^* \).

**A7.** We want to check that, given \( p \), the rich maiden would like to have a \( \theta \) as high as possible. Her welfare as a function of \( \theta \) is:

\[
U(y_h - y_l + U^{-1}(U(y_l) - \theta)) + \theta
\]

Let \( G(\theta) \) be its first derivative. Then we need to prove:

\[
G(\theta) = 1 - U'(y_h - y_l + U^{-1}(U(y_l) - \theta)) U^{-1}(U(y_l) - \theta) > 0
\]

Notice that \( G(\theta) \) is strictly increasing in \( y_h \). Then it is sufficient to prove that \( G(\theta) \geq 0 \) when \( y_h = y_l \):

\[
1 - U'(U^{-1}(U(y_l) - \theta)) U^{-1}(U(y_l) - \theta) = 0
\]

And we are done.

**A8.** Differentiate:

\[
U'(y_l)dy_l - U'(y_l - p)dy_l = d\theta
\]

Rearranging and using \( U''(\cdot) < 0 \):

\[
\frac{d\theta}{dy_l} = U'(y_l) - U'(y_l - p) < 0
\]

The same procedure yields \( d\theta/dy_h \).

**A9.** Now assume \( e^*_i < 0 \) and \( \tilde{e}^*_i > 0 \):

\[
e^*_i = 1 + \frac{\mu_i}{\mu_h} \left\{ - \ln \left( e^*_h \frac{1}{2} \frac{\tau}{1 - \tau} \frac{\mu_h}{\mu_i} \right) + \theta - 1 \right\}
\]

We cannot solve explicitly for \( e^*_h \), but it is still straightforward to check \( e^*_h > 0 \). Finally, if \( \tilde{e}^*_i < 0 \):

\[
e^*_h = \frac{1 - \tau}{2 - 2\tau + \tau \exp(-\theta)}
\]

Where \( e^*_h > 0 \). To see when we have \( \tilde{e}^*_i < 0 \) to begin with:

\[
\tau \geq \tau_2 = \frac{2}{\left( \frac{\mu_h}{\mu_i} - 1 \right) \exp(-\theta) + 2}
\]

**A10.** To spot when that condition is violated, let’s calculate the best candidate for deviation:

\[
\max_{e^*_h} \ln((1 - \tau) \mu_h \cdot e^*_h + \frac{\tau}{2} \mu_i \cdot e^*_i + \frac{\tau}{2} \mu_h \cdot e^*_h) - e^*_h
\]
For instance, if $e^d_h > 0$ the high type would attain a utility:

$$U^d_h = \ln((1-\tau)\mu_h) - 1 + \frac{\tau}{2} \left( \frac{\mu_l e^*_l + e^*_h}{\mu_h} \right)$$

For some parameter values there is a set of $\tau$ such as by getting the conspicuous good the high type cannot attain the reservation utility $U^d_h$, so the above would not be an equilibrium. That is to say, the high-type are better off as a group in the separating equilibrium, but they have individual incentives to work less, don’t buy the conspicuous good and still enjoy the net redistribution coming from rest of the hard-working high-type maidens.

If that is the case, we can jump to any point in a continuum of equilibria indexed by $q$, the proportion of high type individuals working hard (where $q = 1$ is the separating Pareto-best equilibrium and $q = 0$ corresponds to a pooling equilibrium). Nevertheless, this is a result of the discretness of the income and type spaces, which dissapears in the more general model of Section 4.

The pooling equilibrium is given by:

$$\begin{cases}
   e^p_h = \frac{2-\tau - \tau \mu_l}{2} & \text{if } \tau \leq \frac{2}{1+\mu_l} \\
   e^p_h = \frac{2-\tau}{2} & \text{if } \tau > \frac{2}{1+\mu_l}
\end{cases}$$

For the separating equilibrium, we need the high type to be indifferent between making two different effort choices: $e^s_h$ (proportion $q$) and $e^*_h > e^s_h$, where only the latter will buy the conspicuous good. For the sake of simplicity, we will show the case $q = 1$. For the indifference condition to hold:

$$\{ p^* = \theta(1-\tau)\mu_h, \ e^s_h = e^*_h + \theta \}$$

The problem for the high-type that works hard:

$$\max_{e_h} \ln((1-\tau)\mu_h \cdot e_h + \frac{\tau}{2} \mu_l \cdot e^*_l + \frac{\tau}{2} \mu_h \cdot e^*_h - p^*) + \theta - e_h$$

If $e^*_l = 0$:

$$e^s_h = \frac{2-\tau}{2-\tau} + \frac{2-2\tau}{2} \theta - \frac{\tau}{2-\tau} \mu_l e^*_l$$

If $e_l^* > 0$:

$$e^s_h = \frac{2-\tau}{2-\tau} + \frac{2-2\tau}{2-\tau} \theta$$

We can check when $e^*_l = 0$:

$$\tau > \tau_3 = \frac{2\mu_l}{\mu_h(\theta + 1) + \mu_l}$$

If $\tau < \tau_3$ then $e^*_l > 0$ and:
$$e_h^{II} = \frac{2 - \tau}{2} (1 + \theta) - \frac{\tau}{2} \frac{\mu_l}{\mu_h}$$

There are extra details to look at. First, if $e_h^{II} < \theta$ then we could potentially find an equilibrium for a lower $p$. Secondly, if $e_l < 0$ then the low type may have incentives to buy the conspicuous good, in which case the separating equilibrium would break down. This is clearly a "coordination equilibrium": all the high-type maidens are from an individual point of view indifferent between making a high effort or not, but they benefit each other greatly by coordinating $q$ as large as possible.

In fact, the $q$-equilibria exist for all values of $\tau$. We did not consider them at first because they were eliminated by the refinements (e.g. Cho and Kreps). In any case, these issues disappear once we consider the richer setup of Section 4.

A11. For the sake of notational simplicity, we will normalize $\mu_l = 1$. Using the algebra above, it is straightforward to obtain the equilibrium utilities for individuals of high and low type:

$$U_l = \ln (1 - \tau) - 1 + \frac{\tau}{2} (1 + \mu_h + \theta - \theta \tau)$$

$$U_h = -\frac{1}{2\mu_h} \left( -2 \ln((-1 + \tau) (\tau \theta - \mu_h)) \mu_h + \left( 1 - \theta - \frac{\tau}{2} \right) 2\mu_h - \tau + 2\theta - 3\tau \theta + \theta^2 \right)$$

Consider the welfare effects from introducing taxes:

$$\left. \frac{\partial U_l}{\partial \tau} \right|_{\tau=0} = -\frac{1}{2} + \frac{\mu_h}{2} + \frac{\theta}{2} > 0$$

Since $\theta \geq 0$ and $\mu_h > 1$.

$$\left. \frac{\partial U_h}{\partial \tau} \right|_{\tau=0} = -\frac{\mu_h - \theta - 1}{2\mu_h}$$

Which is positive iff $\theta > \mu_h - 1$. Therefore, for $\theta$ high enough, introducing taxes is pareto-improving. We can reproduce the algebra for the case of utilitarian social welfare, $SW = \frac{1}{2}U_l + \frac{1}{2}U_h$:

$$\left. \frac{\partial SW}{\partial \tau} \right|_{\tau=0} = -\frac{2\mu_h + \mu_h^2 + \theta \mu_h + \theta + 1}{2\mu_h}$$

Which is positive iff $\theta > \frac{2\mu_h - 1 - \mu_h^2}{1 + \mu_h}$. But since the RHS is always negative and $\theta \geq 0$, that condition is always true.

A12. The problem is:

$$\max_p \frac{1}{1 - \tau} \left[ \int_{\min\left\{ \frac{y}{p} + \frac{1}{1 - \tau} \right\}}^{\max\left\{ \frac{y}{p} + \frac{1}{1 - \tau} \right\}} \left( y - \frac{1}{\theta} \right) \left( 2h \frac{y - \frac{\tau}{2}}{1 - \tau} - 1 \right) dy + \int_{\min\left\{ \frac{y}{p} + \frac{1}{1 - \tau} \right\}}^{1 - \frac{\tau}{2}} \left( 2h \frac{y - \frac{\tau}{2}}{1 - \tau} - 1 \right) dy \right]$$

Let’s solve it case-by-case. If $p^{\frac{\theta + 1}{\theta}} < 1 - \frac{\tau}{2}$ and $\frac{y}{p} > \frac{\tau}{2}$:
\[ p^* = \frac{3}{4} \theta \frac{\theta b \tau + 2 b \tau + \theta + 2 - \tau \theta - 42 \tau}{b (\theta^2 + 3 \theta + 3)} \]

If \( p_{\theta+1}^* < 1 - \frac{\tau}{2} \text{ and } \frac{\theta}{b} \leq \frac{\tau}{2} \):

\[ p^* = \theta \frac{2 b \tau - 6 \tau + 3 + \sqrt{36 b^2 \tau^2 - 120 b \tau^2 + 60 b \tau + 36 \tau^2 - 36 \tau + 9}}{8b (\theta + 1)} \]

Finally, if \( p_{\theta+1}^* > 1 - \frac{\tau}{2} \text{ and } \frac{\theta}{b} > \frac{\tau}{2} \):

\[ p^* = \theta \frac{-3 \tau + 5b \tau + 3 - 4b + \sqrt{-15 b^2 \tau^2 - 18b \tau - 8b^2 + 72b^2 \tau + 21b + 9 \tau^2 - 48b^2}}{8b} \]