THE ECONOMIC JOURNAL

The Economic Journal, **122** (*September*), 933–956. Doi: 10.1111/j.1468-0297.2012.02516.x. © 2012 The Author(s). The Economic Journal © 2012 Royal Economic Society. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

SAVING RATES AND POVERTY: THE ROLE OF CONSPICUOUS CONSUMPTION AND HUMAN CAPITAL*

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Poor families around the world spend a large fraction of their income consuming goods that do not appear to alleviate poverty, while saving at low rates. We suggest that individuals care about economic status and interpret this behaviour as conspicuous consumption intended to provide a signal about unobserved income. We show that if human capital is observable and correlated with income, then a signalling equilibrium in which poor individuals tend to spend a large fraction of their income on conspicuous consumption can emerge. This equilibrium gives rise to an increasing marginal propensity to save that might generate a poverty trap.

The consumption bundle of the poor includes many goods that do not appear to alleviate poverty or its consequences. For example, according to Banerjee and Duflo (2007) the median spending on festivals, which varies substantially across countries, is as high as 10% of annual income in some regions of India. Rao (2001*a*,*b*) reports even higher spending on festivals in rural India, reaching 15% of households' total expenditures. Similarly, Case *et al.* (2008) show that Black households in South Africa spend on average a year's income on an adult's funeral. In many cases this is financed by borrowing.

These consumption patterns are puzzling because they seem to come at a significant cost for the poor: the very poor spend only 2–3% of their income on their children's education, do not eat well, experience ill health and report that they are worried and anxious to an extent that interferes with their sleep and work. In many cases, they fail to make trivial investments in their business and save so little that they cannot avoid cutting back on meals when they suffer a temporary decline in income (Banerjee and Duflo, 2007).

A recent *New York Times* article ('Moonshine or the Kids'),[1] illustrates the magnitude of such spending. It describes the financial situation and spending habits of a poor family from the Republic of the Congo. According to the article, the Obamza family is eight months behind on the $6 per month rent and is in danger of being evicted, they

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The authors are grateful for comments from participants at seminars in ANU, Auckland, Boston University, Brown, City University London, Harvard/MIT, Hebrew University of Jerusalem, Helsinki Center of Economic Research, Royal Holloway University of London, University of Bristol, University of Copenhagen and Universitat Zurich, as well as conference participants at SMYE 2008, Lille; ESSIM, Tarragona 2008; Intergenerational Economic Mobility, Edinburgh, June 2008; Economics of Education and Education Policy in Europe, Amsterdam, October 2008; NBER Summer Institute 2009; EEA-ESEM, Barcelona 2009; Israeli Economic Association Meetings, June 2010; Behavioral Economics, The Yoram Ben-Porath Fund, Jerusalem, June 2010, The IDC Workshop, Herzelia, December 2010. Abhijit Banerjee, Alexander Danzer, Raquel Fernandez, Oded Galor, Frederic Jouneau, Johan Lagerlof, Victor Lavy, Joram Mayshar, Dilip Mookherjee, Yona Rubinstein, Avichai Snir, David Weil and Itzhak Zilcha all provided useful comments. The authors are grateful to Diana Egerton-Warburton for many valuable comments and discussions.

[1] *The New York Times*, 22 May 2010, by Nicholas D. Kristof.

have no mosquito nets, even though they have already lost two of their eight children to malaria, and they cannot afford the $2.50 per month tuition for each of their three school-age children. Yet, Mr and Mrs Obamza spend $10 per month on cell phones, and Mr Obamza drinks several times a week at a village bar, spending about $12 per month. As the Obamzas are not an outlier, the reporter concludes that 'if the poorest families spent as much money educating their children as they do on wine, cigarettes and prostitutes, their children's prospects would be transformed'.

This pattern of consumption is consistent with the empirical finding that saving rates are increasing with permanent income (Dynan *et al.*, 2004) but is hard to reconcile with the predictions of the standard life cycle/permanent income model with homothetic preferences. The literature that considers this question has focused on non-homothetic preferences (e.g. bequest as a luxury good or subsistence consumption), differences in time preference rates and hyperbolic discounting as possible explanations for this pattern (see Section 1.1 below for more details).

In this article we offer an alternative reason why saving rates may be increasing with income. We propose that individuals care about their economic status and try to signal their income to others by engaging in conspicuous consumption. Our explanation is consistent with the large spending by the poor on festivals, and spending of $<1\%$ of their income on less transparent types of entertainment that are common in high-income countries, such as movies, theatre and video shows (Banerjee and Duflo, 2007). This is notwithstanding the possibility that these consumption patterns can generate social capital and possibly future income.

Our explanation can shed light on the persistence of poverty and is consistent with the behaviour of the poor that is described above. In particular, we suggest that those with high human capital have a recognisable ability (professional titles, degree certificates etc.) and relatively little need to signal success, whereas those without certified accomplishments, such as the poor and the 'newly rich', have a relatively stronger motivation to impress via conspicuous consumption. As a result, the fraction of income allocated to conspicuous consumption can decline, on average, with the level of human capital, resulting in a larger share of income allocated to savings and investment in education. This insight is consistent with the observation by Charles *et al.* (2009), that college educated individuals spend about 13% less than their high school educated counterparts on 'visible goods', controlling for current and permanent income.

The importance of conspicuous spending to signal status is convincingly illustrated in another *New York Times* article ('For India's Newly Rich Farmers, Limos Won't Do'),[2] that reports on a newly rich Indian farmer who sold land for a windfall of about $109,000, and rented a helicopter for $8,327 to transport his son to his wedding two miles away. The son wore a wreath made of 100 rupee notes. The claim in the article, supported by statements from family members and experts, is that the intention was to impress other villagers with the family's new status and spending power.

Public awareness of the ruinous impact of conspicuous consumption on the lives of the poor is reflected in a recent Tajikistani government policy. According to a 2008

[2] *The New York Times*, 'For India's Newly Rich Farmers, Limos Won't Do', 18 March 2010, by Jim Yardley. http://www.nytimes.com/2010/03/19/world/asia/19india.html?emc=eta1

report on National Public Radio,[3] Tajikistan's President, Imomali Rahmon, banned gold teeth, the use of cell phones in universities and large birthday parties. Radio Free Europe reported that the President criticised wealthy citizens 'for showing off their wealth by throwing elaborate parties and thereby setting a standard for others who try to appear wealthy by holding a large party despite having only modest incomes'. The President restricted the number of people and amount of food served at weddings to prevent Tajiks, 60% of whom live below the poverty line, from 'using their life savings just to compete with their neighbours'.[4]

Conspicuous consumption is nearly universal in human societies and not only in them (Pinker, 1997). The argument among evolutionary biologists, following the seminal contribution of Zahavi (1975), is that higher status, or more precisely the costly signal that generates this status, such as the peacock's tail, is positively correlated with other desirable genetic characteristics that are associated with greater fitness. Hence, higher status increases mating opportunities and so confers an evolutionary advantage.

Experiments illustrate that sexual motives induce conspicuous behaviour among humans as well. Griskevicius *et al.* (2007), for example, show that romantic motives seem to produce highly strategic and gender-specific conspicuous displays of consumption and benevolence, where men tend to spend more on conspicuous consumption compared to women. Similarly, Wilson and Daly (2004) show that men respond more strongly than women to romantic situations, by discounting future income for present consumption. De Fraja (2009) provides a theoretical foundation for including status in the utility function based on sexual selection.

In this article we develop an overlapping generations model in which individuals' preferences are defined over their consumption, investment in their offspring's human capital and status. An individual's status is defined by the social beliefs about his or her unobservable income. Individuals' incomes are unobservable but are correlated with the observable human capital. We show the existence of a unique, fully separating equilibrium where an individual's conspicuous consumption serves as a signal about his or her income. In this equilibrium, it is possible to infer the exact income of each individual based on the individual's level of human capital and expenditure on conspicuous consumption. The model also admits a pooling equilibrium with no conspicuous consumption, and a wide variety of partially separating equilibria. However, the fully separating equilibrium is the only equilibrium that satisfies a version of the intuitive criterion (Cho and Kreps, 1987), which is the standard refinement that is applied to equilibria in signalling games.

Our model provides a simple illustration that, despite homothetic preferences, a signalling equilibrium could give rise to an increasing saving rate with income and thereby to a poverty trap. We do not claim that this is always the case: in fact we show that some assumptions regarding the distribution of income as a function of human capital are required. In particular, we assume that poorly educated individuals are subject to bigger negative shocks relative to their expected income. This assumption is consistent with the observed evidence. Banerjee and Duflo (2007) show that in poor

[3] 16 February 2008 National Public Radio. http://www.npr.org/templates/story/story.php?storyId=19085173&ft=1

[4] Radio Free Europe 29 May 2007. http://www.rferl.org/articleprintview/1076782.html

countries the poor tend to be self-employed whereas people with higher levels of human capital tend to be employed by the government or large firms. It seems reasonable that being self-employed implies a larger variance in income, and a lower correlation between human capital and income. This is further supported by Flug *et al.* (1998) who reveal a negative association between schooling and income or employment volatility. Funkhouser (1996) similarly reports a significant negative relationship between education and informal sector employment.

The assumption is also consistent with Gottschalk and Moffitt's (1994) finding that the 'transitory' component of inequality, compared to the 'permanent' component, is much higher for uneducated workers (in the 1970s and 1980s in the US). Their results show that inequality for educated workers is mainly increasing along predictable 'permanent' dimensions such as ability, although uneducated workers are affected in more random ways. This randomness is associated with the higher unemployment rates of the early 1970s that primarily affected the least educated workers. Gould *et al.* (2001) demonstrate empirically that workers consider this type of unemployment risk when making their schooling decisions.

We believe that the mechanism for understanding saving rates and the behaviour of the poor that is described in this article is both potentially important and plausible. However, the same outcome can also be generated by different mechanisms. For example, there could be a neighbourhood effect such that wealthier families, or rather those with higher levels of education, live in areas in which the return to education is higher and hence they spend less on conspicuous consumption, in comparison to those with low levels of human capital who live in poor neighbourhoods with lower return to education. As a result those who live in poor neighbourhoods spend more on conspicuous consumption, leading to persistent inequality.

Similarly, although herein we model income as a continuous function of human capital, a model in which individuals with human capital above some threshold are employed by firms and below are self-employed is a natural alternative. A reasonable assumption could be that being self-employed implies a larger variance in income and a lower correlation between human capital and income, leading to more conspicuous spending and persistence of poverty.

In the model developed in this article, if human capital is non-observable, homothetic preferences lead to a constant fraction of income being allocated to conspicuous consumption, which gives rise to a constant saving rate (in the form of investment in the education of offspring). If, however, human capital is observable, the fully separating equilibrium could imply a negative association between income and the share of conspicuous consumption out of total income. Consequently, the saving rate is increasing with income. Hence, we demonstrate that the trade-off between observable human capital and conspicuous consumption as signals of income may play a crucial role in explaining saving patterns and the persistence of poverty.

Obviously, investment in the health and the education of one's children may also serve as a signal about wealth. Therefore it is puzzling that parents allocate a significant fraction of income to conspicuous consumption while neglecting to invest in the human capital of their children. Perhaps the reason is that, unlike conspicuous consumption, the fruits of such an investment are typically only observable in the long run, which delays the satisfaction that is obtained from impressing others. Moreover,

a private school is typically not an option for the poor whereas other forms of educational support, such as home tutoring, are not as observable. In addition, a purely wasteful signal that does not generate direct utility nor allow for accumulation of wealth provides a stronger indication for unobserved income. Milgrom and Roberts (1986) make a similar argument with respect to advertising serving as a signal.

According to the theory proposed here, in festivals, consumption of tobacco and alcohol in the public domain,[5] and the display of expensive clothing and jewellery, are more transparent than other types of consumption and hence may provide a signal for income or wealth.[6] Of course, one could offer alternative, or complementary, explanations for these consumption patterns. For instance, there is a social norm of lavish spending on festivals; however, the existence of this norm only means that failing to follow the norm issues a strong signal about one's financial situation. Moreover, the claim that festivals serve as signals of unobserved wealth is supported by Bloch *et al.* (2004). They demonstrate, based on survey data from South India, that a daughter's marriage (dowry and celebrations) is the costliest event in the life of an Indian family and can amount to more than six times a family's annual income.[7] It often drives parents into severe debt at high interest rates, and may push families into deep poverty.

Bloch *et al.* (2004) argue that there is a clear distinction between dowries, which may be interpreted as the price paid for desirable grooms (and consist of most of the cost of getting a daughter married) and wedding celebrations, which have a symbolic value and are intended to create a spectacle. This claim is also supported by Srinivas (1989) and Roulet (1996), who emphasise the prestige motive underlying marriage expenses. Bloch *et al.* (2004) show that expenditure on celebrations, which is customarily borne by the bride's family, varies significantly and is positively correlated with the 'quality' of the groom. Since a wealthier family is most likely to attract a high quality groom, it is reasonable to conclude that there is a positive correlation between unobserved income and spending on celebrations. This spending could amount to one-third of a family's annual income.

The idea that there could be trade-offs between different signals of income is consistent with the findings of Charles *et al.* (2009), who support their claim that race provides a signal of income by showing that the gap between races in spending on visible goods increases with the average wage gap between races across the US.

A testable prediction of the model is that providing an external sign on income should reduce conspicuous spending or spending on visible goods. In contrast, most alternative theories, such as a social contract to spend for the benefit of others if one can afford it, will generate the opposite pattern. We further develop this point in the Section 5.

[5] Thorstein Veblen, who coined the phrase conspicuous consumption, used alcohol (and other stimulants) as prime examples of conspicuous consumption that serve as a signal for the superior status of those who are able to afford the associated indulgence (Veblen, 1899).

[6] The consumption of flashy jewellery worn especially as an indication of wealth, known as 'bling' among young African Americans, is another example of conspicuous consumption that could come with a significant cost in terms of persistence of poverty. We are not aware of any study that documents the consumption of bling and its impact on poverty, however, Missy Elliott, a successful rapper, argued in 2004 that 'bling culture' encourages young black men and women to spend their money irresponsibly and that artists should encourage young people to invest in stable, long-term assets (wikipedia).

[7] See Botticini and Siow (2003) for a study of the market for dowries.

In the next section of this article we survey the related literature about saving patterns, poverty traps and concern for status. In Section 2 we present the model. Section 3 is devoted to equilibrium analysis, Section 4 to equilibrium dynamics and Section 5 concludes. All proofs are included in the Appendix.

1. Related Literature

1.1. *Saving Patterns*

Economists have long grappled with the question of the effect of wealth on individuals' saving rates; see the survey in Dynan *et al.* (2004). Friedman (1957) famously argued that the observation that rich individuals save more is due to the smoothing of consumption and that in fact individuals save a constant fraction of their permanent income. Many studies of this hypothesis followed, some supporting Friedman and some not.

Dynan *et al.* (2004) provide the most comprehensive empirical study of the question to date. They find that higher lifetime income households save a larger fraction of their permanent income. Dynan *et al.* consider several theoretical explanations for their finding. They conclude that their finding is inconsistent with the prediction of the standard life cycle model with homothetic preferences, or with explanations that are based on differences in time preference rates, subsistence consumption, or variation in Social Security replacement rates. They mentioned hyperbolic discounting (Laibson *et al.*, 1998), or differential asset accumulation against out-of-pocket health expenditures late in life (Smith, 1999) as possible viable explanations. The explanation that is offered herein is also consistent with their finding.

1.2. *Poverty Traps*

There is a sizable literature in economics that tries to explain the persistence of poverty. Most of this literature assumes that individuals are rational and that the poor, like other individuals, care about their own and their offspring's future well-being and therefore are willing to give up part of their present consumption for the sake of the future. However, as suggested by Galor and Zeira (1993) and Banerjee and Newman (1993), credit constraints prevent the poor from passing the threshold of investment that permits a gradual escape from poverty.[8] Although the evidence suggests that the poor do indeed have limited access to credit (Besley, 1995), there is little empirical support for the existence of significant investment indivisibilities. Moreover, this approach fails to account for the evidence surveyed above, which suggests that the poor could in fact improve their situation over time if only they

[8] See also Dasgupta and Ray (1986) who propose that there exists a nutritional threshold below which individuals cannot work, as well as Benabou (1996), Durlauf (1996) and Mookherjee and Ray (2003) who, among many others, propose different mechanisms that generate poverty traps based on non-convexities in the technology. In many of these models, as well as in Becker and Tomes (1979), Loury (1981), Galor and Tsiddon (1997), Maoz and Moav (1999) and Hassler and Rodriguez Mora (2000) random shocks allow for some intergenerational mobility. Similarly, in our model individuals may escape poverty if they experience a strong positive shock to income. However, the effect of observable human capital on the equilibrium level of conspicuous consumption reduces the likelihood that this would happen.

saved more and spent less on the consumption of goods we view as conspicuous. It has also been observed that a poverty trap can emerge regardless of non-convexities in the technology if individuals' propensity to save increases with income, and credit markets are imperfect (Moav, 2002). Although empirical evidence supports the underlying assumption that the rate of saving increases with income, and in particular, that the poor's savings rate is very low, the reason that the poor fail to save and instead spend their income on festivals, tobacco and so on, remains unclear.[9]

The article that is perhaps closest to ours in its motivation is Banerjee and Mullainathan (2007), who were the first to address the puzzling behaviour of the poor described above in a theoretical model. They argue that poor individuals spend a larger fraction of their income on 'temptation goods' resulting in a convex saving function in income, which, in turn, can generate a poverty trap. In particular, they show that individuals, who are aware of their limited self-control, reduce savings so as to reduce future wasteful consumption, which acts like a tax on their future wealth. Banerjee and Mullainathan's result is a consequence of their assumption that individuals have non-homothetic preferences that induce a weaker preference for temptation goods as individuals become richer.[10] In contrast, in this article, individuals' preferences are homothetic, and the fraction of income spent on conspicuous consumption is endogenously determined in the signalling equilibrium. The key result of the model we present is that, despite homothetic preferences, this share is decreasing with the level of human capital, thus allowing for the emergence of increasing saving rates and a poverty trap. One could view the two explanations as complementary, as people could be impatient to signal their income via conspicuous consumption.

In a related article, Moav and Neeman (2010), we illustrate in a simple model how conspicuous consumption could generate a poverty trap. This poverty trap, however, is due to our focus on an equilibrium that is not fully separating and that fails to satisfy the Cho and Kreps (1987) refinement that is used in this article. Thus, the poverty trap in Moav and Neeman (2010) is a less robust phenomenon than in this article. Moreover, in Moav and Neeman (2010) we assume that human capital is not observable, so obviously cannot provide a signal about income. In contrast, in this article the observability of human capital forms the basis for the analysis and the key theoretical insight is the trade-off between human capital and conspicuous consumption as signals for unobservable income. With this trade-off a poverty trap can emerge despite employing a version of the Cho and Kreps refinement, and thus results are more robust.

In this article, we further assume that output is a linear function of inputs, so that it is not subject to decreasing marginal productivity. In a model without concern for

[9] Another puzzle is related to the fact that the poor tend to have many children, which limits their ability to support financially the health and education of each child. Moav (2005) addresses this puzzle and shows that despite homothetic preferences (defined over consumption and the quality and number of children) and convex technology, a poverty trap can emerge in this case, as less educated individuals have a comparative advantage in producing child quantity rather than quality.

[10] In another article, Banerjee and Mullainathan (2008) suggest that 'comfort goods' can help to divert workers' attention from pressing problems at home so that workers who can afford such goods can pay more attention at work. The poor cannot afford comfort goods and so cannot pay the needed attention and hence stay poor. This poverty cycle is the result of an interaction between attention at home and comfort goods, which make the optimisation problem non-convex, and produces a corner solution despite the fact that both output at work and at home are linear functions of attention.

status, this linear production structure, combined with homothetic preferences, generally results in a linear dynamical system that gives rise to steady-state growth of income, or to a unique globally stable steady-state level of income. However, we show that the introduction of observable human capital and conspicuous consumption into such a framework may curve the dynamical system in a way that could give rise to a threshold level of income, below which dynasties converge to a poverty trap steady-state level of income and above which dynasties converge to a divergent growth path of income.

1.3. *Concern for Status*

Starting with Smith (1759) and Veblen (1899), a huge theoretical literature in the social sciences has been devoted to the idea that people care about and try to manipulate their status.[11] Some of the theoretical models in this literature, for example, Ireland (1994), Cole *et al.* (1992), Bagwell and Bernheim (1996), Glazer and Konrad (1996), Corneo and Jeanne (1997) and Charles *et al.* (2009), interpret conspicuous consumption as a signal about unobserved income as we do herein. Others, for example, Duesenberry (1949), Pollack (1976), Frank (1985) and Basu (1989), focus on the idea that people care about their relative consumption and Hopkins and Kornienko (2004, 2006) and Becker and Rayo (2006) analysed the welfare implications of such preferences.

Empirical support for the notion that people rely on conspicuous consumption to influence their perceived status includes the work of Bloch *et al.* (2004) that is mentioned in the Introduction, Chung and Fischer (2001) and Heffetz (2011). Heffetz and Frank (2011) bring together some of the recent empirical and experimental evidence regarding preferences for social status. Charles *et al.* (2009), as mentioned above, argue that since the marginal return to signalling through conspicuous consumption is decreasing in the average income of a person's reference group, less conspicuous consumption should be observed among individuals who have richer reference groups. They find that consumption of 'visible goods' such as clothing, jewellery and cars is decreasing in the wealth of one's racial reference group, so that Blacks and Hispanics consume relatively more of such goods than comparable Whites. This is also illustrated by Heffetz (2010).

In summary, the existing literature, for example Cole *et al.* (1992), Bagwell and Bernheim (1996) and Corneo and Jeanne (1997), identified the potential negative impact that concern for status has on savings and growth through a rat race of escalating conspicuous consumption. On the other hand, status competition can also lead to increased capital accumulation and thereby economic growth, as for instance argued by Cozzi (2004). But since this literature overlooked the fact that there could be a trade-off between human capital and conspicuous consumption as signals for income, it fell short of arguing that this may generate a poverty trap.

[11] For recent empirical work that shows that people care about their status and relative position in society see Clark and Oswald (1996), McBride (2001), Luttmer (2005) and Dynan and Ravina (2007). See also the survey by Kahneman and Krueger (2006) and the references therein.

2. Model

Consider an overlapping generations model of a one-good economy with a continuum of individuals. The good can be used for consumption, conspicuous consumption and investment in human capital. Each individual lives two periods, has a single parent and a single child. This parent–child relation creates a dynasty. When individuals are 'young', or in their first period of life, their parents are 'old', or in their second period of life.

In their first period of life, (young) individuals invest in human capital. An individual who invests $e \geq 0$ units of the good in human capital when young acquires $h = h(e)$ units of human capital, which enters the production process in the following period, when the individual is old. In particular, we assume that

$$h(e) = \theta + \gamma e, \tag{1}$$

where $\theta > 0$ and $\gamma > 1$. Individuals defer their consumption to the second period of their life, and hence use any resources they receive from their parents when young to enhance their human capital.[12]

In their second period of life, (old) individuals spend a fixed amount of their time working. An individual with human capital h produces a non-negative quantity

$$y = h + \pi$$

of the goods, where $\pi \in [\underline{\pi}(h), \bar{\pi}(h)]$ is an unobserved component of income with an expected value of zero that is drawn from a continuous distribution. A plausible interpretation of π is that it reflects the part of the individual's ability that is unobservable to others.

Old individuals allocate the resources they produce among consumption, c, conspicuous consumption, x and a bequest, b, which pays for the schooling of their offspring. Hence, their budget constraint is given by,

$$c + b + x \leq y. \tag{2}$$

Individuals' preferences are represented by the following Cobb–Douglas utility function:

$$u(c, b, S) = B(c^{1-\beta} b^{\beta})^{1-\lambda} S^{\lambda}, \tag{3}$$

where $\beta \in (0,1)$ and $\lambda \in (0,1)$ are parameters that capture the relative weight given to consumption, bequest, and status, $B \equiv [(1-\beta)^{\beta-1}\beta^{-\beta}]^{1-\lambda}$ is a constant coefficient, and $S = \mathrm{E}(y \mid h,x)$ is 'perceived status'. That is, we assume that the perceived status of an individual is given by the social belief about the individual's expected income conditional on the individual's level of human capital and conspicuous consumption, both of which we assume to be observable. Individuals' consumption and the bequest they leave to their offspring are assumed to be unobservable. Our assumption of a 'warm glow' motive – that parent's preferences are defined over the investment in their offspring's education rather than the offspring's utility is a rather standard

[12] If offspring's preferences affect their investment in education (Saez-Marti and Zilibotti, 2008) then this may imply a stronger correlation in human capital across generations, which would further contribute to the persistence of poverty.

simplifying assumption in the literature. We believe there is no convincing reason to think that results would be qualitatively affected by consideration of an alternative structure.

There are two justifications for the assumption that the bequest is not observable. First, it is possible to interpret the bequest as the amount of resources that parents spend to educate their children. A lot of this spending, such as the effort that goes into instilling in children the value of learning or the number of hours that parents spend helping their children with their homework, is simply non-observable. Second, the level of investment in a child's education is only revealed after considerable delay. If, for instance, we interpret human capital as years of schooling, then investment in human capital is a continuous process. Consequently, not much can be learned from the fact that a child attends primary school, because it is not clear what will be the child's final level of education.

The assumption that conspicuous consumption, x, does not generate any direct utility and that the consumption that does generate direct utility, c, is not observable, provides a simple expression for the notion that individuals may attempt to signal their wealth by shifting their expenditures towards more visible consumption goods. Such a shift would reduce individuals' direct utility from consumption but would increase their utility from status.[13]

The assumption that utility from status is defined by the social belief about the level of income, rather than by the social belief about the ranking in the income distribution, greatly enhances the analytical tractability of the model and, in light of the one-to-one mapping from ranking to income, is not implausible. In fact, as shown in Section 4, assuming that status is defined over ranking would have no effect on the equilibrium level of conspicuous consumption if individuals' income is uniformly distributed. However, analysing the model under this alternative assumption prevents us from obtaining an analytical solution because the distribution of income is changing endogenously over time.

We restrict the model's parameters as follows:

$$\beta\gamma > 1;$$

and

$$(1-\lambda)\beta\gamma < 1.$$

As will become apparent, the first restriction ensures that in dynasties where conspicuous consumption is a sufficiently small fraction of individuals' income, the expected level of human capital grows over time. The second restriction ensures that in dynasties where conspicuous consumption is close to a fraction λ of income, the expected level of human capital converges to a constant level.

[13] It is possible to also let conspicuous consumption enter individuals' utility function directly. We expect that in such a formulation, an individual with a higher level of (observable) human capital would feel a weaker need to distort conspicuous consumption upwards and unobserved consumption downwards. The advantage of the model presented in this article is that it allows us to distinguish between consumption that generates direct utility and consumption that generates utility only via status. In contrast to the more general formulation above where conspicuous consumption affects utility via two channels, in the model presented in this article there is only one such channel.

Observe that the maximisation of individuals' utility function (3) subject to their budget constraint (2) implies that for any level of expenditure on conspicuous consumption, x, the bequest that individuals leave to their offspring is

$$b = \beta(y - x), \tag{4}$$

and individuals' consumption is

$$c = (1 - \beta)(y - x). \tag{5}$$

We now turn to the analysis of the allocation of resources to conspicuous consumption, x. An equilibrium for this economy is defined as follows: let $x(h, y)$ denote individuals' conspicuous consumption as a function of their human capital, h, and income, $y = h + \pi$, and $\tilde{y}(h, x) \equiv \mathrm{E}(y \mid h, x)$ denote the social belief about individuals' expected income as a function of their observable human capital and conspicuous consumption, x.

DEFINITION. *A pair of expenditure on conspicuous consumption and social belief functions,* $x(h, y)$ *and* $\tilde{y}(h, x)$, *is an equilibrium if:*

(*i*) *Individuals' expenditure on conspicuous consumption* $x(h, y)$ *is optimal given the social beliefs* $\tilde{y}(h, x)$.
(*ii*) *The social belief* $\tilde{y}(h, x)$ *is consistent with the expenditure function* $x(h, y)$, *or*

$$\tilde{y}(h, x) = \mathrm{E}[y : x(h, y) = x].$$

3. Equilibrium Analysis

In a standard signalling game, one player sends a message (signal) to which another player responds by taking an action that affects the former player's payoff. Thus, strictly speaking, because no one responds to individuals' choice of conspicuous consumption, the game that is described in this article is not a standard signalling game. However, because individuals' levels of conspicuous consumption affect social beliefs and these enter directly into individuals' utility, the game described here can be analysed in much the same way as a standard signalling game.

Like any signalling game, the many different interpretations that can be given to different choices of off-equilibrium expenditures on conspicuous consumption give rise to many different equilibria. But, as shown in the Appendix, plausible restrictions on off-equilibrium beliefs and, specifically, the restrictions imposed by a variant of the so-called *intuitive criterion* (Cho and Kreps, 1987) imply that the equilibrium must be fully separating. A precise definition of the refinement we use and a formal proof are presented in the Appendix (Proposition A1). Intuitively, the *intuitive criterion* requires that individuals who deviate from equilibrium and claim to be of a certain type should be believed if all the other types would not want to deviate in the same way, even if by deviating they would be believed to be of this claimed type.

Substituting (4) and (5) into the individuals' utility function (3) allows us to derive individuals' utility as a function of their income y, conspicuous consumption x, human capital h and the social belief function $\tilde{y}(h, x)$, as follows:

$$u(y, x) = (y - x)^{1-\lambda}\tilde{y}(h, x)^{\lambda}. \tag{6}$$

An individual with human capital h and income y chooses the level of conspicuous consumption $x(h, y)$ to maximise his utility (6). The implied first-order condition is:

$$\frac{\lambda}{1-\lambda}\frac{y-x}{\tilde{y}(h, x)} = \frac{1}{\mathrm{d}\tilde{y}(h, x)/\mathrm{d}x}. \tag{7}$$

Note that the left-hand side of this first-order condition describes the marginal rate of substitution between the bundle of consumption and bequest, $y - x$, and status, $\tilde{y}(h, x)$, while the right-hand side is the marginal cost of status (because the marginal cost of the consumption/bequest bundle is one). In equilibrium, these two marginal rates have to be equal.[14]

Noting that in the fully separating equilibrium $y = \tilde{y}(h, x)$, the solution $\tilde{y}(h, x)$ of the differential equation (7) is (implicitly) given by the following equation:

$$\tilde{y}(h, x)^{1/(1-\lambda)} - \frac{x}{\lambda}\tilde{y}(h, x)^{\lambda/(1-\lambda)} = \underline{y}(h)^{1/(1-\lambda)}, \tag{8}$$

where $\underline{y}(h) \equiv h + \underline{\pi}(h)$ denotes the smallest possible income that an individual who is endowed with human capital h can possibly have. Except for special cases (such as $\lambda = 1/2$), it is impossible to obtain an explicit solution for the equilibrium social belief $\tilde{y}(h, x)$. But it is possible to invert the implicit solution for $\tilde{y}(h, x)$ in (8) to obtain an explicit solution of the equilibrium level of conspicuous consumption $x(h, y)$ as follows:

$$x(h, y) = \lambda y\left[1 - \left(\frac{\underline{y}(h)}{y}\right)^{1/(1-\lambda)}\right]. \tag{9}$$

This result is summarised in the following Proposition.

PROPOSITION 1. *The signalling game has a unique fully separating equilibriums*

$$\langle x(h, y), \tilde{y}(h, x)\rangle.$$

In this equilibrium, expenditure on conspicuous consumption $x(h, y)$ *is given by* (9) *and social beliefs* $\tilde{y}(h, x)$ *satisfy* (8).

[14] If status in the utility function was defined over the individual's ranking in the income distribution, then the first order condition would have been:

$$\frac{\lambda}{1-\lambda}\frac{y-x}{F[y(h, x)]} = 1\Big/\left\{\frac{\mathrm{d}F[y(h, x)]}{\mathrm{d}y}\frac{\mathrm{d}y(h, x)}{\mathrm{d}x}\right\},$$

where F is the distribution of income. If F is a uniform distribution with support $[0, \bar{y}]$ then $F(y) = y/\bar{y}$ and $\mathrm{d}F/\mathrm{d}y = 1/\bar{y}$ for $y \in [0, \bar{y}]$, and so this first-order condition is identical to the first order condition derived from a utility function in which status is defined by income, as in (7). Therefore, defining status by the ranking in the income distribution has no effect on the analysis provided that income is uniformly distributed over some interval $[0, \bar{y}]$.

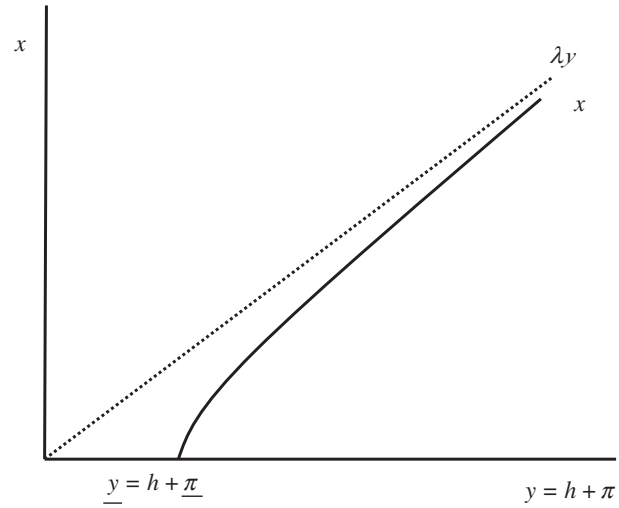

Fig. 1. *Equilibrium Expenditure on Conspicuous Consumption, x(y,h) as a Function of y, Holding h Constant*

The uniqueness of the fully separating equilibrium follows from the fact that the left-hand side of the first-order condition (7), namely the marginal rate of substitution between the bundle of consumption and bequest, $y - x$, and status, $\tilde{y}(h, x)$, is unique and so determines a unique marginal cost of status. Hence any combination of consumption, bequest and status, determines a unique expansion path of expenditure on conspicuous consumption that is increasing with the rise of the unobserved component of income, π. This path is pinned down by the fact that in a fully separating equilibrium, expenditure on conspicuous consumption is zero for an individual who has the lowest possible income $\underline{y}(h)$, and hence, accordingly, social beliefs are $\tilde{y}(h, 0) = \underline{y}(h)$. This has to be the case because in a fully separating equilibrium an individual's income is known. Hence, an individual who has the smallest possible income does not need to spend anything to signal this fact.

Equation (9) implies that the equilibrium expenditure on conspicuous consumption is $x(h, y) = \lambda y$ if $\underline{y}(h) = 0$ (that is, if $\underline{\pi}(h) = -h$). Otherwise, if $\underline{y}(h) > 0$ (that is, if $\underline{\pi}(h) > -h$), then $x(h, y)$ has the following notable properties as depicted in Figure 1:

(*i*) $x[h,\underline{y}(h)] = 0$. An individual who is endowed with the worst possible unobserved component of income $\pi = \underline{\pi}(h)$ does not spend any income on conspicuous consumption.

(*ii*) For any fixed level of human capital h, individuals' expenditure on conspicuous consumption is increasing in the unobserved component of income, π, and in their total income, $y = h + \pi$.

(*iii*) For any fixed level of human capital h, individuals' expenditure on conspicuous consumption is concave in their income y.

(*iv*) For any fixed level of human capital h, the slope of individuals' expenditure on conspicuous consumption as a function of their income increases to $\lambda/(1 - \lambda)$ as individuals' income decreases to $\underline{y}(h)$.

(*v*) For any fixed level of human capital h, the slope of individuals' expenditure on conspicuous consumption as a function of their income tends to λ as individuals' income increases.

(*vi*) Holding income constant, the larger is the unobserved element of an individual's income, π, or the smaller is the individual's (observable) human capital, the larger is the individual's expenditure on conspicuous consumption.

We now turn to study the behaviour of the expected value of conspicuous consumption, x, as a function of human capital, h. First, we restrict the lower bound on the size of the unobserved component of income, $\underline{\pi}(h)$. In particular, we assume that the lowest possible income of an individual who is endowed with a level of human capital h, namely $\underline{y}(h) \equiv h + \underline{\pi}(h) < h$, is non-decreasing and convex in h. This assumption captures the idea that human capital reduces the magnitude of the risk (relative to income) associated with a negative income shock. It implies that human capital plays a larger role in explaining income, or provides more information about income, at higher levels of human capital. It follows that for high h human capital becomes a more precise signal of income, relative to the total variance in income.

Define the 'average individual with human capital h' as the individual with human capital h and average shock $\pi(h) = \mathrm{E}[\pi(h)] = 0$. The income of such an individual is equal to the expected income given h, which is equal to the individual's level of human capital, h.

Proposition 2. *If the lowest possible income of an individual who is endowed with human capital h,* $\underline{y}(h)$*, is non-decreasing and convex in h, then the share of conspicuous consumption out of total income of the average individual with human capital h is decreasing in h, or*

$$h \nearrow \Longrightarrow \frac{x(h,h)}{h} \searrow .$$

The result that the ratio of conspicuous consumption to human capital, $x(h,h)/h$, is decreasing in human capital, is a key result of the model. It implies that the *expected share* of income allocated to investment in the human capital of the offspring is increasing in parental education, which allows for the emergence of a poverty trap. Notably, this property is not necessarily true for values of y that are close to the minimum value $\underline{y}(h)$ because individuals who suffer a large unobservable reduction to their income (relative to the income expected by their level of human capital) do not spend a large fraction of their income on conspicuous consumption.

The assumption that $\underline{y}(h)$ is non-decreasing and convex implies that the share of conspicuous consumption out of total income of the average individual in the economy with a level of human capital h is decreasing in h. Inspection of the proof of Proposition 2 reveals that if $\underline{y}(h)$ was non-decreasing but linear or concave, then the share of conspicuous consumption out of total income of the average individuals in the economy would have been constant or increasing in h, respectively.

Observe that Proposition 2 only imposes assumptions on the difference between the average and minimum income given h, and that therefore, it holds for all continuous distributions of π. Formally, this is due to the fact that the solution of the differential equation that is induced by the separating equilibrium's first-order condition is fully pinned down by the condition that $x(h,\underline{y}) = 0$. Intuitively, in a fully separating

equilibrium individuals' true income is revealed and so individuals with the lowest possible income (given their level of human capital) do not need to spend anything on conspicuous consumption.[15] The fact that h is observable implies that for each level of human capital h, it is possible to solve for the level of conspicuous consumption x, as a function of the unobservable component π (or of income $y = h + \pi$), regardless of the distribution of π as explained above. However, as explained below the relationship between h and y is important for the distribution of conspicuous consumption with respect to human capital and income in the economy.[16]

It is interesting to know whether it is possible to say anything about the expected share of conspicuous consumption out of total income, or

$$\mathrm{E}_{y(h)}\left\{\frac{x[h, y(h)]}{y(h)}\right\}$$

as human capital h increases. Because a higher h implies a lower level of conspicuous consumption for a fixed y, but also a higher y, which in turn implies higher conspicuous consumption, it is difficult to answer this question without making additional assumptions. In particular, it is not necessarily true that the expected share of conspicuous consumption out of total income conditional on income, $\mathrm{E}[x(h, y)/y \mid y]$, is decreasing with income, despite the positive correlation between income y and human capital h. A large realised income could, in fact, imply a large positive random component π and hence a high level of conspicuous consumption, x. Hence, the existence of a negative correlation between human capital and the share of conspicuous consumption does not rule out the existence of a positive correlation between income and the share of conspicuous consumption.

Moreover, a model that explains conspicuous consumption among the rich (which is beyond the scope of this article) would impose an upper limit on the accumulation of human capital, or at least decreasing returns to human capital. This would imply that the rich are wealthy due to a large unobserved component of income (which can also be thought of as family wealth). Hence, as income above some level is unobservable, we would expect an increasing share of conspicuous consumption above this level of income.

We are able to show the following.

Proposition 3. *If $\underline{\pi}(h)$ is given by:*

$$\underline{\pi}(h) = \begin{cases} -h & \text{for} \quad h < |\underline{\pi}|; \\ \underline{\pi} & \text{for} \quad |\underline{\pi}| \leq h, \end{cases} \tag{10}$$

[15] Notice that in a fully separating equilibrium, beliefs are 'point estimates' rather than 'expectations' (or integrals) that depend on the distribution of income. Thus, it is enough to know the lowest possible income of an individual with a given level of human capital h to solve for the equilibrium expenditure on conspicuous consumption. If, instead, we had studied a partially separating equilibrium as in Moav and Neeman (2010) so that based on the observed signals, an individual would have been believed to belong to a set of individuals that is characterised by a non-degenerate distribution of income, then the distribution would have had an effect on the expected income in that set of individuals.

[16] It is critical that the distribution of π be continuous because otherwise there would be 'holes' over which the differential equation induced by the first order condition under the separating equilibrium would not be well defined.

for some $\underline{\pi} > 0$ *and so* $\underline{y}(h)$ *is given by:*

$$\underline{y}(h) = \begin{cases} 0 & \text{for} \quad h < |\underline{\pi}|; \\ h - |\underline{\pi}| & \text{for} \quad |\underline{\pi}| \leq h, \end{cases} \tag{11}$$

then the expected fraction of conspicuous consumption out of total income is decreasing in human capital, or

$$h \nearrow \Longrightarrow \mathrm{E}_{y(h)} \left\{ \frac{x[h, y(h)]}{y(h)} \right\} \searrow .$$

Remark. It is crucial to the existence of a poverty trap that human capital is observable. If human capital is not observable, then the social beliefs $y(x)$ cannot depend on the individuals' level of human capital, and individuals have no reason to condition their conspicuous consumption $x(y)$ on their level of human capital. In this case, the unique solution of the differential equation (7) that satisfies $x(0) = 0$ yields the unique fully separating equilibrium level of conspicuous consumption:

$$x(y) = \lambda y.$$

That is, a constant fraction of income is allocated to conspicuous consumption and so the fully separating equilibrium cannot give rise to a poverty trap. However, Moav and Neeman (2010) show that a poverty trap may emerge in other non-fully separating equilibria.

4. The Dynamics of Income

The fact that individuals' output is subject to a random unobserved component of income implies that the relationship between individuals' human capital, income and bequest and their offspring's human capital and income is stochastic. We describe this relationship for the case of a dynasty of 'average individuals' which begins with an individual who has human capital $h \geq \theta$ and is subject to a random unobserved component of income to output π that is equal to its expected value, $E(\pi) = 0$, in every period.

We focus on 'average individuals' (or the path where $\pi = 0$) for the sake of simplicity. However, although our analysis provides only a partial view of the type of growth paths that may exist in the economy, the view that is afforded is representative of the whole. Moreover, it is possible to arbitrarily reduce the variance of the unobserved component of income, π, in such a way that it has no effect on the conspicuous consumption function $x(y, h)$ (as long as the support of the distribution of π is unchanged and the density function is strictly positive on the entire support) such that almost all the realisations of the noise term π would be equal to, or in the neighbourhood of, the expected value of the noise term $E(\pi) = 0$.

We denote the human capital and output of an individual in a given dynasty at time t by h_t and y_t, respectively. As explained above, we examine a dynasty where $h_0 \geq \theta$ and where $y_t = h_t$ for every $t \geq 1$. We denote the mapping that governs the dynamics of human capital by ϕ so that

$$h_{t+1} = \phi(h_t)$$

for every $t \geq 0$.

By (1), (4) and (9), noting that $e_t = b_t$,

$$\phi(h_t) = \theta + \gamma\beta\left\{(1-\lambda)h_t + \lambda\left[\frac{\underline{y}(h_t)^{1/(1-\lambda)}}{h_t^{\lambda/(1-\lambda)}}\right]\right\}.$$

We offer the following example to illustrate. Suppose that the lower bound on the noise term $\underline{\pi}(h)$ is equal to $-h$ for small values of h but is equal to some $\underline{\pi} < 0$ for values of h that are larger than $|\underline{\pi}|$, that is $\underline{\pi}(h)$ is given by (10) and $\underline{y}(h)$ is given by (11). In this case, it can be verified that the function ϕ has the following properties:

(*i*) If the lower bound on the noise term π is equal to the individual's level of human capital in absolute value, $\underline{\pi}(h_t) = -h_t$, then

$$\phi(h_{t+1}) = \theta + \gamma\beta(1-\lambda)h_t.$$

In this case, h_{t+1} is a linear function of h_t that intersects the 45° line because of our assumption that $(1-\lambda)\gamma\beta < 1$.

(*ii*) If the lower bound on the noise term is a constant, $\underline{\pi}(h_t) = \underline{\pi} < 0$, then for $h_t \geq -\underline{\pi}$, ϕ is increasing and convex, with a slope that increases from $\gamma\beta(1-\lambda)$ as h_t tends to $-\underline{\pi}$ from above, to $\gamma\beta$ as h_t tends to infinity.

So, if it is assumed that the lower bound on the noise term $\underline{\pi}(h)$ is equal to $-h$ for small values of h but is equal to some $\underline{\pi} < 0$ for values of h that are larger than $|\underline{\pi}|$ as in (10), then it follows that the mapping ϕ is increasing and (weakly) convex. If in

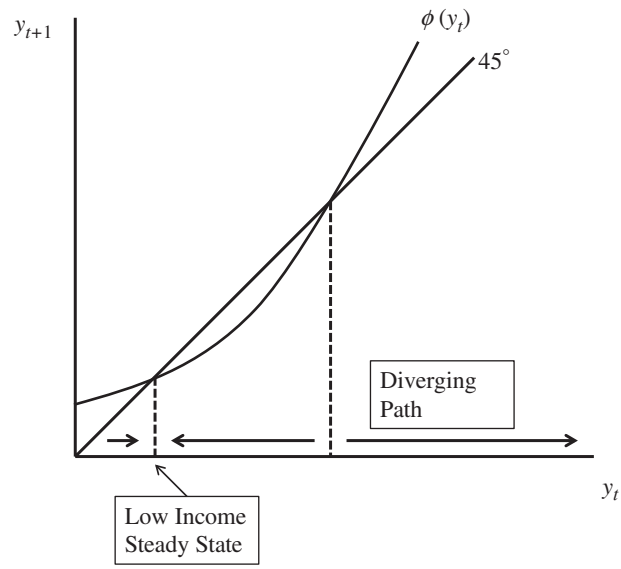

Fig. 2. *The Dynamical System*

addition $\underline{\pi} < \theta/[\gamma\beta(1-\lambda)-1]$, then under the assumption that $(1-\lambda)\beta\gamma < 1$ and $\beta\gamma > 1$, the mapping ϕ intersects the 45° line twice as depicted in Figure 2.

It thus follows that a dynasty that begins with a low level of human capital will be trapped in poverty unless it experiences a series of large unobserved additions to income, π. In contrast, the output of a dynasty that begins with a high level of human capital will grow indefinitely (converging to a rate of growth of $\beta\gamma - 1$), unless it experiences a series of large deductions (in absolute value) to income π.

It should be noted that the assumption we imposed on $\underline{\pi}(h)$ through (10) is not necessary for this conclusion to hold. The same qualitative result would continue to hold as long as the share of expected conspicuous consumption out of human capital $x(h,h)/h$ is decreasing, that is, as long as the conclusions of Proposition 2 hold.

5. Concluding Remarks

This article contributes to the literature about the significance and effect of conspicuous consumption by illustrating that if an individual's level of human capital provides a signal about the individual's income then it is plausible that more educated individuals will spend relatively less on conspicuous consumption. As a result, since human capital is correlated with income, our model offers an explanation for increasing marginal saving rates with income.

We show that this insight can contribute to our understanding of the behaviour of the poor and the persistence of poverty. Intuitively, dynasties that are on a track of human capital accumulation reduce the share of income devoted to conspicuous consumption, which supports and reinforces further accumulation of wealth and human capital in the dynasty and facilitates upward mobility. In contrast, individuals with low levels of human capital spend a relatively larger fraction of their income on conspicuous consumption, which prevents their dynasty from accumulating human capital and escaping poverty.

Interestingly, if, as suggested by evolutionary considerations, women tend to worry less about their social status than men, then maternalistic societies in which women have more control over resources may be characterised by less conspicuous consumption and a bigger potential for escaping poverty.

Another testable implication of our analysis is the following. Consider the issue of public charitable contributions, which we take as a prime example of conspicuous consumption. It is well known that the rich spend a lot more on charitable contributions than the poor. There are at least three different explanations for this behaviour: charitable contribution is a luxury good, there is stronger social pressure on the rich to contribute more to society and our suggestion that charitable contributions provide a signal about unobserved income ('success'). Consider the effect of the revelation of information about individuals' incomes. Such a revelation should have no effect on charitable contributions if they are mostly a luxury good. It should lead to a rise in charitable contributions if they are mostly due to social pressure on the rich to contribute to society and it should lead to a decrease in charitable contributions if they are mostly about signalling. It ought to be possible to examine empiricaly the effect of such a revelation of information on charitable giving.

In addition, an extension of the model that incorporates differences across countries with respect to the transparency of human capital and individuals' investment in the human capital of their offspring, may offer an explanation for cross-country differences in conspicuous consumption and the persistence of poverty. Such differences could, for instance, emerge from differences across countries in the prevalence of private *versus* public schools. Similarly, differences in the distribution of income across countries, captured in the model by differences in the lowest realisation of the unobserved component of income, could have an impact on conspicuous consumption as a function of income or human capital. As explained above, if status is defined by ranking in the income distribution rather than by social beliefs about the level of income, then the entire shape of the income distribution could have an impact on the conspicuous consumption function.

These potential differences across countries could lead to, or may be interpreted as, differences in social norms or culture with respect to the 'creation of a spectacle'. As illustrated in this article, such differences can have serious implications with respect to the persistence of poverty.

Appendix A. Proofs

Proof of Proposition 1. In a fully separating equilibrium the social belief $y(h, x)$ must be monotonically increasing for every $h \geq \theta$. As explained in Section 3, the social belief $y(h, x)$ must satisfy the differential equation (7) for every $h \geq \theta$. This differential equation is homogenous and so can be transformed into a separable differential equation and then solved (Boyce and DiPrima, 1996, pp. 90–1). The solution is given by (8) (the constant term must be equal to zero because $y(h, 0)$ must be equal to zero for every $h \geq \theta$ in equilibrium). Uniqueness of the equilibrium follows from uniqueness of the solution of (7), which follows from standard results about the uniqueness of solutions of differential equations, in addition to the fact that (7) has no singularity points in the relevant range.

Proof of Proposition 2. It follows from (9) that

$$\frac{x(h,h)}{h} = \lambda\left\{1 - \left[\frac{\underline{y}(h)}{h}\right]^{1/(1-\lambda)}\right\}.$$

This is non-increasing if and only if $\underline{y}(h)/h$ is non-decreasing, which follows from the fact that $\underline{y}(h)$ is non-decreasing and convex.

Proof of Proposition 3. From (9), $x[h, y(h)]/y(h)$ is equal to

$$\lambda\left\{1 - \left[\frac{\underline{y}(h)}{y(h)}\right]^{1/(1-\lambda)}\right\}.$$

Thus, for values of $h < |\underline{\pi}|$, $x[h, y(h)]/y(h)$ and therefore also its expectation over π are equal to λ. For $h \geq |\underline{\pi}|$, the expectation $\mathrm{E}_{y(h)}\{x[h, y(h)]/y(h)\}$ is non-increasing if and only if

$$\mathrm{E}_{\pi}\left[\left(\frac{h-|\underline{\pi}|}{h+\pi}\right)^{1/(1-\lambda)}\right] = \int_{\underline{\pi}}^{\infty}\left(\frac{h-|\underline{\pi}|}{h+\pi}\right)^{1/(1-\lambda)} \mathrm{d}F(\pi)$$

is non-decreasing. This follows from the fact that the derivative of the last expression with respect to h is

$$\frac{1}{1-\lambda}\int_{\underline{\pi}}^{\infty}\left(\frac{h-|\underline{\pi}|}{h+\pi}\right)^{\lambda/(1-\lambda)}\frac{\pi+|\underline{\pi}|}{(h+\pi)^2}\,\mathrm{d}F(\pi)\geq 0.$$

A.1. *The Fully Separating Equilibrium is the Unique Equilibrium that Satisfies a Plausible Restriction on Social Beliefs*

As we show below, in equilibrium the social beliefs $\mathrm{E}(y \mid h,a)$ must be non-decreasing in x. Consider an equilibrium that is not fully separating. In such an equilibrium, individuals with different incomes all spend the same amount on conspicuous consumption. Since $\mathrm{E}(y \mid h,a)$ is non-decreasing it follows that there exists an interval of incomes such that every individual whose income belongs to this interval spends the same amount, say a, on conspicuous consumption.

Suppose that the individual with the highest income in this interval, denoted y_b, is indifferent between spending a on conspicuous consumption and being believed to have an average income of $\mathrm{E}(y \mid h, a)$, and spending an additional sum of $b - a$ on conspicuous consumption and being believed to have an average income of $\mathrm{E}(y \mid h, b) > \mathrm{E}(y \mid h, a)$.[17] It follows that for some small $\varepsilon > 0$, an individual with income $y_b - \varepsilon$ who in equilibrium also spends a on conspicuous consumption should be indifferent between spending a on conspicuous consumption and being believed to have an average income of $\mathrm{E}(y \mid h, a)$, and spending an additional sum of $b - a - \delta_\varepsilon$ on conspicuous consumption and being believed to have an average income of $\mathrm{E}(y \mid h, b) - \Delta_\delta > \mathrm{E}(y \mid h, a)$. However, an individual with a lower income than $y_b - \varepsilon$ who in equilibrium spends a on conspicuous consumption would strictly prefer to spend a than to spend $b - \delta_\varepsilon$ on conspicuous consumption even if this implies that he would be believed to have the higher income $\mathrm{E}(y \mid h, b) - \Delta_\delta$.

We consider the following variant of the intuitive criterion (Banks and Sobel, 1987; Cho and Kreps, 1987; Grossman and Perry, 1986; and references therein). We say that an equilibrium satisfies a variant of the intuitive criterion if upon observation of out-of-equilibrium level of conspicuous consumption of $b - \delta_\varepsilon$, it is inferred that the individual who spent this amount has an income that is at least $y_b - \varepsilon$.

PROPOSITION A1. *An equilibrium* $\langle x(h, y), \mathrm{E}(y \mid h, x)\rangle$ *that satisfies the variant of the intuitive criterion described above is fully separating.*

Proof. The proof follows from the following five steps.

(*i*) An equilibrium belief function $\mathrm{E}(y \mid h,x)$ is non-decreasing in x. If, to the contrary, for some $h \geq 0$ and $x' > x$, $\mathrm{E}(y \mid h, x) > \mathrm{E}(y \mid h, x')$, then an agent can spend less on conspicuous consumption and still be believed to have a higher expected income. A contradiction to the optimality of the conspicuous consumption function.

(*ii*) An equilibrium expenditure on conspicuous consumption, $x(h, y)$, is non-decreasing in y. Suppose to the contrary that an agent with human capital h and income y' spends x' on conspicuous consumption, $c' = (1 - \beta)(y' - x')$ on consumption, and $b' = \beta(y' - x')$ on bequest, and is believed to have an income $\bar{y}'$, while an agent with human capital h and

[17] As should become apparent below, it does not matter if this individual actually spends a or b on conspicuous consumption. That is, it does not matter whether the interval of incomes is closed or open from the right.

income $y < y'$ spends $x > x'$ on conspicuous consumption, $c = (1 - \beta)(y - x)$ on consumption, and $b = \beta(y - x)$ on bequest, and is believed to have an income $\bar{y} \geq \bar{y}'$. Because the latter agent optimises,

$$[(1-\beta)(y-x)]^{(1-\beta)(1-\lambda)}[\beta(y-x)]^{\beta(1-\lambda)}\bar{y}^{\lambda} \geq [(1-\beta)(y-x')]^{(1-\beta)(1-\lambda)}[\beta(y-x')]^{\beta(1-\lambda)}(\bar{y}')^{\lambda},$$

or

$$(y-x)^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(1-\beta)^{(1-\beta)(1-\lambda)}\beta^{\beta(1-\lambda)}\bar{y}^{\lambda} \geq (y-x')^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(1-\beta)^{(1-\beta)(1-\lambda)}\beta^{\beta(1-\lambda)}(\bar{y}')^{\lambda},$$

or, because $y' - x/y - x$ is increasing in x,

$$\left(\frac{y'-x}{y-x}\right)^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(y-x)^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(1-\beta)^{(1-\beta)(1-\lambda)}\beta^{\beta(1-\lambda)}\bar{y}^{\lambda} > \left(\frac{y'-x'}{y-x'}\right)^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(y-x')^{(1-\beta)(1-\lambda)+\beta(1-\lambda)}(1-\beta)^{(1-\beta)(1-\lambda)}\beta^{\beta(1-\lambda)}(\bar{y}')^{\lambda}.$$

But then

$$[(1-\beta)(y'-x)]^{(1-\beta)(1-\lambda)}[\beta(y'-x)]^{\beta(1-\lambda)}\bar{y}^{\lambda} > [(1-\beta)(y'-x')]^{(1-\beta)(1-\lambda)}[\beta(y'-x')]^{\beta(1-\lambda)}(\bar{y}')^{\lambda},$$

which means that the agent with income y' cannot be optimising.

(*iii*) If for some level of human capital h the belief function $\mathrm{E}(y \mid h, x)$ is constant (as a function of x) on an interval, then it 'jumps up' immediately to the right of this interval. That is, if for some fixed h the social belief $\mathrm{E}(y \mid h,x)$ is constant on an interval $[a,b]$ or $[a,b)$ and is such that $\mathrm{E}(y \mid h, x) > \mathrm{E}(y \mid h, b)$ for $x > b$ then $\lim_{x \searrow b} \mathrm{E}(y \mid h, x) > \mathrm{E}(y \mid h, b)$ or $\mathrm{E}(y \mid h, b) > \lim_{x \nearrow b} \mathrm{E}(y \mid h, x)$, respectively. We prove this claim for the latter case. The proof for the former case is similar. Suppose to the contrary that two agents with the same h spend a and b on conspicuous consumption. If the two agents are believed to have the same expected income then the agent who spends b on conspicuous consumption cannot be optimising.

(*iv*) If for some h, $\mathrm{E}(y \mid h,x)$, viewed as a function of x alone, is constant on an interval $[a,b)$, then the agent with the lowest income y_b who spends b on conspicuous consumption in equilibrium must be indifferent between spending b or a on conspicuous consumption. If no such agent exists, and an agent with income $\inf\{y{:}x(h,y){=}b\}$ spends a on conspicuous consumption, then this agent must be indifferent between spending a or b on conspicuous consumption. In the former case, it follows from the fact that agents with incomes $y < y_b$ prefer to spend a on conspicuous consumption and continuity; in the latter case, it follows from the fact that agents with incomes $y > \inf\{y{:}x(h, y) = b\}$ prefer to spend b on conspicuous consumption and continuity. The statement and proof in the case where $\mathrm{E}(y \mid h, x)$ is constant on an interval $[a,b]$ is similar.

(*v*) Fix an equilibrium $\langle x(h, y), \mathrm{E}(y \mid h, x)\rangle$. If the belief function $\mathrm{E}(y \mid h,x)$ is (strictly) increasing, then we are done. Suppose then that for some level of human capital h, the belief $\mathrm{E}(y \mid h, x)$ is constant on some interval $[a, b)$, and that it jumps up immediately thereafter as implied by Step (*iii*). Suppose that the equilibrium is such that an agent with income y_b spends b on conspicuous consumption, and that agents with lower incomes spend no more than a on conspicuous consumption (the argument for the case where agents with incomes $y > y_b$ spend at least b on conspicuous consumption and an agent

with income y_b spends a on conspicuous consumption is similar). Step (*iv*) implies that an agent with income y_b is indifferent between spending a on conspicuous consumption if he is believed to have an average income of $E(y \mid h,a)$, and spending an additional sum of $b - a$ on conspicuous consumption if he is believed to have an average income of $E(y \mid h,b) > E(y \mid h,a)$. Similarly, for some small $\varepsilon > 0$, an agent with income $y_b - \varepsilon$ is indifferent between spending a on conspicuous consumption if he is believed to have an average income of $E(y \mid h,a)$, and spending an additional sum of $b - a - \delta_\varepsilon$ on conspicuous consumption if this implies that he would be believed to have an average income of $E(y \mid h,b) - \Delta_\delta > E(y \mid h,a)$. In contrast, an agent with a lower income than $y_b - \varepsilon$ strictly prefers to spend a than to spend $b - \delta_\varepsilon$ even if this means that he would be believed to have the higher income $E(y \mid h,b) - \Delta_\delta$. So, an agent with income between $y_b - \varepsilon$ and y_b would like to spend a little more if this meant that he were believed to have a higher income but this is not possible with the equilibrium beliefs $E(y \mid h,x)$. But, if such an agent deviates from equilibrium and spends an additional sum of $b - a - \delta_\varepsilon$ on conspicuous consumption, then it should be believed that his income is at least $y_b - \varepsilon$, because, as explained above, it is not in the interest of an agent with a lower income to deviate in this way even if he were believed to have an income that is equal to $y_b - \varepsilon$. This argument implies that if $E(y \mid h,x)$ is part of an equilibrium that satisfies the intuitive criterion, then it cannot be constant on any interval. It therefore follows that it must be part of a fully separating equilibrium.

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Submitted: 8 November 2010
Accepted: 5 November 2011

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