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Social inclusion through social status and the emergence of development traps

Vincenzo Lombardo

Department of Business and Economics, University of Naples Parthenope, Napoli, Italy

Correspondence
Vincenzo Lombardo, Department of Business and Economics, University of Naples Parthenope, Palazzo Pacanowski, Via Generale Parisi, 13, Napoli 80132, Italy.
Email: vincenzo.lombardo@uniparthenope.it

Abstract

This paper investigates the long-run implications of concerns for status when heterogeneous agents care about their relative consumption with respect to an endogenous benchmark consumption of their reference group. Agents endogenously choose whether to enter the rat race to consume the benchmark level of a social participation, status, good to gain access to socially advantaged and privileged groups because relative consumption determines agents' relative position in society which is ultimately instrumental in the accumulation of wealth and absolute consumption. The dynamical analysis predicts that increases in mean incomes and reductions in inequality over the long-run process of development foster the competition for status, raise the cost of access to the reference group and drive the onset of multiple stable steady-state equilibria. This mechanism governs the endogenous transition from a Solovian-type stage to a development traps equilibrium at which the poorest dynasties are excluded from the reference group and trapped in a low-income stable equilibrium while the richest dynasties strive to differentiate themselves from the poorest ones to reap the economic benefits of the elite position in society.

KEYWORDS

development traps, economic growth, keeping up with the Joneses, social inclusion, social status

JEL CLASSIFICATION
D31; D90; O40

1 | INTRODUCTION

This paper investigates the implications of agents' status-seeking behavior in macroeconomic growth models focusing on the implications of agents' concerns for relative consumption for the emergence of poverty or development traps. Motivated by the seminal contributions of Veblen (1899) and Duesenberry (1949) that positionality matters for the preferences of the individuals,[1] the theory is grounded on the hypothesis that agents care not only about their absolute level of consumption but also about their relative consumption with respect to a benchmark represented by the consumption of the individuals in their reference group.[2] Following a strand of the literature, I assume that these concerns are not hard-wired in the preferences of the individuals but that agents care about their relative consumption because this determines their relative position in society which is ultimately instrumental in determining their absolute consumption (Ball et al., 2001; Cole et al., 1992; Heffetz & Frank, 2011; Hirsch, 1976).

In this model, agents strive to consume an endogenous benchmark level of social participation, status, good to gain access to and to participate in socially advantaged and privileged groups that are the source of economic gains that ultimately affect their utility. As a working example, consider, for instance, when, selecting the educational career of their children, parents also choose to live in particular neighborhoods because social context and network can enhance the returns of the educational expenditures and boost the accumulation of the children's human capital. Houses in privileged places are, indeed, often a barrier to entry in elite schools; similarly, living in scarce and desirable "better than average" locations is often a source of informational advantage (i.e., on educational plans, type and quality of available jobs). In this example, parents do not engage in a rat race to live in an exclusive place because they have innate concerns for status but because the choice of acquiring a relatively advantageous position in the society favors the human capital accumulation and the income perspective of the children, hence boosting only indirectly the parents' utility. The (degree of) positionality and scarcity of this type of goods imply that if the economic gains of social participation and relative standing in society are great enough, only the wealthiest part of the population choose to compete for and can afford the social participation good at the benchmark level without needing to distort resources from productive investments (i.e., education). Therefore, income differences across individuals emerge and persist over time. Recent empirical evidence from Michelman et al. (2021)

[1]The existence and salience of positional concerns have been empirically tested in several studies on self-reported happiness, expenditure surveys or experiments. Findings indicate that individuals' happiness is significantly and negatively affected by their relative income and relative consumption (Clark et al., 2008; Clark & Senik, 2010; Dynan & Ravina, 2007; Ferrer-í-Carbonell, 2005; Luttmer, 2005) and that individuals' consumption is positively correlated to the consumption of the reference group (Charles et al., 2009; De Giorgi et al., 2020; Heffetz, 2011; Ravina, 2019). Survey experiments on the degree of positionality of income and consumption also suggest that people have stronger positional concerns for the consumption of more visible goods (cars, ceremonies, clothing) than for income (Alpizar et al., 2005; Bursztyn et al., 2018; Solnick & Hemenway, 2005).

[2]Several specifications with interdependent preferences are proposed in the literature to model the idea that agents care about their social status and relative standing in society distinguishing between concerns for relative consumption, income and wealth (Abel, 1990; Barnett et al., 2010; Dupor & Liu, 2003; Galí, 1994) or concerns for the rank in the distribution (Frank, 1985; Hopkins & Kornienko, 2004; Rayo & Becker, 2007).

points in this direction showing that high-status students from prestigious private high schools are much more likely to join exclusive campus clubs and that the club membership premium is very large; club members earn 32% more than other students despite performing worse academically than students outside the elite clubs.[3]

I embed this idea in a simple overlapping generation set-up where parents' preferences are defined over their consumption of a social participation good and the human capital of their children. Children's human capital depends directly on the educational expenditures of the parents and indirectly on the transmission of the privileges that the parents get by consuming the social participation good at the benchmark level of the reference group, that is by joining the relatively advantageous groups of the society. I model this latter channel as a scale effect in the production function of human capital; the high social status induced by the consumption equal or greater than that of the reference group allows parents to ensure their children an extra human capital benefit in the form of a lower bound independent of the educational expenditures.[4] Accordingly, this extra human capital effect generates an extra utility premium only for richer parents who achieve and choose to consume the social participation good over the reference standard.[5] The discontinuity in the agents' preferences generated by the utility premium brings two consequences that are consistent with the empirical evidence showing that the strength of relative concerns is heterogeneous across the income distribution and that status concerns become relevant and affect individuals happiness only when a person reaches a certain level of income and a specific position in the income distribution (Akay and Martinsson, 2011; Akay et al., 2012; Dynan & Ravina, 2007; Ravallion & Lokshin, 2010). First, the richest parts of the population strive to separate themselves from the poorest ones to maintain their position on the distribution and to continue to reap the economic benefits of the greater human capital accumulation and income of the children. Next, people in the model endogenously choose whether to participate in the rat race for the advantageous position in society; in particular, concerns for status become effective and cause agents to privilege the participation good only when individual incomes equal an endogenous income

[3]Several pieces of evidence support the idea that the search for status is not an innate characteristic embedded in the individuals' preferences but that it is instrumental for the attainment of absolute economic benefits. Bloch et al. (2004) show that in the Indian society excessively visible expenditures for wedding celebrations are used instrumentally to signal the quality of the new groom's family and the augmented social status of the bride's family and to favor the best marriage matching that can enhance the wealth of the families. In the same spirit, Rao (2001a, 2001b) document that the poor participate and organize public ceremonies to join social networks that may help them to cope with poverty. Experimental evidence also confirms that higher-status persons have greater access to resources and realize higher economic gains that, in turn, stimulate people to invest resources to acquire social status and a relatively advantageous position in society (Ball et al., 2001). Likewise, Mas and Moretti (2009) and Bursztyn and Jensen (2015) provide evidence that social and peer pressure affects human capital accumulation and on-job productivity of individuals. For thoroughly discussions on the nature of the concerns for relative position and social status, see Fershtman and Weiss (1998), Postlewaite (2011) and Robson and Samuelson (2011).

[4]Main results remain qualitatively unchanged if social status affects the marginal returns of education.

[5]Another possibility would be to assume that the status gratification of parents derives directly from educational investments in their children so that people would strive to keep up with the educational benchmark of their reference group. Results would be qualitatively the same but at the cost of making the analysis much less tractable. I thank an anonymous referee for highlighting this point.

threshold that guarantees the benchmark consumption.[6] This leads to the emergence and persistence of an equilibrium characterized by multiple stable steady states according to which incomes of generations of individuals converge to two stable basins of attraction of a rich and a poor level of income.

Imposing, further, that the benchmark level of the social participation good of the reference group depends on the average consumption in the society, the individual demand for participation results to be a function not only of the personal incomes but also of the mean and the overall distribution of incomes. Consistent with previous empirical and theoretical findings, the model suggests that increases in the mean income and reductions in inequality foster the competition for status by raising the cost of access to the reference group and increasing the mass of people who wants to stay with or join the relevant reference group. On one side, the effect of increases in the mean income captures the idea that the concerns for relative position become increasingly relevant as incomes rise so that social status, as a luxury good, becomes relatively more important with economic growth and/or in already rich countries (Clark et al., 2008; Heffetz & Frank, 2011; Quintana-Domeque & Wohlfart, 2016). On the other side, greater equality stimulates the competition for status because it provides people stronger incentives to differentiate themselves (Hopkins & Kornienko, 2006; Jin et al., 2011; Quintana-Domeque & Wohlfart, 2016).[7] Overall, as the competition for status strengthens, a larger mass of individuals spends an increasing share of their budget in the consumption of the social participation good to reach the benchmark level of the reference group. The associated rise in the average consumption makes, then, more costly for the poorest part of the population to keep up with the reference group so that the development traps emerge.

Then, I finally use these comparative statics results to capture how the development traps emerge over time as the outcome of the long-run process of development. To this end, I provide a dynamical analysis that characterizes the evolution and transition of incomes within each generation also as a function of the mean and overall distribution of incomes. So, when the mean income is low, as in the initial phases of a development process, also the costs of social participation (i.e., benchmark consumption) are low and the dynamical system is temporarily characterized by a unique stable steady state which is the unique basin of attraction for all the dynasties. Throughout the convergence toward the steady state, increases in mean incomes and reductions in inequality determine the rise in the average consumption of the social participation good and drive the onset of the stage characterized by the emergence of an equilibrium in which all the dynasties are perfectly segmented into two groups; those who join the reference group and those who do not. The intuition for this path is that over time, the increasing costs of social inclusion shape the transition from a Solovian-type stage to a regime characterized by multiple steady states since agents sacrifice relatively more resources to keep up with the reference group. Then, some dynasties become excluded from the reference group and hence trapped in a low-income stable equilibrium while the richest dynasties can keep reaping the economic benefits of the elite position in society.

[6]Specifically, the preferences of low-income agents are not affected by concerns for relative position so that these agents share their budget constraint across the two goods in fixed proportions. As individuals' incomes equal the threshold level of income that discriminates between being part or not of the reference group, concerns for relative position kick in according to the strength of the economic gains induced by joining the reference group. This pattern is empirically consistent with the findings of, for instance, Dynan and Ravina (2007) according to which the happiness of people with below-average income is not affected by the distance between their income and the average one, while the happiness of richer people, with above-average incomes, is significantly affected by how much their incomes outperform the average. Likewise, Akay and Martinsson (2011), Akay et al. (2012) and Ravallion and Lokshin (2010) find that relative deprivation becomes a concern amongst the relatively well-off.

[7]Another argument posits that lower initial inequality allows the society as a whole to accept more easily the rising inequality induced by the competition for status (Gershman, 2014).

This paper aims at contributing to the relatively small literature on poverty traps in models with status concerns. Most of the literature largely focuses on the effects of consumption externalities on economic growth and mainly analyzes how the optimality of the growth rates and the speed of convergence toward the (unique) steady state are affected by the introduction of interdependent preferences in otherwise standard neoclassic growth models (Alvarez-Cuadrado et al., 2004; Carroll et al., 1997; Liu & Turnovsky, 2005; Petach & Tavani, 2021).[8] Surprisingly enough, only a few studies investigate the connections between concerns for status and the possibility of multiple stable steady-state equilibria characterizing poverty or development traps (Cole et al., 1992; Genicot & Ray, 2017; Kawamoto, 2009). Particularly close in the spirit of this paper, Moav and Neeman (2010, 2012) show that poverty trap equilibria arise in signaling models as poor individuals waste economic resources and hence hinder their wealth accumulation to engage in conspicuous consumption to distinguish themselves from the very poor. In this paper, I advance another mechanism according to which richer individuals strive to differentiate themselves from the poorer ones to gain a relatively advantageous position in society that is instrumental to achieve economic benefits and accumulate further wealth. In this regard, my paper is also related to the earliest class of models on poverty traps that emphasized capital market imperfections and indivisibilities in production as sources of long-run multiple stable equilibria (among many Banerjee & Newman, 1993; Galor & Zeira, 1993). I connect the literature analyzing the effects of non-convexities in the production of human capital (Galor & Tsiddon, 1997; Moav, 2002; Moav & Neeman, 2012) to the one on concerns for status and relative position by considering that the extra benefit that guarantees a lower bound in the human capital accumulation of the children is not exogenous and equal for all the agents but it depends on the relative position and status of the parents.

The specific formalization of the concerns for relative consumption allows this paper also to contribute to the literature on social status, especially that on the keeping up with the Joneses (KUJ) effects. The main hypothesis of the paper is that the incentives of the agents to consume more than others and hence to enter the rat race to join the Joneses are shaped by an extra utility premium modeled as a discrete discontinuity in the agents' preferences. This is not a completely novel approach to KUJ formalization. Based on the original intuition of Lewis and Ulph (1988), this specification is close to the one used also by Barnett et al. (2010) who assume that the discontinuity is gentler and it is represented by a (continuous) non-convexity in the preferences.[9] Instead, the assumption of this paper that the discontinuity may be qualified as a discrete jump in the agents' preferences is shared with Rayo and Becker (2007) who postulate a step function for the happiness function of the individuals. I depart from these papers as I further assume that this feature is endogenously determined by the instrumental source of the status motive so that the discontinuity in the preferences that determines the strength of the KUJ effect is driven by the economic gains accruing from the relative advantageous position in the society. Lastly and consistently with the empirical findings on the heterogeneity in status motives, the modeling choice advanced in this paper implies that only some individuals are motivated by concerns for relative consumption such that two types of individuals coexist in the economy; those who compete to join the Joneses and those who do not. This result is shared with others

[8]Some authors remark an incentive effect and argue that positional externalities may promote economic growth or lead the poorer agents to catch up with the richer ones as status concerns would push individuals to choose less leisure and more work (Corneo & Jeanne, 2001; Futagami & Shibata, 1998; Long & Shimomura, 2004). Others, instead, have emphasized the negative externality imposed by the consumption of the reference group that would hamper economic growth rates by distorting the saving and investment decisions of the agents (Fershtman et al., 1996; Hopkins & Kornienko, 2006; Kawamoto, 2009).

[9]Genicot and Ray (2017) present a similar feature in the analysis of the effects of aspirations on development.

who, however, assume that the two groups of individuals exist exogenously (Dodds, 2012; Strulik, 2015). In this paper, instead, the two types emerge endogenously as individuals choose whether or not to keep up with the reference group.

Finally, the dynamical analysis of the paper also informs the literature on economic growth and endogenous take-off in the very long run formalized by the Unified Growth Theory that emphasizes that deep factors that may have affected, through the development process, either the rate of technological progress or the accumulation and the composition of human capital provide a comparative perspective for the study of the modern divergences in per-capita income across the world (Galor, 2010; Galor & Weil, 2000). Recently, Chu et al. (2020) show that stronger preferences for status-seeking drive earlier takeoff and higher rates of economic growth in the short run by encouraging the accumulation of assets and stimulating the entry of firms with new products; however, in the long run, they harm the steady-state equilibrium growth rate as the increased entry of firms eventually reduces the market size of each firm and hence the firms' innovation rate.[10] In my setting, instead, the onset of development traps is a by-product of the long-run evolution of the economy as the dynamical systems shift from a Solovian-type stage to a regime characterized by multiple steady states since agents need to sacrifice relatively more educational resources to keep up with the reference group.

The rest of the paper is organized as follows. Section 2 introduces the basic structure of the model; Section 3 presents the endogenization of the benchmark consumption and the comparative statics in the static framework; Section 4 provides the dynamical analysis and the long-run equilibrium results. The last section concludes.

2 | THE BASIC STRUCTURE OF THE MODEL

A continuum of heterogeneous families indexed by i and each composed of a parent and a child is modeled in an overlapping generation economy in which the total population, of unit mass, is constant over time. Agents are differentiated by their income endowments that are determined by previous generations and distributed according to a cumulative distribution function $G_t(y_t^i)$ defined on the support $[0, \overline{\overline{y}}]$ with density $g_t(y_t^i)$, mean income $\overline{y}_t$ and standard deviation σ_t. Individuals live two periods, dying at the end of the second one. In the first period of their life (childhood), children obtain education financed by their parents. In the second period (adulthood), parents supply their efficiency units of labor, receive a wage and choose how to split their budget constraint over two goods; education for their children (e) and social participation good (z).

2.1 | Production

The production of the single homogeneous good is linear in human capital:[11]

$$Y_t = H_t = \int_{i \in I} h_t^i \, g_t(h_t^i) \, \mathrm{d}h_t^i, \tag{1}$$

[10] Also Artige et al. (2004) analyze how consumption habits have affected the pattern of reversals of leadership in the historical process.

[11] Alternatively, physical capital could be introduced by assuming a small open economy with perfect capital mobility; in this environment, the rate of interest, and hence the dynamics of the physical capital, would be internationally fixed without affecting the results.

where H_t is the aggregate stock of human capital at time t, with $\int_{i \in I} g_t(h_t^i)\,\mathrm{d}h_t^i = 1$. In each period, adults inelastically supply their efficiency units of labor receiving a wage equal to one so that their disposable income is $y_t^i = h_t^i$.

2.2 | Preferences

At time t, the preferences of the parents (born at $t-1$) are defined by a standard log-utility function over their second period consumption of the social participation good z_t^i and the human capital of their children h_{t+1}^i:

$$u_t^i(z_t^i, e_t^i) = \ln z_t^i + \gamma \ln h_{t+1}^i, \tag{2}$$

where $\gamma > 0$ is the degree of altruism of the parents. Parents contribute to the accumulation of the human capital of the children through two channels: directly, by investing in educational expenditures e_t^i and indirectly, by bequeathing them an extra human capital benefit θ that they obtain by consuming the social participation good z_t^i over the to-be-specified benchmark κ that each agent i takes as given. Formally,

$$h_{t+1}^i = h(e_t^i, z_t^i) = \left(\Theta(z_t^i) + e_t^i\right)^{\beta}, \tag{3}$$

with

$$\Theta(z_t^i) = \begin{cases} 0 & \text{if } z_t^i < \kappa \\ \theta & \text{if } z_t^i \geq \kappa, \end{cases} \tag{4}$$

where $0 < \beta < 1$, and $\theta > 0$ captures the strength of the economic gains, in terms of human capital accumulation, of holding a relatively advantageous position in society. The human capital accumulation of the young generations is governed by the fairly standard function in (3) that is increasing and concave in the educational expenditures of parents e_t^i and it presents a lower bound θ that, unusually, is not exogenous and equal for all individuals but it depends on the relative consumption and social status of the parents; formally, $h(0, z_t^i) = \theta^{\beta}$ and $\lim_{e_t^i \to 0} \partial h_{t+1}^i / \partial e_t^i > 0$ hold only for agents with $z_t^i \geq \kappa$.[12] The idea is that parents with high social status, obtained consuming the social participation good z over the benchmark κ, can ensure their children an extra human capital benefit, which is increasing in θ and independent of e_t^i.

These economic benefits, which I model for simplicity and tractability as a lower bound in the children's human capital function, shape, in turn, the incentives of the parents to consume the social participation good and lead agents to care for their relative consumption. The discontinuity generated by θ in the human capital function translates, indeed, into a corresponding discontinuity in the preferences of the parents that, after using (3) and (4) in (2), can be represented by the step utility function (Rayo & Becker, 2007)

$$u_t^i = \begin{cases} \ln z_t^i + \alpha \ln e_t^i & \text{if } z_t^i < \kappa \\ \ln z_t^i + \alpha \ln(\theta + e_t^i) & \text{if } z_t^i \geq \kappa, \end{cases} \tag{5}$$

[12]Main results would remain fairly unchanged if social status would not perfectly substitute for education in the human capital accumulation of the children but it would affect the marginal returns of education by assuming, for instance, that social status and education would present some degree of complementarity. However, the analysis would become much more cumbersome and results less clear.

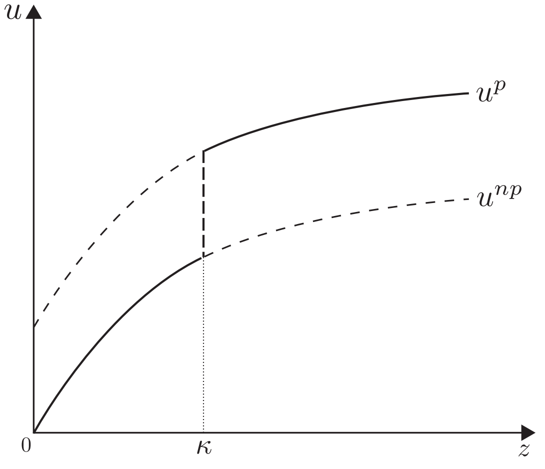


FIGURE 1 Utility: effect of social status in preferences

with $\alpha \equiv \gamma\beta$. Consumption of the participation good z over the reference point κ generates, through the human capital channel, an utility premium θ that captures the satisfaction for staying with the reference group and introduces a sharp discontinuity, a jump, in the preferences of the agents (Figure 1).[13] The corresponding non-convexity in the overall utility endogenously creates heterogeneity in the behavior and types of agents because only the preferences of the richest become non-homothetic. When the consumption of z is equal or greater than the benchmark κ, the marginal rate of substitution between the two goods is, indeed, increasing in θ implying that the cost of giving up an amount of the social participation good for education is increasing in the economic gains and the associated strength of the relative concerns. Hence, the preferences of the individuals become influenced by the behavior of the reference group, leading agents to strive to consume the good z at the benchmark level κ. Increases in κ, indeed, hurt individuals because it becomes more costly and difficult to stay with the reference group even though in this setting changes in the benchmark do not directly affect the utility of the agents as it does in the standard KUJ hypothesis. Otherwise, for consumption levels of z below κ, the marginal rate of substitution between the social participation good and education does not depend on θ so that agents utility is not affected by the behavior and consumption of the reference group. In the following, I refer to the former types as participating agents (p) and the latter ones as not participating agents (np).

2.3 | Optimization

In each period t, each agents i chooses z and e to maximize utility in (2), given an endowment of human capital h_t^i determined by the previous generations, and subject to (3), (4) and the budget constraint

[13]One could also hypothesize that social status is hard-wired in the individuals' preferences and that the preferences are represented by utility function of the form $u(z,e) = \log(z_t^i + \theta(z_t^i - \bar{z}_t)) + \alpha \log e_t^i$, with $h_{t+1}^i = (e_t^i)^\beta$. Alternatively, it would also be possible to imagine that the status gratification of the parents is derived directly from the educational investments in their children assuming, for instance, that the utility function would be represented by a formulation like $u(z,e) = \log z_t^i + \alpha \log(e_t^i + \theta(e_t^i - \bar{e}_t))$ where $\bar{e}_t$ is the average (or some function of the average) education of the reference group of the individual i. In both cases, the utility premium would no longer be associated with a sharp discontinuity (i.e., jump) but it would generate a gentler discontinuity in both the preferences and the human capital accumulation function. The main results would remain fairly unchanged but at the cost of making the dynamical analysis much more complex and less tractable and clear.

$$z_t^i + e_t^i \leq y_t^i. \tag{6}$$

For each of the two possible specifications in the piece-wise utility function in (5), utility is continuous, strictly increasing and concave. Hence, the problem can be solved by studying two conditional optimization problems; one for not participating ($\theta = 0$) and one for participating ($\theta > 0$) agents. Thereafter, the optimal solutions are derived by comparing the conditional indirect utility functions associated with the two problems.

Specifically, not participating generations excluded from the reference group solve the problem of choosing z and e such that

$$\{z_t^i, e_t^i; \theta = 0\} = \text{argmax}\{\ln z_t^i + \alpha \ln e_t^i\} \tag{7}$$

subject to $(z_t^i, e_t^i) \geq 0$, $z_t^i < \kappa$ and the budget constraint in (6). The first-order conditions are

$$z_t^{i,np} = \frac{y_t^i}{1+\alpha}, \quad e_t^{i,np} = \frac{\alpha}{1+\alpha} y_t^i \tag{8}$$

which are valid solutions as long as $z_t^i < \kappa$ that implies that $y_t^i < \hat{y} \equiv \kappa(1+\alpha)$; for any $y_t^i < \hat{y}$, the homotheticity of the preferences indicates that agents are not influenced by concerns for relative consumption and hence they split their budget proportionally across the two goods.

Correspondingly, participating generations solve the problem of choosing z and e such that

$$\{z_t^i, e_t^i; \theta > 0\} = \text{argmax}\{\ln z_t^i + \alpha \ln(\theta + e_t^i)\} \tag{9}$$

subject to $(z_t^i, e_t^i) \geq 0$, $z_t^i \geq \kappa$ and the budget constraint in (6). The optimal solutions defined by the first-order conditions are

$$z_t^{i,p} = \frac{y_t^i + \theta}{1+\alpha}, \quad e_t^{i,p} = \frac{\alpha y_t^i - \theta}{1+\alpha} \tag{10}$$

which are valid solutions as long as $z_t^i \geq \kappa$ that implies that

$$y_t^i \geq \tilde{y} \equiv \kappa(1+\alpha) - \theta, \tag{11}$$

with $\tilde{y} < \hat{y}$ indicating that the income threshold at which the agents join the reference group ($\tilde{y}$) is lower than the one at which agents do not participate ($\hat{y}$). This implies that there exists a range of incomes $y_t^i \in [\tilde{y}, \hat{y}]$ in which both the solutions – participating and not – could potentially be valid optima. Then, the optimal equilibrium choices of each agent are derived by contrasting the conditional indirect utility functions associated with the two maximization problems and defined by $v^{np}(y_t^i; \theta = 0)$ and $v^{p}(y_t^i; \theta > 0)$ for respectively the not-participating and participating agents.

The solutions of the problem of the participating agents in (10) indicate that, when concerns for relative consumption kick in, agents strive to consume the good z at the benchmark level κ so that they are induced to increase the consumption of the participation good at the cost of reducing the expenditures in education; the pressure to join the reference group implies, indeed, that $z_t^{i,p} > z_t^{i,np}$ and $e_t^{i,p} < e_t^{i,np}$. This effect is evident from the corner solution of the optimal education in (10);

$$e_t^{i,p} \begin{cases} =0 & \text{if } y_t^i \leq \tilde{\tilde{y}} \\ >0 & \text{if } y_t^i > \tilde{\tilde{y}}, \end{cases} \tag{12}$$

where $\tilde{\tilde{y}} = \theta/\alpha$ is the income threshold dictating the corner solution at which agents completely sacrifice investments in education. This threshold can be either lower or higher than $\tilde{y}$, the income threshold at which agents enter in the rat race for the social participation good. This implies that some agents can be well willing to forgo investments in education to consume the social participation good at the benchmark κ, especially when the economic gains of social status θ are large enough; in particular, $\tilde{y} < \tilde{\tilde{y}}$ when $\theta > \alpha\kappa$. Then,

Proposition 1 *If $\tilde{y} \leq \tilde{\tilde{y}}$, for any $y_t^i \in [\tilde{y}, \tilde{\tilde{y}}]$*

$$v^p(y_t^i) = u(\kappa, 0; \theta) > u(z_t^{i,np}, e_t^{i,np}; 0) = v^{np}(y_t^i).$$

Proposition 1 illustrates that the economic benefits accruing from holding a relatively advantageous position induce agents to consume the social participation good at the benchmark even at the cost of reducing expenditures in education. So, when $\tilde{y} \leq \tilde{\tilde{y}}$ the economic gains from social participation are large enough that agents with income $y_t^i \in [\tilde{y}, \tilde{\tilde{y}}]$ choose to participate even though this implies a complete drop in education. In particular, to keep up with the reference group, marginal agents prefer to cut education at zero instead of sharing the same income across both the goods because this latter strategy would not allow them to consume the social participation good at the benchmark level and hence to enjoy the extra human capital benefits. Straightforwardly, the smaller the potential economic gains, the smaller the pressure of the agents to change behavior toward more participation good; indeed, as the economic benefits from social participation and hence the strength of the concerns for relative position (θ) decrease, the income threshold $\tilde{y}$ at which agents choose to drop investment in education to access the benefits of keeping up with the reference group increases, while the threshold level of income $\tilde{\tilde{y}}$ at which agents restore a positive amount of education decreases. So, when the potential economic gains of social status are small enough, agents wait to enter the rat race as they do not have the pressure to cut educational investments. This is the case when $\tilde{y} > \tilde{\tilde{y}}$ or $\theta < \alpha\kappa$ in which the unique income threshold dictating the choice of the agents becomes $\tilde{y}$. Then, the optimal equilibrium choices are finally

$$\{z_t^i, e_t^i\} = \begin{cases} z_t^{i,np}, e_t^{i,np} & \text{if } y_t^i < \tilde{y} \\ z_t^{i,p}, 0 & \text{if } y_t^i \in [\tilde{y}, \tilde{\tilde{y}}] \quad \text{and } \tilde{y} \leq \tilde{\tilde{y}} \\ z_t^{i,p}, e_t^{i,p} & \text{if } y_t^i > \tilde{\tilde{y}} \end{cases} \tag{13}$$

and

$$\{z_t^i, e_t^i\} = \begin{cases} z_t^{i,np}, e_t^{i,np} & \text{if } y_t^i < \tilde{y} \\ z_t^{i,p}, e_t^{i,p} & \text{if } y_t^i \geq \tilde{y} \end{cases} \quad \text{and } \tilde{y} > \tilde{\tilde{y}}. \tag{14}$$

For low levels of income, $y_t^i < \tilde{y}$, the homotheticity of the preferences implies that agents share their budget in fixed proportion between both goods as they are not affected by concerns for status.

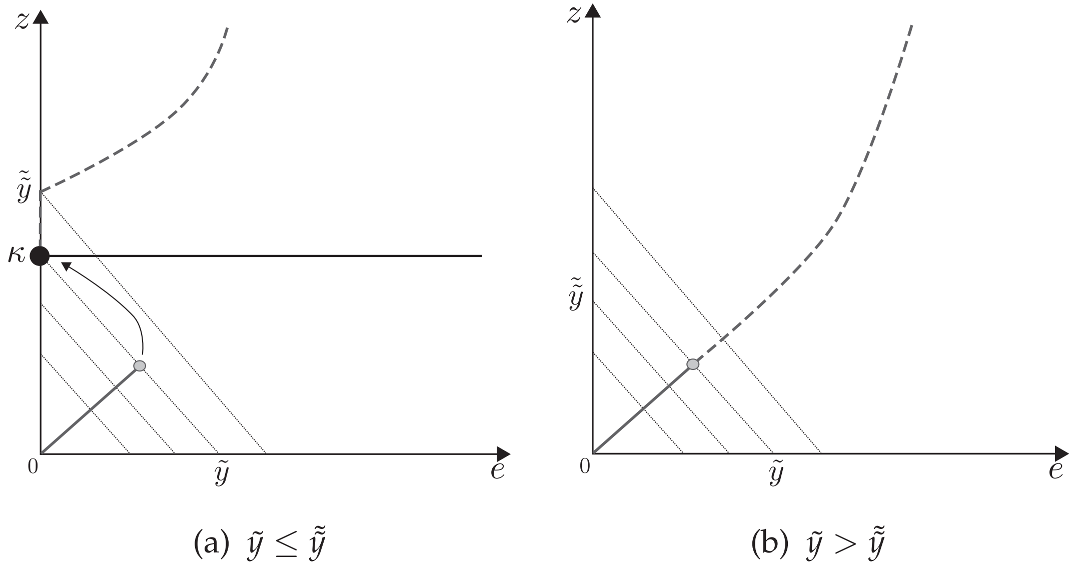


FIGURE 2 Equilibrium and income path

When incomes are high enough that $y_t^i \geq \tilde{y}$, the concerns for relative position kick in as joining the reference group is a source of economic benefits in the form of a greater accumulation of human capital of the children. If these benefits are strong enough ($\tilde{y} \leq \tilde{\tilde{y}}$, Figure 2a), agents with $y_t^i \in [\tilde{y}, \tilde{\tilde{y}}]$ completely forgo investments in education to keep up with the reference group because the relative cost of choosing education instead of the participation good is too large. Otherwise, when the economic gains are small ($\tilde{y} > \tilde{\tilde{y}}$, Figure 2b), the pressure to join the reference group is weak so that agents wait to enter the race to beat the benchmark κ and educational choices no longer present corner solutions. Nonetheless, the *local* non-homotheticity of the preferences in the upper range of incomes implies that as income rises higher shares of the budget are devoted to the participation good to keep on staying with the reference group.

3 | THE REFERENCE GROUP

Until this point, the consumption benchmark κ has been treated as fixed and exogenous. A natural way to proceed is to endogenize it as a function of the average consumption of the social participation good. Without loss of generality, I then assume for simplicity that κ is exactly equal to the average consumption of the social participation good in the society $\bar{z}_t$;

$$\bar{z}_t = \int_0^{\tilde{y}} z_t^{i,np} \, \mathrm{d}G(y_t^i) + \int_{\tilde{y}}^{\bar{\bar{y}}} z_t^{i,p} \, \mathrm{d}Gt(y_t^i).$$

Using the optimal solutions for z^{np} and z^p in (8) and (10),

$$\bar{z}_t = \int_0^{\tilde{y}_t} \frac{y_t^i}{1+\alpha} \mathrm{d}G_t(y_t^i) + \int_{\tilde{y}_t}^{\bar{\bar{y}}} \frac{y_t^i + \theta}{1+\alpha} \mathrm{d}G_t(y_t^i)$$

so that

$$\bar{z}_t = \frac{\bar{y}_t + \theta\left(1 - G_t\left(\tilde{y}_t\right)\right)}{1+\alpha}, \tag{15}$$

where $G_t(\tilde{y}_t)$ is the proportion of the population with an income lower than $\tilde{y}_t$ who do not compete for joining the reference group. When $\theta = 0$, the average consumption of the participation good in the society is independent of the distribution and equal to the share of the economy mean income defined by the preference parameters. When instead $\theta > 0$, agents' concerns for relative consumption drive the over-consumption of the participation good due to the race among agents to gain a relatively better position. Thus, the average consumption $\bar{z}_t$ is higher than the one in the case of no concerns ($\theta = 0$) and becomes dependent on the overall income distribution; in particular, the greater (smaller) is $G_t\left(\tilde{y}_t\right)$ the smaller (greater) is $\bar{z}_t$ because a high (low) proportion of not participating individuals implies, for fixed mean income, a low (high) consumption of the participation good.[14]

Correspondingly, the income threshold $\tilde{y}_t$ associated with the reference point $\bar{z}_t$ is obtained substituting (15) in (11) as

$$\tilde{y}_t = \bar{y}_t - \theta\, G_t(\tilde{y}_t), \tag{16}$$

where the existence and uniqueness of $\tilde{y}_t$ are guaranteed by the properties of the distribution function $G_t(.)$.[15] Likewise the benchmark consumption, also its corresponding income threshold $\tilde{y}_t$ depends on the strength of the economic gains θ and it is a time-dependent function not only of the mean income but also of the overall distribution of incomes.

Proposition 2 *For fixed inequality (σ), increases in the economy mean income generate increases in the income threshold, $\partial\tilde{y}_t/\partial\bar{y}_t > 0$, and in the benchmark consumption level, $\partial\bar{z}_t/\partial\bar{y}_t > 0$. Increases in inequality induced by mean-preserving increasing spreads of the distribution generate decreases in the income threshold, $\partial\tilde{y}_t/\partial\sigma_t < 0$, and in the benchmark consumption level, $\partial\bar{z}_t/\partial\sigma_t < 0$.*

The first part of the Proposition analyzes how the benchmark consumption and its associated income threshold respond to changes in mean income that do not affect the spread of the distribution and such that the resulting distribution first-order stochastically dominates the original one. In particular, the effects of increases in mean income on the average consumption of the participation good and the corresponding income threshold can be split into two intensive and extensive margins channels. For an initially fixed income threshold $\tilde{y}_0$, an increase in the economy mean income from $\bar{y}_0$ to $\bar{y}_1$ such that $G_1(y^i) < G_0(y^i)$ implies that the society as a whole becomes richer; thus, for a given spread of the distribution, also the mass of individuals with an income greater than the threshold $\tilde{y}_0$ increases, $G_1(\tilde{y}_0) < G_0(\tilde{y}_0)$. Both these intensive and extensive margins effects lead to the increase in the average consumption of the participation good because a larger mass of richer individuals enters the race to join the reference group by spending an increasing share of the budget for the social participation good. As a consequence, the income threshold increases. This second effect counterbalances

[14]These static (short-run) comparative statics do not take into account the effects of θ on the average consumption through its effect on the mean income. Nonetheless, conclusions and results will not change when also this effect is brought into the analysis in the Section 4 dealing with the dynamics and long-run equilibrium of the economy.

[15]For continuous distributions, the existence and uniqueness of $\tilde{y}_t$ derive from the continuity of the right-hand side of (16), which is also strictly decreasing in $\tilde{y}_t$ due to the properties of the distribution functions.

the former one and leads to a partial reduction in the share of individuals of the reference group; that is $G_1(\tilde{y}_1) > G_1(\tilde{y}_0)$ for $\tilde{y}_1 > \tilde{y}_0$. However, the Proposition highlights that this extensive margin effect is not strong enough to offset the intensive margin one associated with the increased wealth of the individuals so that the resulting benchmark level of participation good and the income threshold increase when the mean income increases. Yet, the overall effect on the share of individuals with an income lower than $\tilde{y}_t$ that remain excluded from the reference group is ambiguous and it generally depends on the specific functional form of the distribution function. To see this, notice that

$$\frac{\partial G_t(\tilde{y}_t)}{\partial \bar{y}_t} = g_t(\tilde{y}_t)\frac{\partial \tilde{y}_t}{\partial \bar{y}_t} + G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t, \sigma_t), \tag{17}$$

where the first term on the right-hand side is always positive by definition of density function $g_t(\tilde{y}_t)$ and the second term, representing the partial derivative of the distribution function with respect to the mean income for fixed income threshold $\tilde{y}_t$, is negative by definition of first-order stochastically dominance. Then, the overall effect will depend on the relative magnitude of the two forces. Nonetheless, it is still possible to get a more precise clue on the overall effect by considering that the second term can be rewritten in a general form as

$$G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t, \sigma_t) = g(\tilde{y}_t)f(\bar{y}_t, \sigma_t) \tag{18}$$

where, for well-behaved and symmetric distributions, the term $f(\bar{y}_t, \sigma_t)$ is negative and decreasing in the spread σ_t.[16] Hence, the greater is the inequality σ_t the more likely it is that an increase in the mean income generates also an increase in the share of individuals excluded from the reference group $G_t(\tilde{y}_t)$; that is, the greater is the initial inequality the more likely it is that inequality persists and increases if the mean income increases.[17]

The second part of the Proposition presents more directly the effects of inequality induced by mean-preserving changes in the spread of the distribution. In particular, it show that both the reference point $\bar{z}_t$ and the income threshold $\tilde{y}_t$ decrease when the spread of the distribution increases so that the original distribution second-order stochastically dominates the resulting one. The intuition relies again on two mechanisms. First, greater inequality lessens the competition for status by mitigating the incentives of the individuals to differentiate themselves and increases the mass of the people outside the reference group. Formally, for an initially fixed income threshold $\tilde{y}_0$, mean-preserving increases in the spread of the distribution, generated by changes in the standard deviation from σ_0 to σ_1 such that $\int_0^y G_0(s)\,\mathrm{d}s \le \int_0^y G_1(s)\,\mathrm{d}s$, imply that $G_1(\tilde{y}_0) > G_0(\tilde{y}_0)$.[18] As a consequence, the average consumption of participation goods shrinks causing also the reduction of the income threshold $\tilde{y}_t$. This effect tends to compensate for the former one reducing again the share of individuals outside the reference group; that is, $G_1(\tilde{y}_1) < G_1(\tilde{y}_0)$. However, this is a second-order effect that only partially counterbalances the first one. Then, when inequality increases both the average consumption of the participation good and the income threshold $\tilde{y}_t$ decrease while the share of individuals excluded from the reference group

[16] The term $f(\bar{y}_t, \sigma_t)$ captures the partial derivative with respect to the mean income of the standardized random variable associated with y when the distribution is shaped by two parameters governing its location and scale.

[17] Using the explicit solution for $\partial\tilde{y}_t/\partial\bar{y}_t$ from Equation (33) in Appendix, $\partial G_t(\tilde{y}_t)/\partial\bar{y}_t > 0$ if $f(\bar{y}_t, \sigma_t) < 1$.

[18] Throughout I present results based on symmetric and unimodal distributions for which a mean-preserving spread implies that the original and resulting distributions (CDF) cross at the mean income (i.e., $\bar{y}_t$). It is possible to extend the arguments also to skewed distributions (Barnett et al., 2010).

$G_t(\tilde{y}_t)$ overall increases, $G_1(\tilde{y}_1) > G_0(\tilde{y}_0)$. The reason is that since $\tilde{y}_t < \bar{y}_t$ (Equation 16), increases in inequality impact relatively more on the poorest segment of the distribution that is more sensitive to the pressure for status and to abandon the competition for joining the reference group due to the more binding budget constraint. To see this, notice that

$$\frac{\partial G_t(\tilde{y}_t)}{\partial \sigma_t} = g_t(\tilde{y}_t)\frac{\partial \tilde{y}_t}{\partial \sigma_t} + G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) > 0, \tag{19}$$

where the first term on the right-hand side captures the second-order and negative effect, and the second term, representing the partial derivative of the distribution function with respect to the standard deviation for fixed $\tilde{y}_t$, is positive and greater than the first one in absolute value.[19]

4 | DYNAMICS AND LONG-RUN EQUILIBRIUM

The evolution of incomes of each dynasty is determined by the accumulation of the human capital of the children that depends on the trade-off faced by the parents between education and social participation. This trade-off changes over time as a function of the cost of staying with the reference group and keeping up with the benchmark $\bar{z}_t$. Thus, the dynamical systems that govern the transition of incomes also qualitatively change over time as a function of the threshold $\tilde{y}_t$ and hence of the mean and overall distribution of incomes. At each time t, agents make their optimal choice given their income y_t^i and taking as given the benchmark $\bar{z}_t$ and hence the income threshold $\tilde{y}_t$; thereafter, the optimal choices of all the agents determine the average consumption of the participation good and the income threshold of the next period, and so on. Due to the timing of this process, the state variable $\tilde{y}_t$ can be treated, in each period, as temporarily exogenous. This simplifies the study of the income dynamics allowing the analysis of different configurations of conditional dynamical systems, each of them defined for a given threshold $\tilde{y}_t$ and hence for a given distribution of incomes (Galor & Weil, 2000). Then, it is shown that in the long run it exists a limit distribution for which the unique equilibrium configuration is characterized by the multiplicity of stable steady states of income.

In particular, two main economic regimes can be distinguished throughout depending on whether the income threshold $\tilde{y}_t$ at which agents choose to enter the race for joining the reference group is higher or lower than the threshold $\tilde{\tilde{y}}$ dictating the corner solution for education. Evaluating Equation (16) at $\tilde{\tilde{y}} = \theta/\alpha$, it is possible to define the threshold y_t^R

$$y_t^R = \frac{\theta}{\alpha} + \theta\, G_t\left(\frac{\theta}{\alpha}\right) \tag{20}$$

such that

$$\tilde{y}_t \begin{cases} \le \tilde{\tilde{y}} & \text{if} \quad \bar{y}_t \le y_t^R \\ > \tilde{\tilde{y}} & \text{if} \quad \bar{y}_t > y_t^R. \end{cases} \tag{21}$$

When the mean income is low or inequality is high enough such that $\bar{y}_t \le y_t^R$ implies that $\tilde{y}_t \le \tilde{\tilde{y}}$, low-middle income agents are forced to completely drop investments in education in order to join the

[19] This result can be formally derived using the explicit solution for $\partial\tilde{y}_t/\partial\sigma_t$ from Equation (35) in Appendix.

reference group. Moreover, for given mean income, the condition $\bar{y}_t \leq y_t^R$ is more likely to hold when the gains from participation θ and the inequality measured at the threshold θ/α are large enough. Recalling from Proposition 2 that the higher the inequality the lower the costs of participation ($\bar{z}_t$ and $\tilde{y}_t$), this effect supports the idea that when the concerns for joining the reference group are strong and the costs of joining the reference group are low, it is more likely that also agents with low levels of income choose to consume the participation good at the benchmark even at the cost of forgoing investments in education. Correspondingly, when the mean income is high enough or inequality and the gains from participation are low enough such that $\bar{y}_t > y_t^R$ implies that $\tilde{y}_t > \tilde{\tilde{y}}$, agents have both less pressure to join the reference group and large resources so that it is less likely that the consumption of the participation good at the benchmark requires the drop in educational investments.

Using (13) and (14) in the human capital function in (3), for each regime, the evolution of income within a dynasty is determined by the dynamical systems

$$y_{t+1}^i = \phi(y_t^i) = \begin{cases} \delta\,(y_t^i)^\beta \equiv \phi_L(y_t^i) & \text{if } y_t^i < \tilde{y}_t \\ \theta^\beta \equiv \phi_M(y_t^i) & \text{if } y_t^i \in \left[\tilde{y}_t, \tilde{\tilde{y}}\right] \quad \text{and } \bar{y}_t \leq y_t^R \\ \delta\,(y_t^i + \theta)^\beta \equiv \phi_H(y_t^i) & \text{if } y_t^i > \tilde{\tilde{y}} \end{cases} \tag{22}$$

and

$$y_{t+1}^i = \phi(y_t^i) = \begin{cases} \delta\,(y_t^i)^\beta \equiv \phi_L(y_t^i) & \text{if } y_t^i < \tilde{y}_t \\ \delta(y_t^i + \theta)^\beta \equiv \phi_H(y_t^i) & \text{if } y_t^i \geq \tilde{y}_t \end{cases} \quad \text{and } \bar{y}_t > y_t^R \tag{23}$$

with $\delta \equiv (\alpha/(1+\alpha))^\beta$.

The only difference between the two dynamical systems (22) and (23) is that when $\bar{y}_t > y_t^R$, $\tilde{y}_t > \tilde{\tilde{y}}$ holds and no one forgoes investments in education to join the reference group. Thus, the unique threshold that governs the choices of the agents is $\tilde{y}_t$ and the transition equation does not feature the correspondence $\phi_M(y_t^i)$.

Lemma 1 *The dynamical systems governing the evolution of individuals' incomes are characterized by the following properties:*

1. $\phi_L(0) = 0,\ \phi_M(0) = \theta^\beta,\ \phi_H(0) = \delta\,\theta^\beta > 0;$
2. $\phi_j'(y_t^i) > 0, \phi_j''(y_t^i) < 0$, with $j = L, H;$
3. $\lim_{y_t^i \to 0} \phi_L'(y_t^i) = \infty,\ \lim_{y_t^i \to 0} \phi_H'(y_t^i) > 0;$
4. $\phi_M(\tilde{y}_t) > \phi_L(\tilde{y}_t), \phi_M(\tilde{\tilde{y}}) = \phi_H(\tilde{\tilde{y}}).$

Lemma 1 presents the overall features of the dynamical systems in (22) and (23) governing the evolution of incomes. Most of the features are fairly standard except for the discontinuity generated by the premium θ. The transition function $\phi(y_t^i)$ is, indeed, locally increasing and concave but it presents a positive jump at $\tilde{y}_t$ that is associated with the one in the utility function (Figure 1) and that introduces a non-convexity in the overall human capital function and hence in the income transition equation. The magnitude of the jump, and hence of the discontinuity, depends on θ that governs also the dynamics and long-run equilibrium level of the threshold $\tilde{y}_t$. When $\bar{y}_t \leq y_t^R$, the transition equation does not present, instead, any discontinuity at the threshold $\tilde{\tilde{y}}$ which is constant over time but it still depends on θ.

Thus, the strength of the concerns for relative position θ influences the development path and long-run equilibrium of the economy by affecting the stability and relative magnitude of the thresholds

y_t^R, $\tilde{y}_t$ and $\tilde{\tilde{y}}$. First, θ affects the long-run equilibrium through its effect on the threshold $\tilde{\tilde{y}}$. Using $\tilde{\tilde{y}} = \theta/\alpha$ and $\phi_M(y_t^i) = \theta^\beta$, it is immediate to check that for any $\theta \lesseqgtr \alpha^{1/1-\beta} \equiv \overline{\theta}$, $\phi_M(\tilde{\tilde{y}}) \gtreqless \tilde{\tilde{y}}$. This implies that for $\theta \geq \overline{\theta}$, it can exist a long-run equilibrium characterized by at least one stable steady state $\phi_M(y_M^*) = y_M^* = \theta^\beta$ at which no one invests in education, neither the richest part of the population. To avoid this trivial case, throughout I focus on the case $\theta < \overline{\theta}$ for which there is a meaningful trade-off between investments in education and participation goods.

Likewise, θ governs the evolution of incomes and the long-run equilibrium through its effect on the stability and long-run level of the threshold $\tilde{y}_t$. Using (16) and (22), for each t

$$\tilde{y}_t \begin{cases} < \phi_L(\tilde{y}_t) & \text{if} \quad \overline{y}_t < y_t^L \\ \geq \phi_L(\tilde{y}_t) & \text{if} \quad \overline{y}_t \geq y_t^L, \end{cases} \tag{24}$$

where y_t^L is the threshold mean income defined by $\tilde{y}_t(\overline{y}_t) = \phi_L(\tilde{y}_t(\overline{y}_t))$ and given by the implicit solution to

$$\overline{y}_t = y_L^* + \theta\, G_t\,(y_L^*; \overline{y}_t), \tag{25}$$

with $y_L^* = \delta^{1/1-\beta}$ the steady state defined by $y_L^* = \phi_L(y_L^*)$. Next, from (20) and (25) it follows that $y_t^L \lesseqgtr y_t^R$ for any $\theta \gtreqless \alpha^{1/1-\beta}/(1+\alpha)^{\beta/1-\beta} \equiv \underline{\theta}$. Thus, when $\theta < \underline{\theta}$, $y_t^L > y_t^R$ and the unique admissible configuration of the individual dynamics for economies with $\overline{y}_t \leqslant y_t^R$ (i.e., $\tilde{y}_t \leqslant \tilde{\tilde{y}}$) must satisfy $\tilde{y}_t < \phi_L(\tilde{y}_t)$ for each t. This means, in turn, that for all the agents including the marginal ones at the indifference between choosing to participate or not in the reference group, the economic gains from participation are small enough to have only very small leverage on the status concerns and hence on the accumulation of the human capital of their children. Otherwise, when θ is greater than $\underline{\theta}$, the potential economic gains from participation are high enough that status concerns can influence the transitional dynamics of incomes even in economies for which $\overline{y}_t \leq y_t^R$. In this case, the choice of the marginal agents to keep up or not with the consumption behaviors of the reference group may have large long-run effects on the human capital accumulation and hence on the evolution of incomes of the dynasty depending on whether the initial mean $\overline{y}_t$ is either lower or greater than y_t^L.

To avoid the presentations of trivial and uninteresting cases, I focus on the most relevant configuration of intermediate values of the parameter θ.

Assumption $\theta \in (\underline{\theta}, \overline{\theta})$.

This assumption, then, rules out the cases in which θ is too large that no one has the incentive to invest in education, not even the richest part of the population, or θ is too small that the economic gains from participation would only poorly influence the status concerns and hence the choices of the agents and the human capital accumulation of their children.

Accordingly, when $\overline{y}_t \leq y_t^R$ so that $\tilde{y}_t \leq \tilde{\tilde{y}}$ holds, the economy development path can be characterized by two qualitatively different configurations of the dynamics of the individuals' incomes depending on the initial mean income. The first one representing an early stage of the economy development path arises for a range of small mean incomes $\overline{y}_t < y_t^L$ inducing low-income thresholds $\tilde{y}_t^l$ for which $\phi_L(\tilde{y}_t^l) > \tilde{y}_t^l$ is verified. In this case depicted in Figure 3, the dynamical system is characterized by a unique steady-state level of income $y_H^* = \phi_H(y_H^*)$ that, however, is only temporary and cannot be a long-run sustainable equilibrium.

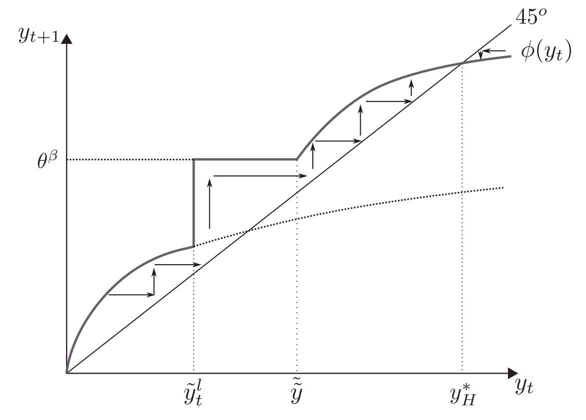
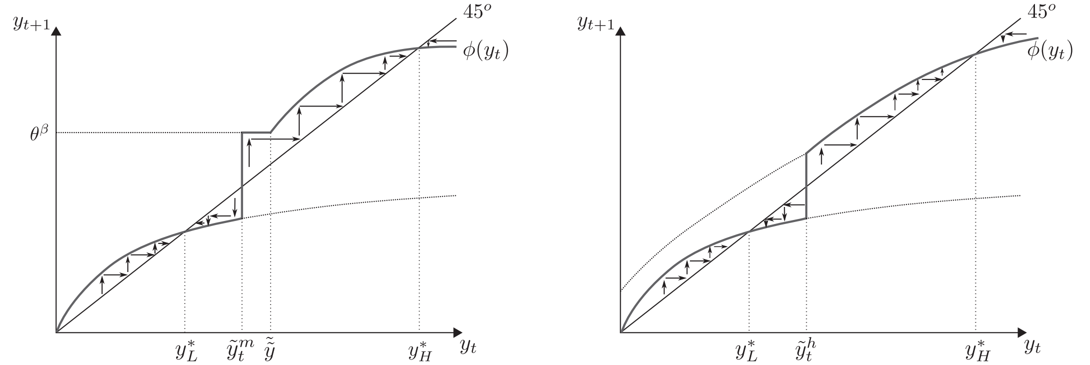


FIGURE 3 Temporary equilibrium ($\bar{y}_t < y^L_t < y^R_t$)



(a) First regime ($\theta > \hat{\theta}$): $\bar{y}^* < y^R \Leftrightarrow \tilde{y}^* \leq \tilde{\tilde{y}}$

(b) Second regime ($\theta < \hat{\theta}$): $\bar{y}^* > y^R \Leftrightarrow \tilde{y}^* > \tilde{\tilde{y}}$

FIGURE 4 Dynamics and long-run equilibrium

Lemma 2 *The long-run equilibrium cannot admit a unique stable steady-state* $y^*_H = \phi_H(y^*_H)$.

The stability and long-run equilibrium properties of the steady-state y^*_H hinge, indeed, on two sets of properties. On a side, they depend on the properties of the individual dynamics presented in Lemma 1. On the other side, they also require the stability of the income threshold $\tilde{y}^l_t$. Lemma 1 guarantees that for any $\bar{y}_t < y^L_t$, all the dynasties converge toward the unique steady-state y^*_H regardless of their initial level of income y^i_t. However, throughout this convergence, the increase in mean income and the reduction in inequality cause the increase in the threshold $\tilde{y}_t$ (Proposition 2). Lemma 2 implies, then, that this process must continue until the economy mean income becomes greater than y^L_t and correspondingly the threshold $\tilde{y}_t$ increases until the condition $\phi_L(\tilde{y}_t) \leq \tilde{y}_t$ eventually determines the onset of the qualitatively different configuration of the individual dynamics depicted in Figure 4. This stage of the economy is described by a dynamical system characterized by two stable steady states of income $y^*_L = \phi_L(y^*_L)$ and $y^*_H = \phi_H(y^*_H)$ that shape the long-run equilibrium of the economy in which the population is divided into two groups. Individuals with an income y^i_t lower than $\tilde{y}_t$ choose to not enter in the race to belong to the reference group and consume an amount of the participation good smaller than the benchmark $\bar{z}_t$, do not benefit of the extra premium in human capital accumulation of their children and then converge to the lower income steady-state y^*_L. Otherwise for those dynasties with an income y^i_t greater than $\tilde{y}_t$ who exploit the economic gains induced by the reference group consuming the participation good at the benchmark and then, in the long run, converge to the upper steady-state y^*_H.

Proposition 3 *The long-run equilibrium is characterized by a limit distribution of incomes supporting two stable steady states* $y_L^* = \phi_L(y_L^*)$ *and* $y_H^* = \phi_H(y_H^*)$ *such that for each dynasty* i

$$\lim_{t\to\infty} y_t^i = \begin{cases} y_L^* & \text{if} \quad y_t^i < \tilde{y}^* \\ y_H^* & \text{if} \quad y_t^i \geq \tilde{y}^* \end{cases}$$

where $\lim_{t\to\infty} \tilde{y}_t = \tilde{y}^*$ is the stable equilibrium value of $\tilde{y}_t$ at which $\phi_L(\tilde{y}^*) \leq \tilde{y}^*$ holds for each t.

Jointly, Lemma 2 and Proposition 3 present the long-run results of the paper. When the initial mean income is low or inequality is high as in the early stages of the development process such that $\bar{y}_0 < y_0^L$, the costs of social inclusion ($\bar{z}_t$ and $\tilde{y}_t$) and the pressure of the agents to differentiate themselves are small. Thus, the concerns for status have small leverage on the accumulation of human capital of the children, and the individual dynamics are temporarily characterized by a unique steady-state y_H^* toward which each dynasty converges (Figure 3). Throughout this transition, continuous increases in mean income and reductions in inequality sustain the increases in the consumption standard $\bar{z}_t$ and the corresponding income threshold $\tilde{y}_t$ until a qualitatively different configuration of the individual dynamics drives the onset of the development trap stage characterized by the two stable steady states y_L^* and y_H^* (Figure 4). At this stage, when $\bar{y}_t > y_t^L$ is eventually verified, the economy becomes segmented into two heterogeneous groups; the share $1 - G(\tilde{y}^*)$ of the population with an income $y_t^i \geq \tilde{y}^*$ joins the reference group and benefits of the human capital accumulation premium while the share $G(\tilde{y}^*)$ for which participation in the reference group becomes too costly does not.

While the long-run equilibrium is not qualitatively affected by θ, its final characterization still depends on θ as this parameter governs the thresholds $\tilde{y}_t$, $\tilde{\tilde{y}}$, y_t^R, y_t^L, and the mean income $\bar{y}_t$ that at the equilibrium steady states y_L^* and y_H^* is given by the implicit solution to

$$\bar{y}^* = y_L^* \, G(\tilde{y}^*) + y_H^* \, (1 - G(\tilde{y}^*)), \tag{26}$$

where $\tilde{y}^*$ is the long-run equilibrium threshold given by the implicit solution of Equation (16)

$$\tilde{y}^* = \bar{y}^* - \theta \, G(\tilde{y}^*). \tag{27}$$

Corollary 1 *It exists a* $\hat{\theta} \in (\underline{\theta}, \bar{\theta})$ *such that the the long-run equilibrium mean income converges to* $\bar{y}^* < y^R$ *so that* $\tilde{y}^* < \tilde{\tilde{y}}$ *holds if* $\theta > \hat{\theta}$*, and to* $\bar{y}^* > y^R$ *so that* $\tilde{y}^* > \tilde{\tilde{y}}$ *holds if otherwise* $\theta < \hat{\theta}$*.*

Corollary 1, finally, qualifies the long-run equilibrium according to different values of θ. If θ is great enough, $\theta > \hat{\theta}$, the long-run equilibrium is characterized by a mean income $\bar{y}^*$ lower than the threshold y^R so that the income threshold $\tilde{y}^*$ is stable at a value $\tilde{y}^m < \tilde{\tilde{y}}$ (Figure 4a). Otherwise, if $\theta < \hat{\theta}$, the configuration of the individual dynamics of the first regime for which $\bar{y}_t < y_t^R$ and $\tilde{y}_t^m < \tilde{\tilde{y}}$ hold is only temporary because the economy eventually reaches a long-run equilibrium in the second regime characterized by a mean income $\bar{y}^* > y^R$ for which the income threshold $\tilde{y}^*$ is stable at a level $\tilde{y}^h$ greater than the threshold $\tilde{\tilde{y}}$ (Figure 4b).

The intuition for this result relies on the effects of θ on the thresholds and the aggregate mean income. From Equation (20) and the definition of $\tilde{\tilde{y}} = \theta/\alpha$, it derives that $\tilde{\tilde{y}}$ and hence y^R increase in θ; the greater the economic gains induced by the participation the stronger the substitution role of the social status in the human capital accumulation so that the range of income for which individuals forgo investments in education to join the reference group enlarges. Furthermore, by implicitly differentiating (26), (27) and $y_H^* = \phi_H(y_H^*)$ with respect to θ, it results that increases in θ generate increases in the aggregate mean income by making the richer richer;

$$\frac{\partial \bar{y}^*}{\partial \theta} > 0 \quad \text{with} \quad \frac{\partial y_H^*}{\partial \theta} > 0 \text{ and } \frac{\partial y_L^*}{\partial \theta} = 0. \tag{28}$$

As a consequence, also the benchmark consumption of the participation good $\bar{z}^*$ rises (Equation 15);

$$\frac{\partial \bar{z}^*}{\partial \theta} > 0. \tag{29}$$

The increase in $\bar{z}^*$ only partially translates into a corresponding increase in the income threshold $\tilde{y}^*$. As it follows from (27) or more clearly from its exogenous formulation in (11), on a side large values of θ raise the income threshold $\tilde{y}^*$ at which it is possible to join the reference group by increasing the costs of participation $\kappa = \bar{z}^*$. On the other side, however, the strong economic gains associated to large values of θ strengthen the pressure of the individuals to join the reference group so that the level of income $\tilde{y}^*$ at which agents choose to enter the race for social status decreases. While the overall effect of θ on $\tilde{y}^*$ is ambiguous, Corollary 1 makes explicit that the difference $\tilde{y}^* - \tilde{\tilde{y}}$ is, instead, decreasing in θ. Hence, when θ is greater than the threshold $\hat{\theta}$, the unique aggregate mean income sustainable in the long-run equilibrium must be such that the threshold $\tilde{y}^*$ is lower than the threshold $\tilde{\tilde{y}}$ (i.e., $\tilde{y}^m$ in Figure 4a). At this equilibrium, although in each period a share of the adult generation with an income $y_t^i \in [\tilde{y}^*, \tilde{\tilde{y}}]$ chooses to completely drop investment in education to join the reference group, all the dynasties with an income $y_t^i \geq \tilde{y}^*$ converge to the steady-state y_H^* while those with $y_t^i < \tilde{y}^*$ to the lower steady-state y_L^* so that inequality persists over time. Otherwise, if θ is lower than the threshold $\hat{\theta}$, the unique aggregate mean income compatible with the long-run equilibrium is the one that induces a threshold $\tilde{y}^*$ greater than $\tilde{\tilde{y}}$ (i.e., $\tilde{y}^h$ in Figure 4b). In this case, if an economy transits the stage of the first regime at which $\bar{y}_t < y_t^R$ and $\tilde{y}_t < \tilde{\tilde{y}}$ hold, its development path requires further increases in mean incomes so that in equilibrium $\bar{y}^*$ is greater than y_t^R and $\tilde{y}^*$ the unique threshold that governs the long-run individual dynamics. Yet, the long-run equilibrium is qualitatively unchanged with two stable steady states that dictate the persistence of inequality over time. Indeed, once reached a stage for which $\tilde{y}^* > \tilde{\tilde{y}}$ and $\phi_L(\tilde{y}^*) < \tilde{y}^* < \phi_H(\tilde{y}^*)$ hold, the mean income and the threshold $\tilde{y}^*$ cannot longer increase over time without bounds.

Lemma 3 *The long-run equilibrium cannot admit a unique stable steady-state* $y_L^* = \phi_L(y_L^*)$.

The intuition behind Lemma 3 is that for a long-run equilibrium to be characterized by a unique basin of attraction $y_L^* = \phi_L(y_L^*) = \delta^{1/1-\beta}$, it should be the case that there exists a $\tilde{y}^*$ such that $\phi_L(\tilde{y}^*) < \phi_H(\tilde{y}^*) < \tilde{y}^*$ is verified throughout the process of convergence (i.e., $\tilde{y}^r$ in Figure 5). But, at the equilibrium, $\bar{y}^* = y_L^* < \tilde{y}^r$ should hold leading to a contradiction and violating the existence properties of $\tilde{y}^*$. Lemma 3, instead, guarantees that if, at some time t, the mean income is high enough to induce a threshold $\tilde{y}^r$ at which the condition $\phi_L(\tilde{y}^*) < \phi_H(\tilde{y}^*) < \tilde{y}^*$ temporarily holds, there exists a long-run path through which the mean income and the threshold $\tilde{y}^*$ decrease until the development trap equilibrium is restored (Figure 4b).

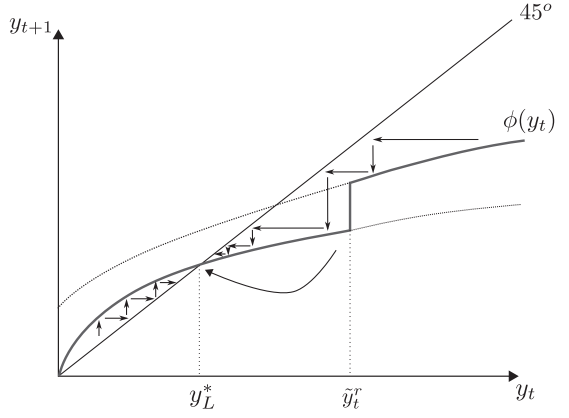


FIGURE 5 Temporary equilibrium ($\bar{y}_t > y_t^R$)

5 | CONCLUDING REMARKS

This paper investigates the dynamics and long-run equilibrium implications of concerns for status when heterogeneous agents care about their relative consumption with respect to the benchmark consumption of individuals in their reference group. In the model, agents endogenously choose whether to enter the rat race to consume an endogenous benchmark level of social participation, status, good to gain access to socially advantaged and privileged groups because relative consumption determines agents' relative position in society which is ultimately instrumental in the accumulation of wealth and absolute consumption. I embed this idea in a simple overlapping generation set-up where parents' consumption of the social participation good over the reference standard generates an utility premium because the consumption equal or greater than that of the reference group confers them the high social status to ensure their children an extra human capital benefit that translates, in turn, into an extra utility. As a consequence, the richest parts of the population strive to separate themselves from the poorest ones to maintain their position on the distribution and to continue to reap the economic benefits of the greater human capital accumulation and income of the children.

I, then, introduce these features into a dynamical analysis that traces the transition of the individual incomes within each generation. The results indicate that the long-run equilibrium is characterized by multiple stable steady states and it is neither an instantaneous event nor it depends on some specific parameter configuration. It is, instead, a by-product of the long-run evolution of the economy as the dynamical systems qualitatively change as a function of the costs of joining the reference group and, hence, of the mean and overall distribution of incomes. So, when the mean income is low, as in the initial phases of a development process, also the costs of social participation are low and the dynamical system is temporarily characterized by a unique stable steady state which is the unique basin of attraction for all the dynasties. Throughout the convergence toward the steady state, increases in mean incomes and reductions in inequality foster the competition for status, determine the rise in the average consumption of the social participation good and drive the onset of the stage characterized by the development traps equilibrium in which all the dynasties are perfectly segmented into two groups; the richest who join the reference group keep reaping the economic benefits of the elite position in society while the poorest excluded from the reference group become trapped in a low-income stable equilibrium.

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APPENDIX A

PROOFS FOR MAIN TEXT

Proposition 1

Using (8), it must be verified that for $\tilde{y} \leq \tilde{\tilde{y}}$ with $\tilde{y} < \hat{y}$, for any $y \in [\tilde{y}, \tilde{\tilde{y}}]$

$$v^p(y) = u(\kappa, 0;\theta) = \ln\kappa + \alpha\ln\theta > \alpha\ln\alpha - (1+\alpha)\ln(1+\alpha) + (1+\alpha)\ln y = u(z_t^{i,np}, e_t^{i,np};0) = v^{np}(y) \tag{A1}$$

or, equivalently, that

$$\hat{v}^p(y) \equiv \kappa\,\theta^\alpha > \frac{\alpha^\alpha\, y^{(1+\alpha)}}{(1+\alpha)^{(1+\alpha)}} \equiv \hat{v}^{np}(y). \tag{A2}$$

Since the left-hand side is independent of y and the right-hand side is increasing in y with $\widehat{v}^{p}(0) > \widehat{v}^{np}(0)$, it suffices to show that the condition in (A2) is still verified for $y = \widehat{y} = \kappa(1+\alpha)$, which implies that

$$\kappa\, \theta^{\alpha} > \alpha^{\alpha}\, \kappa^{(1+\alpha)} \Rightarrow \frac{\theta}{\alpha} > \kappa \tag{A3}$$

where the condition in (A3) is always verified since $\tilde{y} \leq \tilde{\tilde{y}}$ implies $\kappa \leq \theta/\alpha$.

Proposition 2

Effects of changes in mean income on $\tilde{y}_t$ and $\bar{z}_t$

1. Differentiating (16) with respect to the mean income it results that

$$\frac{\partial \tilde{y}_t}{\partial \bar{y}_t} = 1 - \theta \left[g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\frac{\partial \tilde{y}_t}{\partial \bar{y}_t} + G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) \right],$$

which, after simplifying, yields

$$\frac{\partial \tilde{y}_t}{\partial \bar{y}_t} = \frac{1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)} > 0 \tag{A4}$$

since $G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)$, the partial derivative of the distribution function with respect to the mean income for fixed income threshold $\tilde{y}$, is negative by definition of first-order stochastically dominance.

2. Differentiating (15) with respect to the mean income it results that

$$\frac{\partial \bar{z}_t}{\partial \bar{y}_t} = \frac{1}{1+\alpha}\left[1-\theta\left(g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\frac{\partial \tilde{y}_t}{\partial \bar{y}_t} + G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)\right)\right]. \tag{A5}$$

Substituting (A4) in (A5) it results that

$$\frac{\partial \bar{z}_t}{\partial \bar{y}_t} = \frac{1}{1+\alpha}\left[1-\theta\left(g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\left(\frac{1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}\right) + G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)\right)\right] > 0,$$

since

$$1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) - \theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\left(\frac{1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}\right) > 0 \Rightarrow$$

$$\Rightarrow 1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) > \theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\left(\frac{1-\theta\, G_{\bar{y}_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}\right),$$

which, after simplifying, results verified as

$$1 > \frac{\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}.$$

Effects of changes in inequality on $\tilde{y}_t$ and $\bar{z}_t$, for fixed mean income

1. Differentiating (16) with respect to the standard deviation yields

$$\frac{\partial \tilde{y}_t}{\partial \sigma_t} = -\theta \left[g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\frac{\partial \tilde{y}_t}{\partial \sigma_t} + G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) \right],$$

which, after simplifying, yields

$$\frac{\partial \tilde{y}_t}{\partial \sigma_t} = -\frac{\theta\, G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)} < 0 \qquad \text{(A6)}$$

since $G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)$, the partial derivative of the distribution with respect to the standard deviation for fixed income threshold $\tilde{y}_t$, is positive for any $\tilde{y}_t < \bar{y}_t$.

2. Differentiating (15) with respect to the standard deviation it results that

$$\frac{\partial \bar{z}_t}{\partial \sigma_t} = -\frac{\theta}{1+\alpha} \left[g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\frac{\partial \tilde{y}_t}{\partial \sigma_t} + G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) \right] < 0. \qquad \text{(A7)}$$

Substituting (A6) in (A7) it results that

$$\begin{aligned}\frac{\partial \bar{z}_t}{\partial \sigma_t} &= -\frac{\theta}{1+\alpha}\left[G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t) - g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\left(\frac{\theta\, G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)}\right)\right] \\ &= -\frac{\theta\, G_{\sigma_t}(\tilde{y}_t;\bar{y}_t,\sigma_t)}{(1+\alpha)\left(1+\theta\, g_t(\tilde{y}_t;\bar{y}_t,\sigma_t)\right)} < 0.\end{aligned}$$

Lemma 1

The first three properties are easily verified by simple algebra. The first one of the properties in point (4) implies that $\phi_M(y_t^i) = \theta^\beta > \delta \tilde{y}^\beta = \phi_L(\tilde{y}) \Rightarrow \tilde{y} < \theta(1+\alpha)/\alpha$. From (16) it follows that $\tilde{y} < \theta(1+\alpha)/\alpha$ if

$$\bar{y}_t < \frac{\theta(1+\alpha)}{\alpha} + \theta\, G_t\left(\frac{\theta(1+\alpha)}{\alpha}\right). \qquad \text{(A8)}$$

The proof follows by noticing that the correspondence $\phi_M(y_t^i)$ exists only for $\bar{y}_t \le y_t^R$. Then also equation (A8) is verified since $G_t(\theta(1+\alpha)/\alpha) > G_t(\theta/\alpha)$ by definition of cumulative distribution function.

Finally, simple algebra returns $\phi_M(\tilde{y}) \equiv \theta^\beta = \left(\frac{\alpha}{1+\alpha}\right)^\beta \left(\frac{\theta}{\alpha}+\theta\right)^\beta \equiv \phi_H(\tilde{y})$.

Lemma 2

The proof derives by contradiction. If $y_H^* = \phi_H(y_H^*)$ is a stable steady state, at the long-run equilibrium the mean income is also equal to y_H^*; then, to be an equilibrium it should also be verified that

$\overline{y}^* = y_H^* < y^R$ holds. But at the equilibrium $\overline{y}^* = y_H^*$, $G(\theta/\alpha)$ is equal to zero leading to the contradiction as this would imply that θ should be greater than $\overline{\theta} = \alpha^{1/(1-\beta)}$.

Proposition 3

The multiple stable steady-state equilibrium is characterized by the equilibrium mean income in (26) and by the stable threshold $\tilde{y}^*$. To be an equilibrium it must be verified that it exists a limit distribution $G_\infty(y)$ such that $\phi_L(\tilde{y}^*) < \tilde{y}^*$ or using the implicit function theorem and Equations (24) and (25) that

$$\overline{y}^* > y_L^* + \theta\, G(y_L^*), \tag{A9}$$

with $y_L^* = \delta^{1/(1-\beta)}$. Then, (A9) and (26) jointly imply that it must verified that

$$y_L^* + \theta\, G(y_L^*) < y_L^*\, G\left(\tilde{y}|_{\overline{y}^*=y^L}\right) + y_H^*\left[1 - G\left(\tilde{y}|_{\overline{y}^*=y^L}\right)\right]. \tag{A10}$$

Since $\tilde{y}|_{\overline{y}^*=y^L} = y_L^*$, then the following must hold

$$y_L^* + \theta\, G(y_L^*) < y_L^*\, G(y_L^*) + y_H^*\left(1 - G(y_L^*)\right) \tag{A11}$$

which implies that

$$y_H^* > y_L^* + \frac{\theta\, G(y_L^*)}{1 - G(y_L^*)} \equiv y_H^\dagger. \tag{A12}$$

As it follows from (22) - (23), the definition and properties of $y_H^* = \delta(y_H^* + \theta)^\beta$ imply that $y_H^* > y_H^\dagger$ if

$$Y_L(y_L^*) \equiv y_L^* + \frac{\theta\, G(y_L^*)}{1 - G(y_L^*)} < y_L^{*\,1-\beta}\left[\theta + y_L^* + \frac{\theta\, G(y_L^*)}{1 - G(y_L^*)}\right]^\beta \equiv Y_R(y_L^*) \tag{A13}$$

for any admissible θ, α and β, where for clarity δ it has been rewritten in function of y_L^* as $\delta = y_L^{*\,1-\beta}$. Then, $Y_L(y_L^*) < Y_R(y_L^*)$ is always verified since $Y_L(0) = Y_R(0) = 0$, $\partial Y_L(y_L^*)/\partial y_L^* > 0$, $\partial^2 Y_L(y_L^*)/\partial y_L^{*\,2} > 0$, $\partial Y_R(y_L^*)/\partial y_L^* > 0$ and $\lim_{y_L^* \to 0} Y_R' - Y_L' \to \infty$.

To complete the proof, notice that when $\overline{y} \leq y^R$ also $\phi_M(\tilde{y}) > \tilde{y} \Rightarrow \overline{y} < \theta^\beta + \theta G(\theta^\beta)$ is verified for any $\theta < \overline{\theta}$.

Corollary 1

It must be verified that it exists a unique $\hat{\theta} \in (\underline{\theta}, \overline{\theta})$ such that for any $\theta > \hat{\theta}$ the equilibrium mean income implicitly defined in (26) is lower than y^R and the associated $\tilde{y}^*$ in (27) is lower than $\tilde{\overline{y}}$, and otherwise for any $\theta < \hat{\theta}$, $\overline{y}^* > y^R$ and $\tilde{y}^* > \tilde{\overline{y}}$ hold. Using implicit function theorem on (20) and (26), it then results that $\overline{y}^* = y^R$ if

$$\mathscr{M}(\theta) \equiv y_L^*\, G\left(\frac{\theta}{\alpha}\right) + y_H^*\left[1 - G\left(\frac{\theta}{\alpha}\right)\right] = \frac{\theta}{\alpha} + \theta\, G\left(\frac{\theta}{\alpha}\right) \equiv \mathscr{R}(\theta), \tag{A14}$$

where $\mathscr{R}(0) = 0 < y_L^* = \mathscr{M}(0)$, $\partial \mathscr{R}(\theta)/\partial \theta > 0$, $\partial^2 \mathscr{R}(\theta)/\partial \theta^2 > 0$, $\partial \mathscr{M}(\theta)/\partial \theta > 0$, $\partial^2 \mathscr{M}(\theta)/\partial \theta^2 < 0$ imply that it exists a unique $\theta \equiv \hat{\theta}$ such that $\mathscr{M}(\hat{\theta}) = \mathscr{R}(\hat{\theta})$ and such that for any $\theta \lesseqgtr \hat{\theta}$, $\mathscr{M}(\hat{\theta}) \gtreqless \mathscr{R}(\hat{\theta}) \Rightarrow \bar{y}^* \gtreqless y^{\mathscr{R}}$ so that $\tilde{y}^* \gtreqless \tilde{\bar{y}}$ also holds.

To show that $\hat{\theta} \in (\underline{\theta}, \bar{\theta})$, then it suffices to check that $\mathscr{M}(\underline{\theta}) > \mathscr{R}(\underline{\theta})$ and $\mathscr{M}(\bar{\theta}) < \mathscr{R}(\bar{\theta})$.

$$\mathscr{M}(\underline{\theta}) = y_L^* \mathscr{G}\left(\frac{\underline{\theta}}{\alpha}\right) + y_H^*|_{\theta=\underline{\theta}} \left[1 - \mathscr{G}\left(\frac{\underline{\theta}}{\alpha}\right)\right] > \frac{\underline{\theta}}{\alpha} + \underline{\theta}\, \mathscr{G}\left(\frac{\underline{\theta}}{\alpha}\right) = \mathscr{R}(\underline{\theta})$$

implies, after using the equivalence $\underline{\theta}/\alpha = y_L^*$, that

$$y_H^*|_{\theta=\underline{\theta}} > y_L^* \left[1 + \frac{\alpha G(y_L^*)}{1 - G(y_L^*)}\right] \equiv \underline{y_H}.$$

As it follows from (22)-(23), the definition and properties of $y_H^* = \delta(y_H^* + \theta)^\beta$ imply that $y_H^* > \underline{y_H}$ if

$$\mathscr{G}_{\mathscr{L}}(y_L^*) \equiv 1 + \frac{\alpha \mathscr{G}(y_L^*)}{1 - \mathscr{G}(y_L^*)} < \left[1 + \frac{\alpha}{1 - \mathscr{G}(y_L^*)}\right]^\beta \equiv \mathscr{G}_{\mathscr{R}}(y_L^*),$$

with $\mathscr{G}_L(0) = 1 < 1 + \alpha = \mathscr{G}_R(0)$, $\partial \mathscr{G}_L(y_L^*)/\partial y_L^* > 0$, $\partial^2 \mathscr{G}_L(y_L^*)/\partial (y_L^*)^2 > 0$, $\partial \mathscr{G}_R(y_L^*)/\partial y_L^* > 0$, $\partial^2 \mathscr{G}_R(y_L^*)/\partial (y_L^*)^2 < 0$. Then, $\mathscr{G}_R(y_L^*) > \mathscr{G}_L(y_L^*) \Rightarrow y_H^* > \underline{y_H} \Rightarrow \mathscr{M}(\underline{\theta}) > \mathscr{R}(\underline{\theta}) \Rightarrow \underline{\theta} < \hat{\theta}$.

Likewise, $\mathscr{M}(\bar{\theta}) < \mathscr{R}(\bar{\theta})$ implies, after rearranging, that

$$y_H^* < \frac{\alpha^{\frac{\beta}{1-\beta}}}{1 - G\left(\alpha^{\frac{\beta}{1-\beta}}\right)} \left[1 + G\left(\alpha^{\frac{\beta}{1-\beta}}\right)\left(\alpha - \frac{1}{(1-\alpha)^{\frac{\beta}{1-\beta}}}\right)\right] \equiv \overline{y_H}.$$

Using again $y_H^* = \delta(y_H^* + \theta)^\beta$ it follows, after simplifying and rearranging, that $y_H^* < \overline{y_H}$ if

$$(1+\alpha)^{\frac{\beta}{1-\beta}} + G\left(\alpha^{\frac{\beta}{1-\beta}}\right)\left(\alpha(1+\alpha)^{\frac{\beta}{1-\beta}} - 1\right) > \left(1 - G\left(\alpha^{\frac{\beta}{1-\beta}}\right)\right)^{1-\beta} \left(\alpha^{\frac{1}{1-\beta}} - G\left(\alpha^{\frac{\beta}{1-\beta}}\right)\right)^\beta.$$

For $\alpha = 0$, the left-hand side is equal to one and greater than the right-hand side equal to zero; furthermore, the left-hand side is increasing and the right-hand side is decreasing in α for some α and β. Then, it finally results that $y_H^* < \overline{y_H} \Rightarrow \mathscr{M}(\bar{\theta}) < \mathscr{R}(\bar{\theta}) \Rightarrow \hat{\theta} < \bar{\theta}$.

Further proofs for the main text

Implicitly differentiating $y_H^* = \delta(y_H^* + \theta)^\beta$ and using the identity $\delta = (y_L^*)^{1-\beta}$ implies that

$$\frac{\partial y_H^*}{\partial \theta} = (y_L^*)^{1-\beta} \beta\, (y_H^* + \theta)^{\beta-1} \left(1 + \frac{\partial y_H^*}{\partial \theta}\right) \Rightarrow \frac{\partial y_H^*}{\partial \theta}\left[1 - \beta\left(\frac{y_L^*}{y_H^* + \theta}\right)^{1-\beta}\right] = \beta\left(\frac{y_L^*}{y_H^* + \theta}\right)^{1-\beta} \Rightarrow$$

$$\frac{\partial y_H^*}{\partial \theta} = \frac{\beta (y_L^*)^{1-\beta}}{(y_H^* + \theta)^{1-\beta} - \beta (y_L^*)^{1-\beta}} > 0 \qquad \text{(A15)}$$

since $y_H^* > y_L^*$.

To show that $\partial \bar{y}^* / \partial \theta > 0$ in (28), let first differentiate Equations (26) and (27). From Equation (26) it results that

$$\frac{\partial \bar{y}^*}{\partial \theta} = \frac{\partial y_H^*}{\partial \theta}(1 - G(\tilde{y}^*)) - \frac{\partial \tilde{y}^*}{\partial \theta} g(\tilde{y}^*)(y_H^* - y_L^*) \tag{A16}$$

and from Equation (27) it results that

$$\frac{\partial \tilde{y}^*}{\partial \theta} = \left(\frac{\partial \bar{y}^*}{\partial \theta} - G(\tilde{y}^*) \right) (1 + \theta g(\%\tilde{y}^*))^{-1} \tag{A17}$$

Using Equation (A17) in (A16) it finally results that

$$\frac{\partial \bar{y}^*}{\partial \theta} = \frac{1 + \theta g(\tilde{y}^*)}{1 + \theta g(\tilde{y}^*) + g(\tilde{y}^*)(y_H^* - y_L^*)} \left[\frac{\partial y_H^*}{\partial \theta}(1 - G(\tilde{y}^*)) + \frac{G(\tilde{y}^*) g(\tilde{y}^*)(y_H^* - y_L^*)}{1 + \theta g(\tilde{y}^*)} \right] > 0. \tag{A18}$$

To show that $\partial \bar{z}^* / \partial \theta > 0$ in (29), let first differentiate Equation (15) to get

$$\frac{\partial \bar{z}^*}{\partial \theta} = \frac{1}{1 + \alpha} \left[\frac{\partial \bar{y}^*}{\partial \theta} + 1 - G(\tilde{y}^*) - \theta g(\tilde{y}^*) \frac{\partial \tilde{y}^*}{\partial \theta} \right] \tag{A19}$$

which, after using (A18) and (A17) and simplifying, implies

$$\frac{\partial \bar{z}^*}{\partial \theta} = 1 - G(\tilde{y}^*) + \frac{\partial y_H^*}{\partial \theta} \frac{(1 - G(\tilde{y}^*))}{(1 + \theta g(\tilde{y}^*) + g(\tilde{y}^*)(y_H^* - y_L^*))} + \frac{\theta g(\tilde{y}^*) G(\tilde{y}^*)}{1 + \theta g(\tilde{y}^*)} + \frac{g(\tilde{y}^*) G(\tilde{y}^*)(y_H^* - y_L^*)}{(1 + \theta g(\tilde{y}^*))(1 + \theta g(\tilde{y}^*) + g(\tilde{y}^*)(y_H^* - y_L^*))} > 0.$$