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Relative consumption and human capital accumulation

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Abstract

This paper shows that the interaction between consumption and production externalities generates multiple equilibria in a simple model in which individuals care of their relative consumption because holding a relatively advantageous position is instrumental to obtain productive benefits.

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1. Introduction

Recent empirical evidence shows that the concerns for one's relative position influence especially the preferences of the individuals with high levels of income, while the utility of the poorest agents does not appear to be affected by one's relative income or consumption (Akay and Martinsson, 2011; Clark et al., 2008; Dynan and Ravina, 2007; Heffetz, 2011; Ravallion and Lokshin, 2010). One possible reason is that the concerns for one's relative position are not hard-wired in the individuals' preferences, but, instead, that they become active because of the productive gains enjoyed by holding a relatively advantageous position in the society (Cole et al., 1992). Further pieces of empirical research corroborate the existence of multiple growth regimes as a source of the persistence of poverty (Fiaschi and Lavezzi, 2003) as well as estimate that the relative poverty rates have recently increased both in the developing and in the OECD countries (Ravallion and Chen, 2011).

This paper matches these two stylized facts in a simple model in which individuals care of their relative level of consumption with respect to the average level in the population because the consumption over the reference standard is instrumental to achieve productive advantages that augment the accumulation of the individuals' human capital, which is taken for the main engine of the process of economic development. This idea is investigated by assuming that the individuals with a level of consumption exceeding the average gain an utility premium that depends on the magnitude of the productive benefits accruing by "beating the reference standard" (Barnett et al., 2010). Hence, although the marginal utility of the consumption is equal for both rich and poor agents, the marginal cost of a reduction in the consumption is higher for individuals close to the reference standard than for very poor agents because the potential utility loss is stronger for the former than for the latter.

The interaction between the consumption and the production externalities[1] induces agents to start a race to consume the good over its average level and influences the dynamics of the individuals' human capital causing the rise of multiple equilibria. At this regard, this paper relates to a large literature on the persistence of poverty (Galor and Zeira, 1993; Moav, 2002) and particularly complements recent studies on the relations between the quest for social status and economic growth (Bilancini and D'Alessandro, 2012; Hopkins and Kornienko, 2006; Kawamoto, 2009; Moav and Neeman, 2010, 2012). The contribution of this short note to this literature is to illustrate a simple model in which the existence of multiple steady states equilibria (i.e., poverty traps) is grounded on the incentives of the individuals to keep up with some reference standard in order to enjoy the productive gains.

The rest of the paper is organized in two sections. Section 2 presents the basic features of the model and highlights the consumption problem; Section 3 analyzes the evolution of the individuals' human capital.

2. The model

Consider an overlapping-generations economy with no population growth, in which activity extends over infinite discrete time.

The production of the final good is assumed to depend linearly on the aggregate stock of human capital[2], $Y_t = H_t$. Thus, the wage rate is equal to one and the agents' income is equal to

[1] Liu and Turnovsky (2005) study how consumption and production externalities affect capital accumulation and economic growth, by assuming that a direct connection between the two externalities does not exist.

[2] Alternatively, physical capital could be introduced through a standard neoclassical production function ($F(K_t, H_t)$) and by assuming a small open economy with perfect capital mobility; in this environment, the rate

the amount of efficiency units of human capital h_t^i supplied on the labor market.

2.1. Individuals

Individuals, within as well as across generations, are identical in their preferences. However, agents within a generation are differentiated by the stock of the human capital of their parents. Individuals live for two periods. In the first period of their life, children obtain education. In the second period, when old, agents inelastically supply their efficiency units of human capital to the labor market, earn an income and choose how to split their budget constraint between consumption and education for their children. The parent-child connection constitutes a dynasty.

At each time t, the preferences of the parents (born at $t-1$) are standard log-linear functions of the second period consumption c_t^i and the children's human capital h_{t+1}^i:

$$u_t^i = \log c_t^i + \alpha \log h_{t+1}^i \tag{1}$$

where $\alpha > 0$ is the degree of altruism of the parents.

The link between the consumption and production externalities is introduced by assuming that the consumption of c_t^i over a threshold $\underline{c}$ generates a positive externality in the production of the children's human capital that is formally given by

$$h_{t+1}^i = \chi\left(c_t^i\right)\left(e_t^i\right)^\beta \tag{2}$$

with

$$\chi\left(c_t^i\right) = \begin{cases} 1 & \text{if } c_t^i \leq \underline{c} \\ \kappa & \text{if } c_t^i > \underline{c} \end{cases} \tag{3}$$

with $\beta \in (0,1)$ and $\kappa > 1$. The human capital of the children (2) depends on the education expenditures of the parents e_t^i. Further, it is augmented by a factor κ as long as the parents consume a sufficiently high amount of the good c_t^i. In particular, the consumption of c_t^i over the threshold $\underline{c}$ brings forth a premium κ that measures the degree of the productive gains accruing by exceeding the benchmark. As a working example, one can think of c_t^i as a social participation good, whose consumption over the benchmark $\underline{c}$ produces also some informational advantage that increases the children's human capital[3].

The reference standard $\underline{c}$ can be interpreted either as a fixed cost of participation or as the benchmark level of some reference group, when endogenized as the average level of consumption (or income) of the individuals. In this latter case, the productive gains (κ) generated by the participation over the benchmark $\underline{c}$ imply a consumption externality that induces the agents to start a race to consume the participation good over its average level. Different from the

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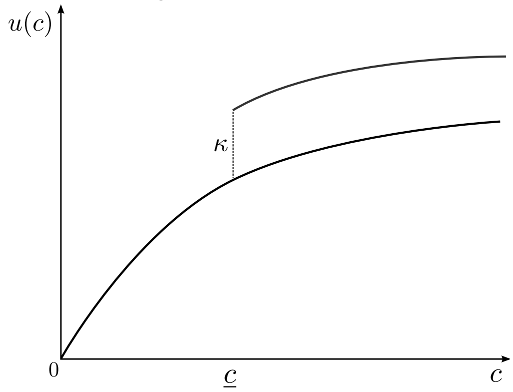
of interest, and hence the dynamics of the physical capital, would be internationally fixed without affecting the results.

[3]For instance, social participation allows the creation of social networks that spread productive benefits that are conducive of absolute gains (Bloch et al., 2004). Banerjee and Duflo (2007) emphasize that also the very poor expend relevant shares of their budget towards goods often identified as positional such as festivals and ceremonies, or more broadly social participation goods. Notably, participation in these social activities does not appear to be driven, or at least not only, by pure pleasure nor by an altruistic behavior, but mostly by productive goals. Rao (2001) document that the poor participate and organize public ceremonies to join social networks that may help them to cope with poverty.

Figure 1: Preference



literature (see for instance Dupor and Liu, 2003)[4], the reference standard does not affect the preference of the individuals directly; as a consequence, also the marginal utility of the consumption of c_t^i does not directly depend on the level of the benchmark. Instead, the reference standard generates a consumption externality because the benefits of consuming more than the benchmark, the premium κ, cause a discrete change in the parents' utility functions by boosting the accumulation of the children's human capital[5].

The degree at which the individuals' utility is affected by the reference standard is not constant along the income distribution as well as it depends on the extent of the advantages (κ) generated by exceeding the benchmark. Although the marginal utility of the consumption of c_t^i is equal for both rich, with $c_t^i > \underline{c}$, and poor agents, with $c_t^i \leq \underline{c}$, the marginal cost of a reduction in the consumption is higher for individuals close to the reference standard $\underline{c}$ than for very poor agents, because the individuals' utility presents a discrete jump at the threshold level $\underline{c}$ that depends on the magnitude of the productive gains κ (Fig. 1). Hence, the greater are the productive benefits of exceeding the reference standard (i.e., the higher the premium κ), the stronger is the consumption externality, which induces the individuals to consume more than the benchmark, since the stronger is the potential utility loss. Conversely, the effects of increases in the reference standard depend on the extent of the potential gains accruing by exceeding it. As long as the productive advantages of consuming more than the benchmark are strong enough, an increase in the reference standard increases the potential utility loss of the marginal agents, those with a level of consumption close to the threshold $\underline{c}$, and hence causes a partial substitution of the educational expenditures in favor of c_t^i.

The rest of the model is fairly simple. Agents choose $c_t^i \geq 0$ and $e_t^i \geq 0$ to maximize utility in (1) subject to (2), (3) and the budget constraint

$$c_t^i + e_t^i \leq h_t^i \tag{4}$$

The solutions are given by the first order conditions

[4] See also Tsoukis (2007) for a review of the different approaches used in the literature to introduce consumption externalities.

[5] Continuing with the example, consider the possibility of going out to have a drink with someone. Increasing the frequency (Duesenberry, 1949) of the meetings induces an improvement in the quality of the relationship, such that at a point in time there is a jump in the satisfaction derived from the relationship; increasing the frequency of the meetings also increases the probability to receive relevantly productive information, due to a network effect. The higher the productivity gain, the stronger the preference effect. This example can highlight, moreover, that neither indivisibilities in the characteristics of the good nor restrictions to the access of its consumption (membership, club goods) are needed to generate the discontinuity in the preferences.

$$c_t^i = \frac{h_t^i}{1+\gamma}, \quad e_t^i = \frac{\gamma h_t^i}{1+\gamma} \tag{5}$$

with $\gamma \equiv \alpha\beta$. Since the marginal utility does not directly depend on the benchmark $\underline{c}$, the solutions to the maximization problem are the standard optimal choices implied by a homothetic utility function. Notwithstanding, the next section illustrates that the non-convexity in the preference generated by the premium κ influences the accumulation of the human capital of the individuals. At this end, it is assumed that the reference standard is equal to the average level of consumption of the good c_t^i over the whole population; formally, $\underline{c} \equiv (1+\gamma)^{-1}\bar{h}_t$, where $\bar{h}_t$ is the average human capital of the population.

3. Dynamics

The evolution of the children' human capital depends on the expenditures in education and the relative stock of human capital of the parents. As follows from eqs. (2)-(3)-(5) and the definition of the reference standard, parents with a level of human capital higher than the average, those with $h_t^i > \bar{h}_t$, consume more than the benchmark $\underline{c}$ and obtain a productive benefit κ, which boosts the accumulation of the children' human capital. Hence, the transition equation of the individuals' human capital can be written as

$$h_{t+1}^i = \begin{cases} \delta\left(h_t^i\right)^\beta & \text{if } h_t^i \leq \bar{h}_t \\ \kappa\delta\left(h_t^i\right)^\beta & \text{if } h_t^i > \bar{h}_t \end{cases} \tag{6}$$

with $\delta = (\gamma/(1+\gamma))^\beta$. The dynamical equation in (6) presents a discrete jump, matching the one in the individuals' indirect utility function, at the average human capital threshold $\bar{h}_t$. This formalization suggests that rich agents, the ones with $h_t^i > \bar{h}_t$, have a comparative advantage with the respect to the poor ones - those with $h_t^i \leq \bar{h}_t$, in the accumulation of human capital due to an informational benefit accruing from the social participation. As the evolution of the individuals' human capital across the generations depends on two state variables, the parents' stock of human capital and its average level across the population, the dynamical system in (6) can be rewritten as

$$\hat{h}_{t+1} = \begin{cases} \dfrac{\delta\hat{h}_t^\beta}{g_t\bar{h}_t^{1-\beta}} \equiv \phi^p(\hat{h}_t) & \text{if } \hat{h}_t \leq 1 \\ \kappa\phi^p(\hat{h}_t) \equiv \phi^r(\hat{h}_t) & \text{if } \hat{h}_t > 1 \end{cases} \tag{7}$$

where $\hat{h}_t$ and g_t are, respectively, the relative human capital of the individual i and the growth rate of its average level defined as

$$\hat{h}_t \equiv \frac{h_t^i}{\bar{h}_t}, \quad g_t \equiv \frac{\bar{h}_{t+1}}{\bar{h}_t} \tag{8}$$

A simple way to analyze the system in (7) is to assume that the population is composed of two types of agents: a relatively poor agent, with a stock of human capital below the average ($h_t^p \leq \bar{h}_t$ or $\hat{h}_t^p \leq 1$), and a relatively rich agent, with a stock of human capital above the average ($h_t^r > \bar{h}_t$ or $\hat{h}_t^r > 1$). Thus, the average human capital across the population is given by:

$$\bar{h}_t = \frac{h_t^p + h_t^r}{2} \tag{9}$$

and

$$\hat{h}_t^r = 2 - \hat{h}_t^p \tag{10}$$

Using eq. (7), the evolution of the human capital of relatively poor dynasties is given by

$$\hat{h}_{t+1}^p = \frac{\delta(\hat{h}_t^p)^\beta}{g_t \bar{h}_t^{1-\beta}} \tag{11}$$

while, from (10), that of the richer ones by

$$2 - \hat{h}_{t+1}^p = \frac{\delta\kappa(2-\hat{h}_t^p)^\beta}{g_t \bar{h}_t^{1-\beta}} \tag{12}$$

Combining (11) and (12), the dynamical system in (7) is, finally, given by

$$\hat{h}_{t+1} = \varphi(\hat{h}_t) = \begin{cases} \dfrac{2\hat{h}_t^\beta}{\hat{h}_t^\beta + \kappa(2-\hat{h}_t)^\beta} \equiv \varphi^p(\hat{h}_t) & \text{if } \hat{h}_t \leq 1 \\ \dfrac{2\kappa\hat{h}_t^\beta}{\kappa\hat{h}_t^\beta + (2-\hat{h}_t)^\beta} \equiv \varphi^r(\hat{h}_t) & \text{if } \hat{h}_t > 1 \end{cases} \tag{13}$$

The evolution of the individuals' human capital, described by the system in (13), is characterized by the existence of two locally stable interior steady states. Depending on the parents' initial endowments, dynasties converge either to a low or high stable steady state level of human capital, as specified in the following Proposition.

Proposition 1. *The economy exhibits multiple equilibria described by two locally stable interior steady state levels of human capital $\hat{h}^* = [\hat{h}_p^*, \hat{h}_r^*]$, with $\hat{h}_p^* = 2/(1+\kappa^{\frac{1}{1-\beta}})$ and $\hat{h}_r^* = 2\kappa^{\frac{1}{1-\beta}}/(1+\kappa^{\frac{1}{1-\beta}})$. Dynasties with an initial endowment of human capital lower (higher) than the average converge to the low (high) steady state $\hat{h}_p^*$ ($\hat{h}_r^*$), characterized by a persistent low (high) level of human capital.*

Proof. It follows from the properties of the system in (13); $\varphi(0) = 0$, $\varphi(2) = 2$, $\varphi^r(\hat{h}_t) > \varphi^p(\hat{h}_t)$, $\partial\varphi(\hat{h}_t)/\partial\hat{h}_t > 0$ and $\exists \tilde{h}_j > \hat{h}_j^*$, with $j = p, r$, such that $\partial^2\varphi^j(\hat{h}_t)/\partial\hat{h}_t^2 \lesseqgtr 0$ for $\hat{h}_t \lesseqgtr \tilde{h}_j$ (see Appendix). □

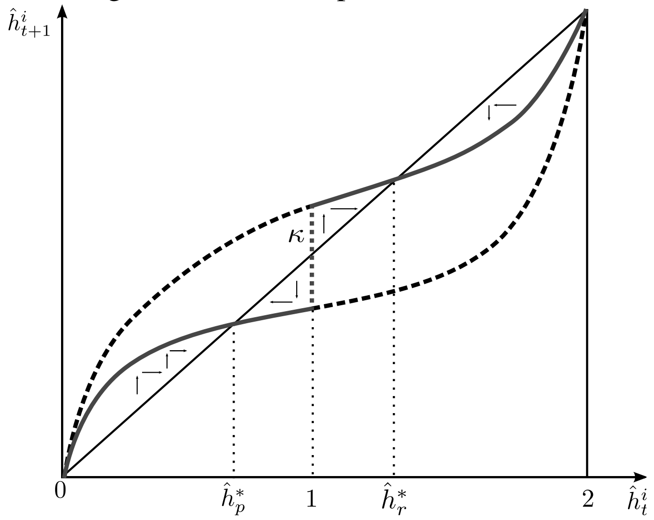
Relatively poor parents, with an initial endowment of human capital lower than the average, cannot sustain both the expenditures in education and the race to gain the further productive benefits brought about by the social participation; hence, the human capital of their children converge in the long-run to the low stable steady state $\hat{h}_p^*$. On the other side, initially relatively richer individuals, on top of the educational expenditures, keep on spending in social participation to retain their relatively advantageous position and to obtain the premium that allows their descendants to accumulate, in the long-run, the high level of human capital $\hat{h}_r^*$ (Fig. 2).

Changes in the productive gains generated by the premium κ cause variations in the relative position and human capital of the agents.

Corollary 1. *Increases in the premium κ increase (decrease) the steady state level of human capital of the relatively richer (poorer) individuals, $\hat{h}_r^*$ ($\hat{h}_p^*$).*

Proof. It derives from Proposition 1 by differentiating $\hat{h}_p^*$ and $\hat{h}_r^*$ with respect to κ. □

Figure 2: Human capital accumulation



Increases in the premium κ have two effects on the distribution of human capital. On a side, increases in κ rise the high stable steady state equilibrium $\hat{h}^*_r$ by augmenting the productivity of the human capital accumulation of the richer dynasties. On the other hand, increases in κ also decrease the low stable steady state $\hat{h}^*_p$ via their effect on the average human capital. As a consequence, increases in the premium bring forth an increase in the relative distance between the two groups (i.e., inequality).

In order to conclude this short paper, it can be remarked that the technological non-convexity alone, introduced via the premium κ in (3), would have not been sufficient to generate multiple equilibria. While most of the literature has coupled this mechanism with, for instance, credit market imperfections (Galor and Zeira, 1993) or preference non-homotheticity (Moav, 2002), the channel that here produces the multiplicity of the steady states hinges on the incentives of the individuals in retaining a relatively preferential position in the society due to the connection between the production and consumption externality.

This last feature can be highlighted by looking at what emerges when either the productive benefits produced by beating the benchmark are omitted (i.e., $\kappa = 1$) or when the reference standard (i.e., $\underline{c}$) does not depend on the interaction among the agents. In the first case, if $\kappa = 1$, all the dynasties, regardless of their initial conditions, converge to the unique steady state level of human capital $h^* = \delta^{1/(1-\beta)}$, which is lower than that the rich dynasties reach in presence of production and consumption externalities. Similarly, but most strikingly, even in presence of productive benefits $\kappa > 1$, if the reference standard is modeled as a fixed cost independent of (some measure of) the distribution of human capital across the population, the lack of credit market imperfections eventually leads all the agents, again, to converge to the unique steady state level of human capital $h^* = (\kappa\delta)^{1/(1-\beta)}$, following the tradition of the standard neoclassical growth models. As a consequence, in both cases the inequality among the individuals disappear since everyone accumulates the same level of human capital (i.e., $\hat{h}^* = 1$).

Appendix

Properties of the dynamical system in equation (13)

$$\left.\frac{\partial \hat{h}_{t+1}}{\partial \hat{h}_t}\right|_{\hat{h}_t \leq 1} = \frac{4\beta\kappa}{\left[\hat{h}_t\left(2-\hat{h}_t\right)\right]^{1-\beta}\left[\hat{h}_t^{\beta}+\kappa\left(2-\hat{h}_t\right)^{\beta}\right]^2} > 0$$

and

$$\left.\frac{\partial \hat{h}_{t+1}}{\partial \hat{h}_t}\right|_{\hat{h}_t > 1} = \frac{4\beta\kappa}{\left[\hat{h}_t\left(2-\hat{h}_t\right)\right]^{1-\beta}\left[\kappa\hat{h}_t^{\beta}+\left(2-\hat{h}_t\right)^{\beta}\right]^2} > 0$$

since $\hat{h}_t < 2$ by definition. Further,

$$\left.\frac{\partial^2 \hat{h}_{t+1}}{\partial \hat{h}_t^2}\right|_{\hat{h}_t \leq 1} = \frac{8\beta\kappa\left[\hat{h}_t^{\beta}\left(\hat{h}_t-\beta-1\right)+\kappa\left(2-\hat{h}_t\right)^{\beta}\left(\hat{h}_t+\beta-1\right)\right]}{\left[\hat{h}_t\left(2-\hat{h}_t\right)\right]^{2-\beta}\left[\hat{h}_t^{\beta}+\kappa\left(2-\hat{h}_t\right)^{\beta}\right]^3} \tag{14}$$

and

$$\left.\frac{\partial^2 \hat{h}_{t+1}}{\partial \hat{h}_t^2}\right|_{\hat{h}_t > 1} = \frac{8\beta\kappa\left[\kappa\hat{h}_t^{\beta}\left(\hat{h}_t-\beta-1\right)+\left(2-\hat{h}_t\right)^{\beta}\left(\hat{h}_t+\beta-1\right)\right]}{\left[\hat{h}_t\left(2-\hat{h}_t\right)\right]^{2-\beta}\left[\kappa\hat{h}_t^{\beta}+\left(2-\hat{h}_t\right)^{\beta}\right]^3} \tag{15}$$

In both cases, simple algebra implies that

$$\frac{\partial^2 \varphi^j(\hat{h}_t)}{\partial \hat{h}_t^2} \lesseqqgtr 0 \quad \text{if} \quad \hat{h}_t \lesseqqgtr \tilde{h}_j$$

with $\tilde{h}_j > \hat{h}_j^*$, for $j = p, r$. In particular, using eq. (14), it results that

$$\frac{\partial^2 \varphi^p(\hat{h}_t)}{\partial \hat{h}_t^2} \lesseqqgtr 0 \quad \text{if} \quad L(\hat{h}_t) \equiv \hat{h}_t^{\beta}\left(\hat{h}_t-\beta-1\right) \lesseqqgtr \kappa\left(2-\hat{h}_t\right)^{\beta}\left(1-\beta-\hat{h}_t\right) \equiv R(\hat{h}_t) \tag{16}$$

where $L(0) = 0, \partial L(\hat{h}_t)/\partial \hat{h}_t > 0$, while $R(0) > 0, \partial R(\hat{h}_t)/\partial \hat{h}_t < 0$. Hence, it exists a unique value of $\hat{h}_t \equiv \tilde{h}_p : L(\tilde{h}_p) = R(\tilde{h}_p)$. Further, substituting $\hat{h}_p^*$ in (16) and after some algebra, it results $L(\hat{h}_p^*) < R(\hat{h}_p^*)$, which implies that $\tilde{h}_p > \hat{h}_p^*$. Similar arguments show that the claim holds also for $\varphi^r(\hat{h}_t)$.

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