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REDISTRIBUTION OR EDUCATION? THE POLITICAL ECONOMY OF THE SOCIAL RACE

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Redistribution or Education? The Political Economy of the Social Race*

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Abstract

In an overlapping generations model with two social classes, rich and poor, parents of the different social classes vote on two issues: redistributive policies for them and education investments for their kids. Public education is the engine for growth through its effect on human capital; but it is also the vehicle through which kids born from poor families may exchange their positions with kids born from rich families. This is because education reduces the probability of the mismatch, i.e. individuals with low talent but coming from rich families being placed in jobs which should be reserved to people with high talent (and viceversa). We find a political economy equilibrium of the voting game using probabilistic voting. When the poor are more politically influent, the economy is characterized by a higher level of education, growth and social mobility than under political regimes supported by the rich; pre-tax inequality is greater in the first case, but post-tax is lower.

Keywords: social mobility, talents' mismatch, probabilistic voting

"...For if the son of a golden or silver parent has an admixture of brass and iron, then nature orders a transposition of ranks, and the eye of the ruler must not be pitiful towards the child because he has to descend the scale and become a husbandman or artisan, just as there may be sons of artisans who having an admixture of gold or silver in them are raised to honour, and become guardians or auxiliaries. For an oracle says that when a man of brass or iron guards the State, it will be destroyed" [Plato, The Republic - Book III, 414 D, circa 360 BCE; translation by Benjamin Jowett, 1865].

1 Introduction

In a social race individuals of different social classes compete to improve their economic positions. The outcome of this competition depends on individual

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talent, individual and family behavior, and on public policies.

This paper analyzes the effects of two transfer programs, redistribution and education, on the outcome of a social race between two social classes, the rich and the poor. In an intergenerational setting we explore the economic motivations and the political process leading parents to choose redistributive policies for them and public education programs for their kids.

On the conceptual side, the main contribution of the paper is to analyze the role of public education on social mobility. Parents of different classes have different incentives in investing on the education of their kids, since education may increase exchange mobility, that is, education may allow kids born from poor parents to exchange their positions with kids born from rich parents[1]. We argue that this is because education reduces what we call the "mismatch of talents" in society.

Since Plato, a fundamental principle of political philosophy in western societies argues that, in an ideal social state, the allocation of individuals in social classes should be made according to talents. High talent individuals should be assigned to higher job positions and, hence, upper social classes and low talent individuals to more basic jobs and thus lower social classes. However, typically, this does not perfectly happen in societies, where we instead observe that social positions are often inherited through family lines at an extent which is difficult to explain only by factors like genetic transmission of talent. On one side, this can happen because talent is quite difficult to observe by itself, as separated by social backgrounds; while, on the other side, family connections, social relations, neighborhood networks give more chances to kids from rich families of being allocated in better job positions, and hence of remaining rich, than to kids from poor families[2]. However, this "mismatch of talents" is sensitive to public policies. We argue that public education may increase the capacity of a society to correctly recognize the true talent of individuals, to allocate them to the correct social classes and, consequently, to increase social mobility[3].

In a model with imperfect information, we show that strategic implications for the social race emerge, due to this effect of public education on

[1]While in the economic literature education has always been considered an important input for growth especially for its effect on human capital (see Barro 1997, and Krueger and Lindahl 2001, for comprehensive surveys), the effect of education on exchange mobility has been emphasized by a rather large sociological literature (see e.g. Breen and Jonsson 2005 for a review. See also Jackson, Goldthorpe and Mills 2005, and Goldthorpe 2005, for recent disputes both about the actual mechanism through which this effect may occur and about its relevance for the establishment of a so called "knowledge" society).

[2]See e.g. Bowles and Gintis (2002) and the references therein for discussion of the various factors, genetic and environmental, entering in the causal mechanism of the intergenerational transmission of economic status.

[3]Other examples of public policies that may increase social mobility include health policy, security policy, anti-lobby policies addressed to liberalize the access to several professions.

the mismatch of talents: the poor prefer high education spending to reduce the social mismatch and increase exchange mobility, while the rich prefer low education spending, provided that this will stop exchange mobility by maintaining a high mismatch of talents.

We embed these strategic incentives in a probabilistic voting game, where the two social classes vote simultaneously over a pure redistributive taxation programme and a balanced public education budget. The political economy equilibrium of the policy mix of redistribution and education depends on who, amongst the poor and the rich, have more political influence. When the poor are more politically influent, the economy is characterized by a higher spending in education and a lower spending in redistribution with respect to the case in which the two classes have the same political influence (neutral case). When instead the rich are more politically influent, the economy is characterized by a lower spending in redistribution and a lower spending in education with respect to the neutral case.

This economy shows an interesting dynamic. When the poor are more politically influent, growth and social mobility are larger, pre-tax inequality is greater, and post-tax inequality is lower than in the case where the rich are more politically influent. Interestingly, higher growth is associated with smaller mismatch and higher mobility. This is due to an indirect effect, i.e. a society with less mismatch is associated with more education, which thus induces more human capital and growth. Additionally, when the mismatch of talents causes also an efficiency cost in production, a direct effect emerges, and higher growth is associated with smaller mismatch for any level of average human capital. Moreover, when the mismatch is lower and mobility higher, pre-tax inequality is greater.

The paper crosses various streams of literature. With respect to them, we can clarify our contribution. First of all, from a theoretical perspective, our model of imperfect information in the determination of social classes is cast in an overlapping generation model of human capital formation, inspired by the seminal works of Becker and Tomes (1979) and Loury (1981). In particular, in these models and in various extensions which they have originated[4], innate ability concurs with family and social backgrounds to determine the economic attainment of kids in the social race. In these models however kids' innate ability is either independent from that of parents, or the correlation is tied to that of other socio-economic variables, so that in the process of formation of kids' human capital the genetic effect of the transmission of talent from parents to kids is indistinguishable. We instead explicitly model this genetic effect, using transition probabilities of talent. We however assume that these probabilities, as well as talent itself,

[4]See, in particular, Bénabou (1996, p. 588), for a model of human capital formation developed in line with the above seminal papers and encompassing several other contributions.

are unobservable[5]. This allows a richer representation of the mechanism of intergenerational persistence of social status, particularly useful to emphasize the role of imperfect information in generating the mismatch between people talent and their allocation in social classes. To maintain technical tractability, the overlapping generation model assumes "impure altruism", as in particular proposed by Glomm and Ravikumar (1992), in which parents of both social classes care about their own consumption and experience a warm-glow to endow their kids with an adequate human capital (see also Galor and Zeira 1993, Bénabou 2000, Zilcha 2003).

Glomm and Ravikumar (1992) has also been the seminal paper for much of the recent literature on the effect of schooling in models of endogenous growth and income inequality (see e.g. Saint-Paul and Verdier 1993, Bénabou 1996, Davies, Zhang and Zeng 2005). In this stream, we focus on a pure system of public education (as in particular in Loury 1981, Perotti 1993, Saint-Paul and Verdier 1993). In a political economy environment, we emphasize the relationships between growth and inequality under different political regimes[6], as well as the relationships between inequality and mobility, growth and the mismatch of talents. This latter in particular corroborates the idea (coming back to Plato) that social mobility is positively correlated with economic efficiency and economic growth (see in different contexts Galor and Tsiddon 1997, and Maoz and Moav 1999)[7].

The idea that public policy, and in particular public education, can contribute to increase growth and social mobility is also a point often emphasized in the literature (see e.g. Solon 1999 and 2002, Breen and Jonsson 2005, and references therein). In most of the existing studies, however, this effect is due to capital market imperfections, which in a world where private education is possible may prevent the poor from undertaking the same level of education investment as the rich (e.g. Becker and Tomes 1986, Maoz and Moav 1999, Restuccia and Urrutia 2004). We obtain a similar effect in a model of imperfect information where only public education is possible.

[5]Moreover, this hypothesis of unobservability of individual talent makes our contribution rather distant from the idea (or even the desiderability) that, eventually, innate ability could or should be the only determinants of the individual socio-economic status (as for example argued in "the Bell Curve", by Herrnstein and Murray, 1994).

[6]See also the recent contributions of the political economy of growth and inequality stimulated by the renewed interest of the Kuznets' curve, e.g. Perotti (1996), Forbes (2000), and Barro (2000).

[7]Galor and Tsiddon (1997) analyse the effect of technological progress on income inequality and intergenerational mobility in a model with perfect capital markets. They find that both growth and pre-tax inequality are positively associated with mobility. In the model with imperfect capital market of Maoz and Moav (1999) instead, which is in some sense closer to our contribution, more growth stems from an increase in human capital, which arises from the intergenerational mobility of individuals born from uneducated dynasties who decide to purchase education. Differently from our paper, they assume perfect information and considers only the effect of human capital on growth, and not the effect of the costly mismatch of talent (see Section 5).

This is also relevant to study societies both quite immobile and, yet, where the system of private education is very limited (see e.g. Checchi, Ichino, Rustichini 1999, for the typical case of Italy).

The paper also relates to the political economy literature on redistributive taxation. We replace the standard one-dimensional issue space with a more realistic two-dimensional issue space, in which redistributive taxation and public education are jointly determined[8]. A previous paper by Levy (2005) has also addressed this joint determination, though focusing on the generational conflict within the class of poor agents, with young poor preferring public education and old poor preferring income redistribution. The political equilibrium then arises from endogenous political coalitions, in which rich agents collude with either the poor young or the poor old to minimize the size of the government. Differently, in our paper kids' preferences are internalized in parents' preferences and thus there is no generational conflict. Our focus is instead on the conflict between social classes, via the income redistribution, which affects parents' disposable income, and the public education, which stimulates economic growth and increases social mobility. To determine the equilibrium in a two-dimensional issue space[9], we use probabilistic voting in the tradition of Lindbeck and Weibull (1987), building on Coughlin and Nitzan (1981a, 1981b) (see also Coughlin 1992). Probabilistic voting is particularly useful in the present context, because it allows dealing with an "ideological" component, which will differentiate the political influence of the two competing social classes, rich and poor. Thus, it represents the more natural context for a social race to emerge.

In a wider perspective, the paper is also closely tied to the idea of social mobility as equality of opportunity[10], and contributes to the recent

[8]Income redistribution programs and public education policies have generally been studied independently. In particular, in face of the more traditional political economy literature on redistributive taxation (see Hettich and Winer 1997, Bodway and Keen 2000, Harms and Zink 2003 for recent surveys), a lively more recent stream of research has been studying independently, since a decade or so, public education as a form of redistribution in kind, generally interpreted as occurring from the rich to the poor (see e.g. Gloom and Ravikumar 1998, and Fernández and Rogerson 1995, for an interpretation of redistribution flowing in the opposite direction), or from the old to the young (see Poterba 1998, and Gradstein and Kaganovich 2004, as recent contributions).

[9]A technical problem arises, since in a multidimensional issue space, Nash equilibrium of a majoritarian voting game may fail to exist. The political economy literature suggests different solutions: probabilistic voting, lobbying, structure induced equilibrium, agenda setting (see Persson and Tabellini, 2000).

[10]There is a large literature on the connection between social mobility and various notions of equality of opportunity: see, in particular, Shorrocks (1978) and Atkinson (1981) for classical papers in the economic literature, Roemer (1998) for an interpretation which emphasizes the distinction between equality of "outcomes" and equality of "opportunity", Fields and Ok (1999) for a review of the literature on social mobility measurement. Swift (2002), Jackson, Goldthorpe and Mills (2005), and the collection of papers in Arrow, Bowles and Durlauf (2000) provide various perspectives on the relationships amongst the notion of meritocracy, equality of opportunity and economic inequality.

political economy literature on equality of opportunity and redistribution. Recent contributions (Bénabou and Ok, 2001) have in particular emphasized the emergence of a trade-off between social mobility and redistribution: in socially mobile communities, since the poor have more chance of upward mobility, they may be induced not to support high levels of redistribution. As a result, the level of redistribution arising in a more mobile democratic society is lower than the one arising in a less mobile society (Alesina and La Ferrara 2001). Other contributions have emphasized the role of individuals' perceptions of exchange mobility (see Piketty 1995). As these previous studies, we also analyze both social mobility and redistribution in a political economy context and we specify the role of individuals' perceptions of exchange mobility. However, we also show that additional, generally neglected, elements are crucial in the political determination of redistribution and social mobility, such as the mismatch of talents and the competition between different social classes. As a consequence, in our paper redistribution, education, talents mismatch, and exchange mobility, all these elements are related and endogenously determined in a process of democratic decision.

The paper is organized as follows: next section presents the general features of the overlapping generations model, section three explains the political institution governing the social race and provides the results on the political economy equilibrium of the voting game between the social classes. Section four studies the dynamics of the system. Section five extends the basic setting to include the economic cost of the talents mismatch. Section six concludes. All proofs are in the appendix.

2 The setting of the analysis

In this section, we introduce an overlapping generations economy made up of a continuum of dynasties i, with unit measure $i = [0; 1]$. Individuals are heterogenous in their innate talent, which can be high or low. They live for two periods: in the first period young individuals accumulate human capital building on their innate talent; in the second period adult individuals receive an income, which depends on the social class they have been allocated to and take voting decisions. Each adult person becomes a parent and gives birth to one kid. He dies at the end of the second period. Notice that in this environment individuals take no economic, but only political decisions. In fact, individuals' human capital accumulation and allocation into social classes depends mainly on the level of public education, which is determined in the political environment. Moreover, there is imperfect information, since the innate talent is unobservable, even to each individual, and cannot be inferred from the economic outcome. In this section we present the fundamental features of the economic setting, while Section 3 describes the political decision.

2.1 Individuals and social classes

In every period, the society is divided into two social classes of equal size. Social classes correspond to job's types and hence income. Rich individuals of dynasty i have a high-paid job and they receive income $y_{t,i} = y_t^R$ and poor individuals have a low-paid job and income $y_{t,i} = y_t^P$, where the subscript index t with $t = 0, 1, 2, ...$ identifies individuals born at time t, the subscript index i identifies the specific dynasty i and the superscript index R or P identifies the social class, rich or poor. Incomes and social classes will be endogenously determined (see Section 2.4). All parents are employed and there is no flexibility in the amount of working hours.

The process of class transition from parents of generation t to parents of generation $t+1$ is represented by the following social mobility matrix:

	y_{t+1}^P	y_{t+1}^R
y_t^P	$\widetilde{p}_{t+1}$	$1-\widetilde{p}_{t+1}$
y_t^R	$1-\widetilde{p}_{t+1}$	$\widetilde{p}_{t+1}$

(1)

where $\widetilde{p}_{t+1} \in [0, 1]$ is the fraction of parents and kids who belong to the same social class, and $(1-\widetilde{p}_{t+1})$ is the fraction of those belonging to different social classes.

2.2 Preferences and public policies

We assume that only parents take political decisions. Hence, only parents' preferences will matter. Parents experience a warm-glow in ensuring their kids with an adequate level of human capital to start their second period of life (see in particular Glomm and Ravikumar, 1992)[11]. More particularly, parents value $C_{t,i}$ in the second period of their life and their kids' level of human capital $h_{t+1,i}$ according to the following Cobb-Douglas utility function:

$$V(C_{t,i}, h_{t+1,i}) = \ln(C_t, i) + E_{t,i} \ln(h_{t+1,i}) \tag{2}$$

where $E_{t,i}$ is the expectation operator for a parent's belief about his kid talent. We explain how these beliefs are formed in Section 2.6.

There are no capital markets. Government imposes a proportional tax rate τ_t on income. Per-head tax proceeds at all times $t = 0, 1, 2, ...$ are given by $\tau_t \overline{y}_t$, with $\overline{y}_t = 0.5y_t^P + 0.5y_t^R$ being the average gross income at time t. Tax proceeds of time t can either finance a pure redistributive program or public education: let $\gamma_t \in [0, 1]$ the fraction of tax proceeds going into redistribution and $(1-\gamma_t)$ into education. The redistributive program provides a lump-sum transfer b_t to parents at time t; public education finances a per-head amount e_t of education spending that will enter the human capital of each young individual at time t (kids), as specified below. Education is

[11] Other contributions are Bénabou 2000, Cremer and Pestieau 2004, Zilcha 2003.

public and the overall government budget is balanced at every period t, so that $b_t = \gamma_t \tau_t \overline{y}_t$ and $e_t = (1-\gamma_t)\tau_t \overline{y}_t$.

Net resources available for the second period consumption of each parent of generation t are thus $C_{t,i} = y_{t,i}(1-\tau_t) + b_t$.

2.3 Human capitals and innate talent

Individuals form their human capital $h_{t,i}$ in the first period of life. A fundamental variable in the determination of an individual's human capital is his innate ability or talent. Innate talent is a random shock hitting all individuals at the moment of their birth. For each individual i it can take a low value A^L, or a high value A^H. The probability of the two shocks vary depending on individuals and generations. For the generation born at time $t = 0$, we assume that the two values, A^L and A^H, have equal probability, i.e. 0.5. Starting with generation $t = 1$ however we assume a genetic mechanism of talent transmission, which follows a simple Markov process: with probability p an individual i has the same talent of his parent and with probability $1-p$ he has the opposite talent. The law of large number holds at all $t = 0, 1, 2, ...$, so that at all t half individuals are born with A^L and half with A^H.

Individuals form their human capitals according to a Cobb-Douglas learning technology, which builds on the average level of knowledge reached by the society in the previous generation (i.e. the existing stock of human capital), transmitted to the new born individuals through education. Formally, for any individual i of generation $t+1$ and innate talent A^j (where A^j can either be A^L or A^H), human capital is given by[12]:

$$h_{t+1,i} = {e_t}^{\xi} \overline{H}_t^{\delta} A^j \tag{3}$$

where $\overline{H}_t$ is the average human capital at time t; e_t is the per-head level of public education decided by parents at time t for their kids; and ξ and δ are the parameters of the Cobb-Douglas, with both δ and $\xi \in (0,1)$.

Notice that at time $t = 0$ society starts with no parents, thus the human capital accumulation for a young person with talent A^J is some primitive knowledge k_0 directly available to all individuals.

This process of human capital formation guarantees that at all $t = 0, 1, 2, ...$, there are only two types of human capital in the society: $h^L_{t+1} =$

[12]Our assumption on human capital formation is conceptually in line with the literature, in particular with the seminal work of Becker and Tomes (1979) and Loury (1981). These papers focus on human capital investment and innate ability as major sources of intergenerational earnings persistence. We combine this idea with a Cobb-Dogulas learning technology adopted by Gloom and Ravikumar (1992). However, differently from Gloom and Ravikumar (1992), we include random ability, but neglect sons' effort in the process of formation of human capital. Similar, more recent, contributions include Bénabou (1996), Fernández and Rogerson (1998), Davies, Zhang and Zeng (2005).

$e_t{}^\xi\overline{H}_t^\delta A^L$ for all individuals with talent A^L ($h_0^L = k_0 A^L$ at $t = 0$); and $h_{t+1}^H = e_t{}^\xi\overline{H}_t^\delta A^H$ for all individuals with A^H ($h_0^H = k_0 A^H$ at $t = 0$). Further, since at all t half individuals born with A^L and half with A^H, both categories count for half of the population.

2.4 Imperfect information and social mismatch

An important feature of our setting is that we explicitly model the genetic transmission of talent, through the probability p[13]. In this way we make explicit the possibility of an "objective" mechanism of genetic talent transmission and we may also emphasize that the genetic probabilities p and $(1-p)$ of talent transmission are not generally known. Several authors have in fact argued and also provided estimates that innate ability of a child is positively correlated with innate ability of the parent (see Bowles and Gintis 2002, Sacerdote 2002, Plug and Vijverberg 2003, and references therein), which implies that p lies in some range of $(0.5, 1)$. A complete agreement on the precise value of p is however far from having being reached. This is because talent is very difficult to observe, even by the individuals themselves. Thus, we have an imperfect information context.[14]

If talents were perfectly observed, given the process of formation of human capital at equation (3), at all $t = 0, 1, 2, ...$, it would be natural to assign high human capital individuals to high-paid jobs and viceversa. Thus, high human capital individuals would be rich, and they will receive an income equal to their productivity, as measured by their human capital, $y_t^R = h_t^H$, and low human capital individuals would be poor and receive an income $y_t^P = h_t^L$.[15] In this case the probability of class persistence of matrix (1)

[13]None of the contributions reported in the previous footnote explicitly considers the effect of genetic transmission of talent. At most, the effect is tied to that of some other variables measuring parent's economic status, like income or human capital, in the process of formation of kids' human capital.

[14]In particular, the hypothesis of imperfect information implies that talent cannot be observed either *directly* through the individual's human capital, or even *indirectly* through the individual's productivity. Suppose, for example, that each individual i of generation $t+1$ produces an output $q_{t+1,i}$ according to the production function:

$$q_{t+1,i} = h_{t+1,i} + \varepsilon_{t+1,i} \tag{4}$$

where $h_{t+1,i}$ is the human capital of the individual, and $\varepsilon_{t+1,i}$ is an unobservable random shock in production (with $E(\varepsilon_{t+1,i}) = 0$). Since there are only two types of human capitals, an individual with talent A^H will produce $q_{t+1,i} = e_t{}^\xi\overline{H}_t^\delta A^H + \varepsilon_{t+1,i}$; while an individual with talent A^L will produce $q_{t+1,i} = e_t{}^\xi\overline{H}_t^\delta A^L + \varepsilon_{t+1,i}$. Thus, equation (4) implies that if talent cannot be directly recognized from human capital, given the white noise $\varepsilon_{t+1,i}$, it cannot either be inferred from $q_{t+1,i}$.

[15]More formally, following from equation (4) of footnote 14, it follows that the half of individuals with talent A^H produce on the average output $q_{t+1}^H =: E(q_{t+1,i} \mid h_{t+1,i} = h_{t+1}^H) = e_t{}^\xi\overline{H}_t^\delta A^H$; while the half of individuals with talent A^L produce on the average output $q_{t+1}^L =: E(q_{t+1,i} \mid h_{t+1,i} = h_{t+1}^L) = e_t{}^\xi\overline{H}_t^\delta A^L$. Thus, if talent could be perfectly

would always correspond to the probability of genetic talent transmission, that is $\widetilde{p}_{t+1} = p$. However, given imperfect information, this allocation process is unfeasible. In particular, social classes will be formed with some fundamental mismatch, i.e. people with high and low talents are mixed up in both classes of "poor" and "rich". Precisely, at any time, each social class contains a fraction $\overline{\alpha}_t$ of individuals allocated in the "correct" social class (low talented people in the class of poor, and high talented people in the class of rich) and a fraction $(1 - \overline{\alpha}_t)$ of individuals allocated in the "wrong" social class. In the following, we refer to $(1 - \overline{\alpha}_t)$ as the "mismatch of talents". Thus, at time $t + 1$, the income of each individual in a social class corresponds to the average productivity, measured by human capital, of all individuals allocated in this class. Thus, the income of the rich and the poor are respectively:

$$y^P_{t+1} = \overline{\alpha}_{t+1}(e_t{}^{\xi}\overline{H}^{\delta}_t A^L) + (1 - \overline{\alpha}_{t+1})(e_t{}^{\xi}\overline{H}^{\delta}_t A^H) \quad (5)$$

$$y^R_{t+1} = \overline{\alpha}_{t+1}(e_t{}^{\xi}\overline{H}^{\delta}_t A^H) + (1 - \overline{\alpha}_{t+1})(e_t{}^{\xi}\overline{H}^{\delta}_t A^L) \quad (6)$$

(For individuals born at $t = 0$, the two incomes are: $y^P_0 = \overline{\alpha}_0 k_0 A^L + (1 - \overline{\alpha}_0)k_0 A^H$ and $y^R_0 = \overline{\alpha}_0 k_0 A^H + (1 - \overline{\alpha}_0)k_0 A^L)$[16].

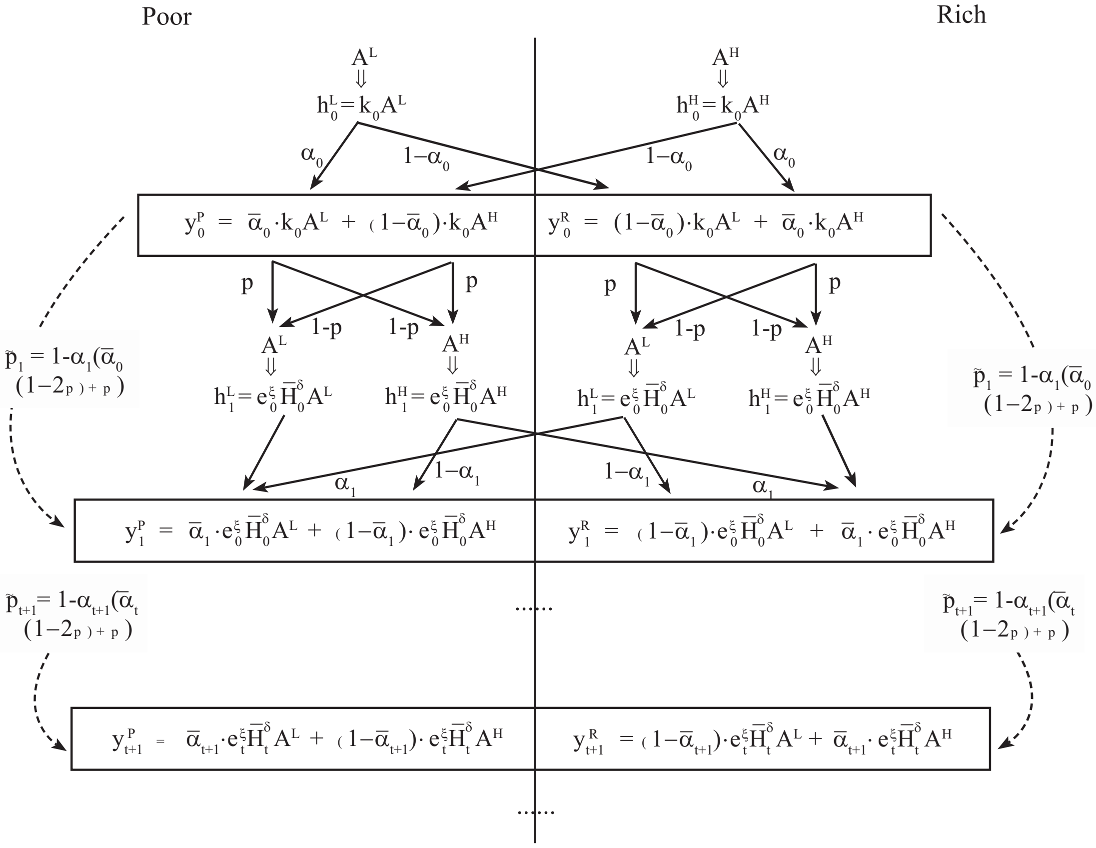
This mismatch of talents is at the origin of the formation of social classes, as represented in Fig. 1.[17] Each individual is assigned to a social class according to an allocation mechanism which, after the first generation born at $t = 0$ (for which the fractions $\overline{\alpha}_0$ and $(1 - \overline{\alpha}_0)$ of people allocated respectively in the right and in the wrong social classes are determined completely random) is based on two simple rules: *i)* a low talent kid with poor parents is always assigned to the class of poor and a high talent kid with rich parents

observed, the half individuals with high talent should ideally be paid $y^R_{t+1} = q^H_{t+1}$ (hence, $e_t{}^{\xi}\overline{H}^{\delta}_t A^H$); while the half individuals with low talent should ideally be paid $y^P_{t+1} = q^L_{t+1}$ (hence, $e_t{}^{\xi}\overline{H}^{\delta}_t A^L$).

[16]Notice that we are here continuing to assume that individuals are paid by the average productivity measured their human capitals, but that individual human capitals cannot be monitored, either directly or indirectly. More formally, from equation (4), the income of the poor can be seen as given by: $y^P_{t+1} = \overline{\alpha}_{t+1}E(q_{t+1,i} \mid h_{t+1,i} = h^L_{t+1}) + (1-\overline{\alpha}_{t+1})E(q_{t+1,i} \mid h_{t+1,i} = h^H_{t+1})$; while the income of the rich given by: $y^R_{t+1} = \overline{\alpha}_{t+1}E(q_{t+1,i} \mid h_{t+1,i} = h^R_{t+1}) + (1 - \overline{\alpha}_{t+1})E(q_{t+1,i} \mid h_{t+1,i} = h^L_{t+1})$.

[17]Here, we focus only on the mechansim of generation of the $\overline{\alpha}'_{t+1}s$, and not also on the value they can assume. Specifcally, notice that for the "poor" being poor and the "rich" being rich from equations (5) and (6), it is necessary that $\overline{\alpha}_{t+1} > 0.5$ so that it can actually be $y^R_{t+1} > y^P_{t+1}$. This can be viewed as an incentive compatibility constraint for society. The condition for such constraint to be satisfied is given below. Conversely, also notice that the assumption that individual productivity corresponds to individual human capital (unless possibly for a random error $\varepsilon_{t+1,i}$), implies that the average income in society, $\overline{y}_{t+1} = 0.5(y^P_{t+1} + y^R_{t+1}) = 0.5e_t{}^{\xi}\overline{H}^{\delta}_t(A^L + A^H)$, is independent from the extent of the mismatch measured by $\overline{\alpha}_{t+1}$, and it is always equal to the average human capital: $\overline{H}_{t+1} = 0.5e_t{}^{\xi}\overline{H}^{\delta}_t(A^L+A^H)$. In Section 5 we will consider a specification for the production technology which will slightly differs from equation (4), in which the mismatch will instead affect the average income (but not the average human capital).

Figure 1: The formation of social classes with the mismatch of talents



to the class of rich; *ii)* a high talent kid with poor parents is assigned with probability α_{t+1} to the class of rich and with probability $(1 - \alpha_{t+1})$ to the class of poor, and a low talent kid with rich parents is assigned with probability α_{t+1} to the class of poor and with probability $(1-\alpha_{t+1})$ to the class of rich. In other words, α_{t+1} is the probability that the society correctly recognizes an individual's talent and assigns him to the "correct" social class (rich for the high talents, poor for the low talents), while $(1 - \alpha_{t+1})$ is the probability of having mistakes or errors in the allocation of individuals in social classes. Thus, α_t measures the ability of the society to correctly recognize each individual's talent.

This process of class formation suggests that, while in general there are little problems in putting both poor kids with low talent in the lower class and rich kids with high talent in the upper class, it is more difficult to upgrade kids with high talents from poor parents and to downgrade kids from rich parents but with low talent[18]. This is a quite realistic issue[19], as supported by a large literature (see for instance Bowles et al. 2005, and others contributions quoted in the introduction).

The process of class formation hence depends crucially on the probability α_{t+1}. In the next section we will assume that α_t is endogenously determined based on the level of public education in the society, and we will discuss various factors which may affect α_{t+1}. Thus, social classes will also be endogenously determined. Notice now that α_{t+1} enters both in the determination of the fraction $\overline{\alpha}_{t+1}$ of people with the correct talent in each social class and in the probability of class persistence $\widetilde{p}_{t+1}$ in society. Iterating from the example of Fig. 1 with $t = 1$, the precise proportions $\overline{\alpha}_{t+1}$ and $(1 - \overline{\alpha}_{t+1})$ follows this law of motion:

$$\overline{\alpha}_{t+1} = 1 + [\overline{\alpha}_t(2p - 1) - p](1 - \alpha_{t+1}) \tag{7}$$

Similarly, in the society the probability of class persistence $\widetilde{p}_{t+1}$ for kids of poor parents to remain poor and for kids of rich parents to remain rich evolves according to the following equation (see dotted lines in Fig. 1):

$$\widetilde{p}_{t+1} = 1 - \alpha_{t+1}(\overline{\alpha}_t(1 - 2p) + p) \tag{8}$$

The latter equation shows that $\widetilde{p}_{t+1}$ is equal to p only when *both* α_{t+1} *and* $\overline{\alpha}_t$ are 1; while $\widetilde{p}_{t+1} > p$ whenever either α_{t+1} or $\overline{\alpha}_t$ (or both) are less than 1. Thus, when imperfect information generates a mismatch of talents, class persistence is larger than what should be justified by the genetic probability of talent transmission.

2.5 Education and class transitions

In this section, we argue that the probability α_{t+1} of correctly recognizing individuals' talents is affected by the level of public education. A society

[18]Notice that although in Fig. 1 and in the above Section 2.4 we have assumed that a low talent kid with poor parent and a high talent kid with rich parent are always put in the correct social classes, the model can be easily generalized to a case in which a random error also occurs in such a phase of the formation of social classes. (Indeed, the main point of the mismatch illustrated in Fig. 1 is that failures to allocate the kids from poor parents to high-paid jobs and the kids from rich parents to low-paid jobs is not random).

[19]Given that social classes correspond to jobs' types, the allocation process of individuals in social classes may replicate quite realistic stories. For example, kids of a rich family have better opportunities to find an initial better-paid job (say, a stage), independently on their talent, because of family background, social connections, neighborhood networks etc. Their on-the-job performance may then reveal the true talent of this person. If he has a high talent, it is reasonable that he will keep the job, while if he has a low talent, with probability α_{t+1} he is recognized and he has to quit. Instead, the kids of a poor family are on their own. Low talent kids will mainly find a low-paid job. Yet, if they have high talent, with (the same) probability α_{t+1}, they may be recognized and upgraded to high-paid jobs.

with a higher level of education is more able to correctly allocate individuals in their appropriate job or social class. In particular, although family background, social connections, neighborhood networks and all similar factors still remain at the origin of the social mismatch illustrated in Fig. 1, education better allows firms to disentangle the impact of family background from innative talent. Education thus increases the equality of opportunity. This idea is supported by several studies. Yet, the ability of firms to separate these two effects, family background and innate talent, may be reduced by the size of the group of individuals (low talent kids from rich parents and high talent kids from poor parents) who has to be evaluated.

Formally, we assume the following relation:

$$\alpha_{t+1} = \frac{1 - c + d\frac{e_t}{\overline{y}_t}}{(1-\overline{\alpha}_t)p + \overline{\alpha}_t(1-p)} \tag{9}$$

where the parameter c represents the general degree of openness of society; the parameter d is the degree to which openness responds to the per-head education expenditure $\frac{e_t}{\overline{y}_t}$ at time t; and the denominator expresses for each social class the number of kids at time $t+1$ who, if correctly allocated according to their talent, should change their social position with respect to that of their parents. The capacity of education of increasing the correct allocation of talents is lower the higher the number of people who should change their social class with respect to that of their parents ($\frac{\partial\left(\frac{\partial\alpha_{t+1}}{\partial e_t}\right)}{\partial(1-\overline{\alpha}_t)p+\overline{\alpha}_t(1-p)} < 0$). This is because the signaling of talents through education works better in a small group.

We generally expect $c \in (0.5, 1)$ and $d \in (0, 0.5)$. We also assume that the following condition is satisfied:

$$c - d \geq p. \tag{10}$$

The latter condition in particular incorporates the notion of both an upper and a lower bound in the probability that society commits a mistake in the allocation of individual to social classes (and, indeed, that α_{t+1} is a genuine probability belonging to the interval $(0, 1)$ at all t). Specifically, when $\frac{e_t}{\overline{y}_t} = 0$ and $c = 1$, society is completely closed and immobile ($\alpha_{t+1} = 0$ and $\widetilde{p}_{t+1} = 1$; see equation (8)); when instead $\frac{e_t}{\overline{y}_t} = 1$ and $c - d = p$, the numerator of (9) reaches its maximum value $1 - p$, which is also the lower bound the denominator $(1 - \overline{\alpha}_t)p + \overline{\alpha}_t(1 - p)$ can take, when in particular $\overline{\alpha}_t = 1$.

Using equation (9), at time $t + 1$, both the proportion of individuals correctly allocated in the society $\overline{\alpha}_{t+1}$(equation 7) and the probability of class persistence $\widetilde{p}_{t+1}$ (from equation 8), depends on the share of GDP spent for public education, as follows:

$$\overline{\alpha}_{t+1} = 2 - (c - d\frac{e_t}{\overline{y}_t}) - p + \overline{\alpha}_t(2p - 1) \tag{11}$$

and

$$\widetilde{p}_{t+1} = c - d\frac{e_t}{\overline{y}_t}. \tag{12}$$

Equation (11) describes how the mismatch evolves in society at any time $t > 0$ (starting from some initial condition $\overline{\alpha}_0$). It also shows that condition (10) is necessary and sufficient for $\overline{\alpha}_{t+1} \in [0.5, 1]$ at all t, that is for society to respect the incentive compatibility constraint $y^P_{t+1} < y^R_{t+1}$ at all $t = 0, 1, 2, ...$ (see footnote 17). Furthermore, it is worthwhile noticing that, for some time-invariant $\frac{e_t}{\overline{y}_t} \in [0, 1]$, equation (11) implies a unique steady state $\overline{\alpha}_v$, obtained as:

$$\overline{\alpha}_v = \frac{2 - (c - d\frac{e_t}{\overline{y}_t}) - p}{2(1-p)}. \tag{13}$$

The latter entails $\overline{\alpha}_v = 1$, namely that society can end-up in a state without mismatch, if and only if $c - d = p$ and $\frac{e_t}{\overline{y}_t} = 1$. Given the specificity of the two conditions[20], in particular that convergence to $\overline{\alpha}_v = 1$ requires $\frac{e_t}{\overline{y}_t} = 1$, equation (13) thus indicates that the model of social mismatch outlined in this section is not vacuous and that the social mismatch may be a quite concrete possibility in the model[21].

Equation (12) makes clear that public education increases exchange mobility, by reducing the mismatch of talents. Moreover, in the present world of imperfect information, it represents the only relationship that individuals can estimate, as explained in the following section.

2.6 Individuals' information set

Remember that, according to their preferences at equation (2), parents care about their kids' human capital and hence about their talents. Although parents do not observe their kids' talents nor the genetic probability p of talent transmission, they have information on the ex-post realizations of $\widetilde{p}_t$ and e_t. In other words, individuals do not know all the process leading to equation (12), but they do know how many kids of poor (rich) parents have remained poor (rich) and how many have become rich (poor) in previous generations, and how much education was paid by that society. Thus, using these past realizations, they may infer the form of equation (12) for $\widetilde{p}_{t+1}$, and estimate the values of c and d.

Since parents do not know their kids' talents nor the process of genetic talent transmission, they will also use their estimates of equation (12) to form their beliefs on their kids' talents. In particular, a poor parent will assign probability $\widetilde{p}_{t+1}$, as defined in equation (12), that his kid will be recognized

[20]From basic properties of linear difference equations, notice also that equation (11) implies that convergence is monotonic, with an increasing trajectory if $\overline{\alpha}_v > \overline{\alpha}_0$ and a decreasing trajectory if $\overline{\alpha}_0 > \overline{\alpha}_v$.

[21]From a different perspective, the same condition may also be viewed as suggesting that a world of complete meritocracy is highly idealistic (if desiderable at all).

by the society to have talent A^L, and will assign probability $(1-\widetilde{p}_{t+1})$ that he will be recognized talent A^H; the converse holds for the rich. Using this hypothesis in equation (2), the utility functions for the poor and the rich parents become respectively:

$$V(C_t^P, h_{t+1}^j) = \ln(C_t^P) + \widetilde{p}_{t+1}\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^L) + (1-\widetilde{p}_{t+1})\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^H) \quad (14)$$

$$V(C_t^R, h_{t+1}^j) = \ln(C_t^R) + \widetilde{p}_{t+1}\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^H) + (1-\widetilde{p}_{t+1})\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^L) \quad (15)$$

Since what ultimately matters for parents with warm-glow is the position that their own kids will have in society, the above way of using the individuals' information set to specify parents' preferences seems quite reasonable. It also suggests the emergence of a strategic dimension in the social race: in particular, given the effect of education on $\widetilde{p}_{t+1}$ (and given the asymmetry in the way in which $\widetilde{p}_{t+1}$ enters in the utility functions of the poor and of the rich), it follows that while the poor have an incentive to increase public education to increase the chance for their kids to have a recognized high talent and thus become rich, the rich have the opposite incentive to reduce public education to avoid that kids with poor parents will have recognized a high talent and take the good jobs at their place. In the remaining of the paper we will show how this strategic dimension of public education can affect substantially the political economy of the social race and its consequences for the macroeconomy[22].

[22] One may perhaps objects that even if society may only imperfectly monitor human capitals, individuals are better informed than society; and therefore there may be differences in the perception of own and kids' talent amongst individuals of both different and same social classes. We acknowledge this point and below will give some details about how the setting could be extended to account for such possibilities. But we also emphasize that summarizing in different hypotheses all the various views which people may hold about the effect that talent and other factors may have on their achievment in the social race is quite complex, as also pointed out by various recent papers on the topic, both theorethical (see e.g. Piketty 1995, and Bénabou and Ok 2001) and empirical (Fong 2001, and Alesina and La Ferrara 2001). In addition, as noted by one them, "although people can have different beliefs..., these beliefs are not arbitrary" (Piketty 1995, p. 578). In this respect, we therefore also note that the hypothesis incorporated in the utility functions (14) and (15), about what people believe is important to go ahead in life, is consistent with some stylized facts collected in opinion surveys. In particular, in a study conducted by the "International Social Survey Program" (ISSP) in 1992 about people attitude towards social inequality, it was shown that around 49% of the interviewed (on a sample of about 23000 people from 18 countries) thought that having a "wealthy family" is "fairly important" or "very important" for "getting ahead in life", while about 9% thought that it is "essential", with the remaining 42% believing that it is either "not very important" or "not important at all". Thus, it seems that while the majority of people think that having a "wealthy family" is definitively of help in life, only a minority think that one cannot do without it. Indeed, the same people also answered that factors like "good education", "hard work", "natural ability" were equally (or even slightly more) relevant. These results are in line with our setting, where, on one side there are distortions favoring the rich in the social race, but on the other side factors like natural ability, paired with investments in human capital through good education, may limit the effects of family bias.

3 The political institution

At time t, based on their preferences at equations (14) and (15), poor and rich parents vote on both the overall tax rate τ_t and on the fraction γ_t of tax proceeds going into the pure redistribution transfer $b_t = \gamma_t \tau_t \overline{y}_t$ (with the fraction $(1-\gamma_t)$ financing the per-head public education expenditure $e_t = (1-\gamma_t)\tau_t \overline{y}_t$).

In this section we introduce a probabilistic voting model to determine the equilibrium levels of τ_t and γ_t. These will determine the GDP shares going into redistibution and public education, i.e. the ratios $\frac{b_t}{\overline{y}_t} = \gamma_t \tau_t$ and $\frac{e_t}{\overline{y}_t} = (1-\gamma_t)\tau_t$ respectively. In Section 4 we will analyze the dynamic of the model and the evolution of incomes growth, incomes inequality and social mobility.

3.1 The political economy equilibrium

In the political economy literature, models of probabilistic voting are used to solve for political equilibria in situations in which political platforms include more than one issue (see Persson and Tabellini 2000, Coughlin, 1992).[23]

Consider two parties, or candidates. Before the election takes place, the parties commit to a policy platform. They act simultaneously and do not cooperate. Each party chooses the platform which maximizes its expected number of votes, or, equivalently, the probability of winning the election. Platforms are chosen when the election outcome is still uncertain. The two parties differ along some other dimension relevant to the voters than the announced policies, unrelated to the policies at issue, and which may reflect ideological elements. Ideology may also twist voters' preferences away from strict economic interest. In particular, when there is an ideological twist, it pays candidates to propose policy mix more attractive to more mobile voters, also called the "swing" voters. In this sense, the notion of "swing" voters becomes in models of probabilistic voting the direct equivalent to the notion of the decisive median voter in model of unidimensional political competition[24].

As a general result of probabilistic voting models, there is a unique political equilibrium in which the two candidates propose the same policy. This policy maximizes a social welfare function weighting all voters utility, with weights which depend on the size of the "swing" voters in each class. If the number of swing voters is the same, all groups get equal weight in the candidate's decision, which turns out to be maximizing the average voters'

[23]When the issue space is multidimensional, Nash equilibrium of a majoritarian voting game may fail to exist. Probabilistic voting is one of the solutions provided by the political economy literature.

[24]"Swing" voters are more ideologically "neutral" individuals, whose vote can be more easily swayed by a policy change in their favor.

utility. However, if the groups differ in how easily their votes can be swayed, the group containing more swing voters is more responsive to policy and gets a higher weight in the party's objective.

In our set-up, there are only two classes, the poor and the rich, with utility functions given in equations (14) and (15), respectively. Let $\omega_t \in (0, +\infty)$ denote the weight measuring the proportion of "swing" voters in the class of "rich" relative to the proportion of "swing" voters in the class of "poor".

Definition. *A probabilistic voting equilibrium at time t is a pair (τ_t, γ_t) for $\tau_t \in [0,1]$ and $\gamma_t \in [0,1]$, which maximizes a policy maker's objective function given by:*

$$\begin{aligned}\max_{\gamma_t,\tau_t} W &= \omega_t[\ln(C_t^P) + \widetilde{p}_{t+1}\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^L) + (1-\widetilde{p}_{t+1})\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^H)] \quad (16)\\ &\quad +[\ln(C_t^R) + \widetilde{p}_{t+1}\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^H) + (1-\widetilde{p}_{t+1})\ln(e_t{}^{\xi}\overline{H}_t^{\delta}A^L)]\end{aligned}$$

where: i) $\omega_t > 0$; ii) $C_t^i = y_t^i(1-\tau_t)+\gamma_t\tau_t\overline{y}_t$ *for* $i = R, P$; iii) $\widetilde{p}_{t+1} = c - d\cdot\frac{e_t}{\overline{y}_t}$, *with* $e_t = (1-\gamma_t)\tau_t\overline{y}_t$ *and* $\overline{y}_t = 0.5(y_t^P + y_t^R)$; iv) *and with* y_t^P, y_t^R, $\overline{H}_t$ *all given at time* t.

Given the definition, when $\omega_t \in (0,1)$ the bias due to "swing" voters is in favor of policy mix preferred by the rich; when $\omega_t \in (1, +\infty)$ bias is in favor of policy mix preferred by the poor; while when it is exactly $\omega_t = 1$, there is no ideological bias and all preferences count equally.

The following proposition characterizes the political economy equilibrium under the three different political conditions.

Proposition 1 *In the above economy, depending on ω_t, the political equilibria are as follow:*

- *For $\omega_t = 1$ (all voters count equally), $\tau_t = 1$ and $\gamma_t = \frac{1}{1+\xi}$. Hence, the GDP shares going into pure redistribution and into public education are, in the order: $\tau_t\gamma_t = \frac{1}{1+\xi}$ and $\tau_t(1-\gamma_t) = \frac{\xi}{1+\xi}$ at all $t = 0, 1, 2, ...$;*

- *For $\omega_t > 1$ (bias favors poor), $\tau_t = 1$ and $\gamma_t < \frac{1}{1+\xi}$ for all $t = 0, 1, 2, ...$ Hence, the GDP shares are: $\tau_t\gamma_t < \frac{1}{1+\xi}$ and $\tau_t(1-\gamma_t) > \frac{\xi}{1+\xi}$ at all $t = 0, 1, 2, ...$; further, for a time-invariant ω_t (that is, constant for all $t = 0, 1, 2, ...$), γ_t is time-invariant, so that the two shares are also time-invariant;*

- *For $\omega_t < 1$ (bias favors rich), τ_t and γ_t are more elaborate functions of the parameters (their exact values are given in Appendix); the more interesting GDP shares are: $\gamma_t\tau_t < \frac{1}{1+\xi}$ all $t = 0, 1, 2, ...$ with $\gamma_t\tau_t = 0$*

for any $\omega_t \le \frac{y_t^P}{y_t^R}$ *and with* $\frac{\partial \gamma_t \tau_t}{\partial(y_t^P/y_t^R)} > 0$ *when* $\omega_t \in (\frac{y_t^P}{y_t^R}, 1)$ *;* $(1-\gamma_t)\tau_t < \frac{\xi}{1+\xi}$ *at all* $t = 0, 1, 2, ...$*; further, for a time-invariant* ω_t*,* $(1-\gamma_t)\tau_t$ *is time-invariant.*

Moreover, the shares of GDP going into redistribution $\gamma_t \tau_t$ *and into public expenditure* $\tau_t(1-\gamma_t)$*, as functions of the various parameters of the political decision problem are characterized as depicted in Fig. 2, which is integral part of the Proposition.*

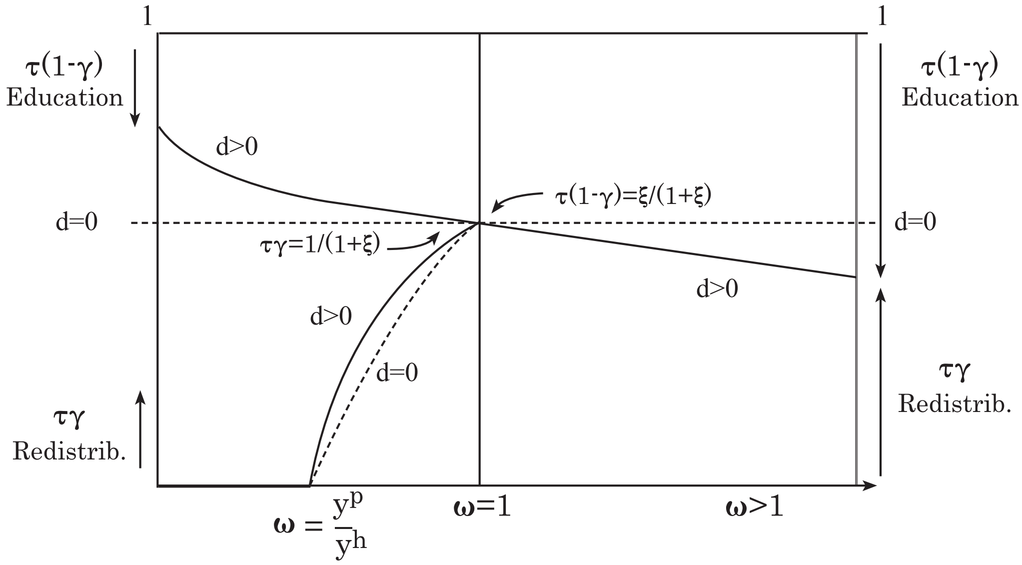


FIGURE 2: Political equilibrium for education and redistribution

The Proposition delivers the main result of political economy of the paper, as illustrated in Fig. 2. When $\omega = 1$ there is no political bias towards any of the two social classes and the policy maker optimally chooses between education and redistribution ignoring any effect of education on social mobility. In fact, when $\omega = 1$, the policy maker's objective function (16) reduces to $W = \ln(C_t^P) + \ln(C_t^R) + \ln(e_t{}^\xi \overline{H}_t^\delta A^L) + \ln(e_t{}^\xi \overline{H}_t^\delta A^H)$, which is independent of $\widetilde{p}_{t+1}$. This may seem strange, but it is a simple consequence that a "neutral" policy maker is not interested in "who is who" in the social parade, i.e. he is utilitarian[25]. Thus, he maximizes the objective function equalizing the marginal utilities of all individuals: rich and poor parents,

[25]In other words, since when $\omega = 1$, the policy maker's objective function turns out to be equivalent to an utilitarian welfare function, it implicitely also subscribes the so called "anonimity" principle of utilitarianism. (See Atkinson 1981, for a classical discussion on the connection between utilitarianism and social mobility; see Dardanoni 1993, and Gottschalk and Spolaore 2002, for alternative non-utilitarian welfare appraches which value mobility).

high and low talent kids. To do this, he fixes the maximum tax rate, i.e. $\tau = 1$, and divides the revenues collected so that the marginal benefit of one more unit of taxes spent for consumption today, that is $\frac{1}{\gamma}$, equals the marginal benefit of one more unit of taxes spent for education tomorrow, $\frac{\xi}{1-\gamma}$. Solving for γ, we have $\gamma = \frac{1}{1+\xi}$ and the GDP shares for redistribution and education are shown in Fig. 2.

When $\omega \neq 1$ and education has a positive impact on exchange mobility ($d > 0$), the share of revenues going into redistribution is zero for $\omega_t \leq \frac{y_t^P}{y_t^R}$, it increases with ω for $\frac{y_t^P}{y_t^R} < \omega < 1$, it reaches a maximum at $\omega = 1$, and then decreases when $\omega > 1$. The share of GDP going into public education instead increases over the interval $\omega \in (0, +\infty)$, meaning that when the poor have more political influence, education spending is larger than when the two social classes have equal influence, which in turn is larger than the case in which the rich have more political influence. This is because the rich and the poor have an opposite strategic incentive regarding the effect of education on mobility, which induce the former to vote for low public education to take advantage of the social mismatch which will leave even their low talent kids in the rich social class, and the poor to oppose it.

Fig. 2 also plots the equilibria which arise if instead education would play no role on exchange mobility ($d = 0$, dotted lines in the figure). The incentive effects that induce the poor to prefer more education and the rich less would obviously disappear in this case; and education would not depend on ω.[26] Interestingly, the Figure also shows how, when $d > 0$, a government under the political influence of the rich would reduce the level of redistribution with respect to the case when $d > 0$. This is because, with the same tax revenues, the rich prefer now to spend more for public education and less for redistribution, since the effect of public education that they dislike has disappeared. On the other hand, redistribution would be maximum from $\omega \geq 1$ on, because when the poor have more political influence, they have no incentive to choose less redistribution in exchange of more education and mobility.

A further result to emphasize from Proposition 1 is that, for time-invariant ω_t, the equilibrium GDP shares $(1 - \gamma_t)\tau_t$ going into public education are constant under all political regimes (namely, whether ω_t is equal, greater or lower than 1), and do not depend on time. This follows from the property of the Cobb-Douglas utility function and from the fact that both the rich and poor would in any case put a positive amount of resources in public education. It is an important property of the equilibrium policy, which will be useful in the next section to analyze the dynamics of the whole system.

Conversely, but also intuitive from Proposition 1, when the rich have

[26]This in part also depends on the specification of logarithmic utility functions.

more political influence and the policy maker will put some money in the budget for redistribution (only when $\omega_t \geq \frac{y_t^P}{y_t^R}$), then the GDP share $\gamma_t \tau_t$ may change when $\frac{y_t^P}{y_t^R}$ is changing, in particular it increases when there is more pre-tax inequality, even for the same ω_t.

Our results draw on some simplifying assumptions of the setting. First, taxation has no distortionary costs. This implies that when $\omega \geq 1$, then $\tau = 1$. This is an additional reason why a "neutral" policy maker ($\omega_t = 1$), who does not care about mobility, chooses the maximum amount of redistribution, while a policy maker supported by the poor, to obtain more mobility, must sacrifice some of the budget for redistribution. Introducing the distortionary effects of taxation may yield a neutral policy maker to reduce the overall tax rate and, hence, also to decrease the GDP share going into redistribution. A government more influenced by the poor, who cares about both education and redistribution, may instead reduce less the overall rate of taxation, while maintaining a higher budget for redistribution. Introducing distortionary taxation may thus reduce the sharpness of our results, without however altering their overall flavor.

Another source of concern depends on the identical beliefs that all individuals of the same class have on their kids' likelihood to remain or to move in the other social class. Introducing different beliefs as an extension of this model could deliver interesting results. If, for instance, we allow a fraction of poor individuals to believe that their kids have high talent and another fraction that theirs have low talent, the former fraction will prefer more education than the second. As a consequence, a majoritarian coalition of rich and poor individuals believing in the low talent of their kids may emerge, which would endorse a political equilibrium with more redistribution and less education and taxation than the one that we obtain in our model when the poor are more politically influent[27]. However, even in this case, the latent conflict between the two social classes on mobility would not disappear, with the final outcome depending on the fractions of poor agents having different beliefs on upwards mobility[28].

Finally, one may suggests that if agents are fully rationale, they should care about the overall welfare of their kids, rather than only on their human capital, as assumed in our model of "impure altruism". However, we argue that this assumption of "myopic" parents is the more natural, "behavioral", form that intergenerational altruism can take in a world of imperfect infor-

[27]This extension would introduce different beliefs about talent within the same social class, similar in spirit to Levy (2005), where differences are within the poor and due to age. Notice also that a majoritarian coalition of rich and poor agents with low talent would vote for a tax rate lower than one, as in Levy 2005, even without distortionary taxation.

[28]See Bénabou and Ok (2001), for the effect of beliefs of upwards mobility on the demand of redistribution, in a setting in which mobility is exogenous to the political process.

mation, where parents are not only uncertain about their kids' talent, but don't even know the incomes that their kids may receive when they are put either in the class of rich or in the class of poor. Imperfect information, in turn, is clearly a fundamental of the class formation with the mismatch of talents, also affecting people' beliefs of mobility (see also footnote 22 again) and their preferences.

4 The dynamics of the economy

In the previous section we have analyzed how the equilibrium GDP shares spent by generation t for pure redistribution and for public education vary depending on the political influence of the poor and of the rich, as measured by the relative proportion ω_t of "swing" voter in each social class. Our purpose now is to compare the dynamics of all major endogenous variables of the system, for political regimes parametrized by the same ω_t. We focus on economic growth, measured by the changes in per-capita income $\overline{y}_{t+1} = 0.5y^P_{t+1} + 0.5y^R_{t+1}$; pre-tax inequality, measured by the difference between the two gross incomes $I_{t+1} = (y^R_{t+1} - y^P_{t+1})$;[29] and social mobility, measured by $(1 - \widetilde{p}_{t+1})$. We also look at the evolution of the mismatch in society, as parametrized by the dynamics of $\overline{\alpha}_{t+1}$.

Following the literature on endogenous growth we treat all exogenous variables as fixed and we study the dynamics of the system for time-invariant ω. Symmetrically with Proposition 1, we analyze all variables under the three political regimes: the "neutral" case in which rich and poor have the same political influence, i.e. $\omega = \omega^N = 1$; the case of political bias favoring the poor, with $\omega = \omega^P > 1$; and the case of political bias favoring the rich, where $\omega = \omega^R < 1$. To identify the various macroeconomic variables under the three conditions, we will use the capital index $J = N, P, R$ in the obvious way[30].

We first consider the dynamics of the basic model in which gross incomes y^P_{t+1} and y^R_{t+1} are given by equations (5) and (6), so that the mismatch has no effect on the average income (see footnote 17). In Section 5, we will extend the analysis to situations in which the mismatch has implications for the average income.

[29]Since in our economy for all t half of the population is poor and half is rich, the only source of inequality is given by the difference in the two levels of incomes.

[30]As it will be clear, this new index only apply to macroeconomic variables: for example, average income is $\overline{y}^N_{t+1}$ when $\omega = \omega^N$, $\overline{y}^P_{t+1}$ when $\omega = \omega^P$, and $\overline{y}^R_{t+1}$ when $\omega = \omega^R$. Since we do not need to identify micro variables, such as individual income, under different political regimes, we will continue to use y^P_{t+1} and y^R_{t+1} to indicate the income of the two social classes, poor and rich respectively, independently on the political regime.

4.1 Growth

Remember that the average income, $\overline{y}_{t+1} = 0.5e_t{}^{\xi}\overline{H}_t^{\delta}(A^L + A^H)$, is equal to average human capital in society, $\overline{y}_{t+1} = \overline{H}_{t+1}$, so that by substitution we obtain the following dynamics equation for average income:

$$\overline{y}_{t+1} = 0.5e_t{}^{\xi}\overline{y}_t^{\delta}(A^L + A^H) \tag{17}$$

Using now the results of Proposition 1, we can establish the following implications for economic growth under the three regimes $J = N, P, R$.

Proposition 2 . *Given a fixed initial condition for the average income $\overline{y}_0 = 0.5(A^L + A^H)$ equal for all $J = N, P, R$, and given time-invariant ω^J under regimes $j = N, P, R$, economic growth evolves according to:*

$$\overline{y}_{t+1}^J = B^J(\overline{y}_t^J)^{\xi+\delta} \tag{18}$$

where $B^J = 0.5(A^L + A^H)[(1-\gamma^J)\tau^J]^{\xi}$, constant under all J, and with $B^P > B^N > B^R$. Thus, $\overline{y}_{t+1}^P > \overline{y}_{t+1}^N > \overline{y}_{t+1}^R$ for all $t = 0, 1, 2, ...$

Equation (18), characterizing the dynamics of the system, is virtually identical to that studied by Gloom and Ravikumar (1992)[31]. Growth depends on the sum $\xi + \delta$. We can distinguish three cases under which compare the different political regimes (see also Fig. 3): *a)* if $\xi + \delta < 1$, under all political conditions there are unique, globally stable, steady states with $\overline{y}_s^P > \overline{y}_s^N > \overline{y}_s^R > 0$. Notice also that in this case $\lim_{t\to\infty} \overline{y}_{t+1}^J / \overline{y}_t^J = 1$ for all J; *b)* if $\xi + \delta = 1$, there is no steady state under the regime $J = N, P, R$ for which $B^J \neq 1$. In this case $\overline{y}_{t+1}^J / \overline{y}_t^J = B^J$; *c)* if $\xi + \delta > 1$, under all political conditions there are unique unstable steady states with $\overline{y}_s^R > \overline{y}_s^N > \overline{y}_s^P > 0$. In this case $\overline{y}_{t+1}^J / \overline{y}_t^J > 1$ and $\overline{y}_{t+1}^J / \overline{y}_t^J$ increases over time if $\overline{y}_0 > \overline{y}_s^J$.[32]

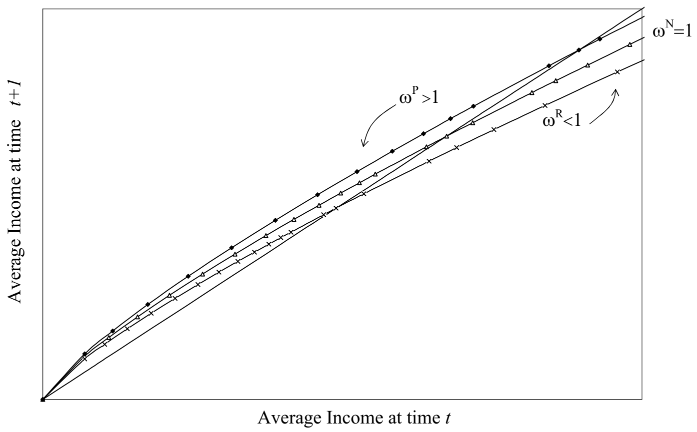
Thus, as in Gloom and Ravikumar (1992), education busts growth through its impact on human capital, so that economic growth is higher when education is higher. However, since the strategic effect of education on social mobility induces the poor to support education more than the rich, political regimes supported by the poor are also more effective to sustain economic growth. In fact, in case *a)* the long-run growth rates are zero under all political regimes, while in cases *b)* and *c)* the highest long-run growth rate is when the poor have more political influence, followed by the neutral case and then by the situation in which the rich have more influence.

[31] This is not surprising, given that we have adopted their Cobb-Douglas model of capital formation. Notice, however, that Glomm and Ravikumar (1992) compare economic growth in a public versus a private education system, while we compare within a public education system the consequences on growth of the different political conditions.

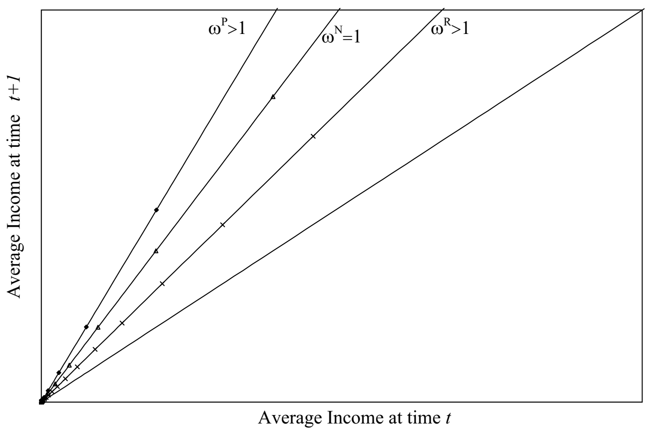
[32] In particular, this is the case in which the economy gets unbounded growth under regime J; otherwise the economy may also ends up in the trivial steady-state in which income is zero. (This trivial steady-state apply to all cases *a)*, *b)* and *c)* under all regimes $J = N, P, R$; see Fig. 3).

Figure 3: Income dynamics under time-invariant political regimes

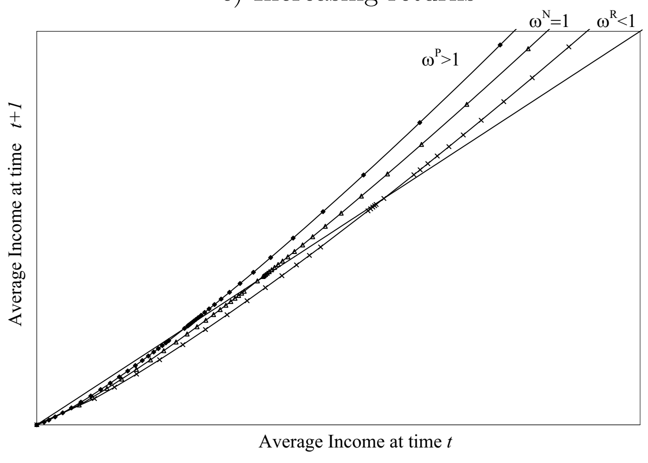
a) Decreasing returns



b) Constant returns



c) Increasing returns



4.2 Inequality

Since in our economy for all t half of the population is poor and half is rich, the only source of inequality is given by the difference in the two levels of incomes. Thus, we can measure pre-tax inequality simply by the difference $I_{t+1}^{J} = \left(y_{t+1}^{R} - y_{t+1}^{P}\right)$ which we know to be positive as long as condition (10) of Section 2.5 is satisfied and $\overline{\alpha}_{t+1} \in [0.5, 1]$. Thus, under regime J, with $J = N, P, R$, inequality can be written as:

$$I_{t+1}^{J} = \left(y_{t+1}^{R} - y_{t+1}^{P}\right) = (\overline{H}_{t}^{J})^{\delta}(e_{t}^{J})^{\xi}(2\overline{\alpha}_{t+1} - 1)(A^{H} - A^{L}) \tag{19}$$

Thus, while the mismatch does not affect economic growth (see equation 18), it affects inequality. In fact, within each generation $t+1$, the greater is the mismatch, the lower is inequality[33]. Intuitively, more mismatch implies a lower income for the rich (reduced by the presence in the class of low talented people) and a higher income for the poor (increased by the presence in the class of high talented people). Therefore, to study the evolution of inequality we should first analyze the evolution of the mismatch under the three political regimes.

Proposition 3 . *Given time-invariant ω^{J} under political regimes $J = N, P, R$, the fractions of people with the "right" talent in each class converge to values of steady state given by $\overline{\alpha}_{v}^{N}$, $\overline{\alpha}_{v}^{P}$, $\overline{\alpha}_{v}^{R}$, with $1 \geq \overline{\alpha}_{v}^{P} > \overline{\alpha}_{v}^{N} > \overline{\alpha}_{v}^{R} \geq 0.5$. Further, given the some initial condition $\overline{\alpha}_{0} \in [0.5, 1]$ under all regimes, it is also $1 \geq \overline{\alpha}_{t+1}^{P} > \overline{\alpha}_{t+1}^{N} > \overline{\alpha}_{t+1}^{R} \geq 0.5$ for all $t = 0, 1, 2, ...$*

Intuitively, Proposition 3 confirms that, since the rich are those who mostly (only) benefit from the mismatch, when they have more political influence the mismatch is comparatively higher. Furthermore, the facts that the shares $\overline{\alpha}_{t+1}^{J}$ converge under all regimes to the values of steady-states and that convergence is globally stable, suggest that the impact of the mismatch on the dynamics of inequality may be treated independently from the effects of economics growth.

To this respect, substituting in equation (19) the values of $e_{t}^{J} = (1 - \gamma^{J})\tau^{J}\overline{y}_{t}^{J}$ found in Proposition 1 for the different regimes $J = N, P, R$, dating the same equation one period back, and substituting, we can derive the following dynamic equation for the inequality:

$$I_{t+1}^{J} = I_{t}^{J}\left(\frac{\overline{y}_{t}^{J}}{\overline{y}_{t-1}^{J}}\right)^{\xi+\delta}\left(\frac{2\overline{\alpha}_{t+1}^{J} - 1}{2\overline{\alpha}_{t}^{J} - 1}\right) \tag{20}$$

With the results of Proposition 3, this expression indicates that, under all political regimes $J = N, P, R$, when $\overline{\alpha}_{t+1}^{J}$ are in steady-states $\overline{\alpha}_{v}^{J}$, inequality

[33] In particular, $\frac{\partial I_{t+1}^{J}}{\partial \overline{\alpha}_{t+1}} = 2(\overline{y}_{t}^{J})^{\delta}(e_{t}^{J})^{\xi}(A^{H} - A^{L}) > 0$.

evolves with economic growth. In particular, inequality increases if the economy is growing; it stays constant if the economy is at the steady-state of average income $\overline{y}_s^J$; it decrease if the economic growth rate is negative. Before the $\overline{\alpha}_{t+1}^{J\prime}s$ have reached their respective steady-states $\overline{\alpha}_v^J$,[34] growth and inequality may move in opposite directions depending on whether the initial condition $\overline{\alpha}_0$ is greater or lower than the steady states $\overline{\alpha}_v^J$ themselves. (See Fig. 4 for three examples, under the three regimes, of the relationships between growth and pre-tax inequality for the case of decreasing returns).

Notice also that the fact that $\overline{\alpha}_{t+1}^{J\prime}s$ converge under all regimes to values of steady-state, does not imply that in the long-run the impact of $\overline{\alpha}_{t+1}^{J\prime}s$ may become irrelevant for inequality. On the contrary, given that a higher $\overline{\alpha}_{t+1}^J$ has a direct effect to increase inequality for generation $t+1$, and given that inequality evolves according to equation (20), under all regimes $J = N, P, R$, a higher trajectory of $\overline{\alpha}_{t+1}^J$ implies a higher $\left(y_{t+1}^R - \ y_{t+1}^P\right)$ at all $t = 0, 1, 2, ...$ Though obvious from equations (19) and (20), this point is important because it allows to make unambiguous the comparisons of inequality under the different political regimes, as established by the following proposition.

Proposition 4 *Given initial condition $\overline{\alpha}_0 \in [0.5, 1]$ and time-invariant ω^J under the three regimes $J = N, P, R$, then $I_{t+1}^P > I_{t+1}^N > I_{t+1}^R$ at all $t = 0, 1, 2, ...$*

The proposition indicates that, when the poor are more politically influent, the economy is characterized by a higher pre-tax inequality than under a "neutral" political regime, which in turn shows higher inequality than under a regime supported by the rich.

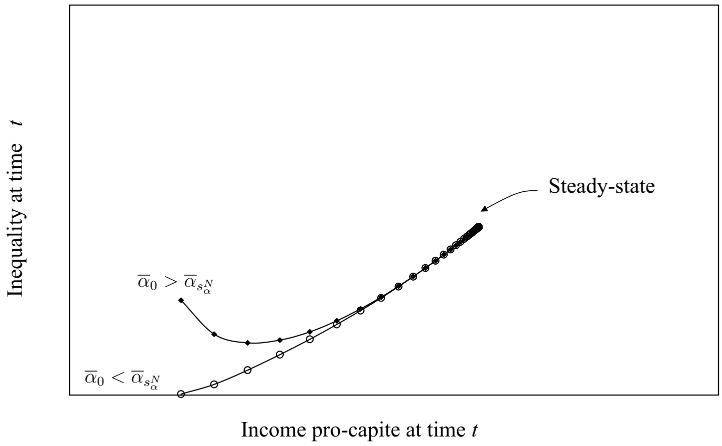
These results deserve some comments. Technically, they arise because in this model both mismatch and economic growth are positively correlated with inequality, with both growth and inequality being higher in the first political regime (poor), followed by the second (neutral) and then by the third (rich). That higher mismatch is associated with more pre-tax inequality is (as it has been noted) intuitive. The relationship between growth and inequality is, on the other hand, one of the most debated in the literature[35].

[34] Notice the different subscripts v and s, for the steady-steates of $\overline{\alpha}_{t+1}^J$ and $\overline{y}_{t+1}^J$. This is because the two variables will typically reach the steady-state at different times. (In addition, while the steady-state of $\overline{\alpha}_{t+1}^J$ will always be reached and under all regimes — see Proposition 3 —, the steady-state of the average income $\overline{y}_{t+1}^J$'s may well fail to exist or to be reached under different conditions — see Section 4.1).

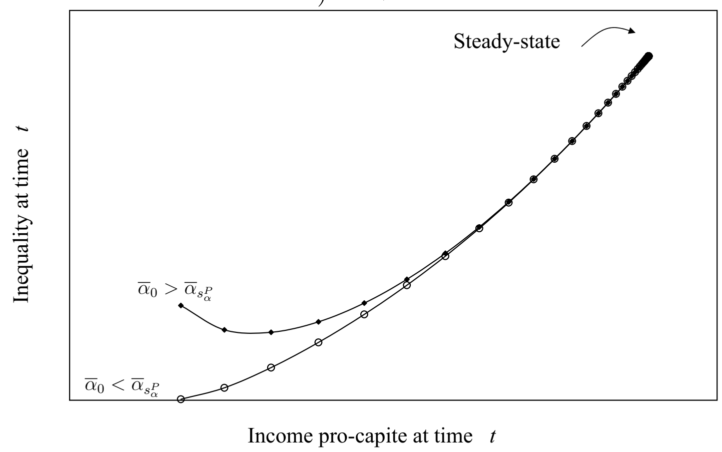
[35] In particular, in the ninenties various theories of endogenous growth, stimulated by the renewed interest in the Kuznets' curve, have theorized a negative relationship between inequality and growth. As however recently put by Forbes (2000), "a careful reading of this literaure indicates that such negative relationship is far less definitive than generally believed" (p. 869). In addition, while on the empirical side "the Kuznets curve — whereby inequality first increases and then decreases during the process of economic development — emerges as a clear empirical regularity... this relation does not explain the bulk of variations in inequality across countries or over time" (Barro 2000, p. 29). See also

Figure 4: Interaction between inequality and growth (example of decreasing returns)

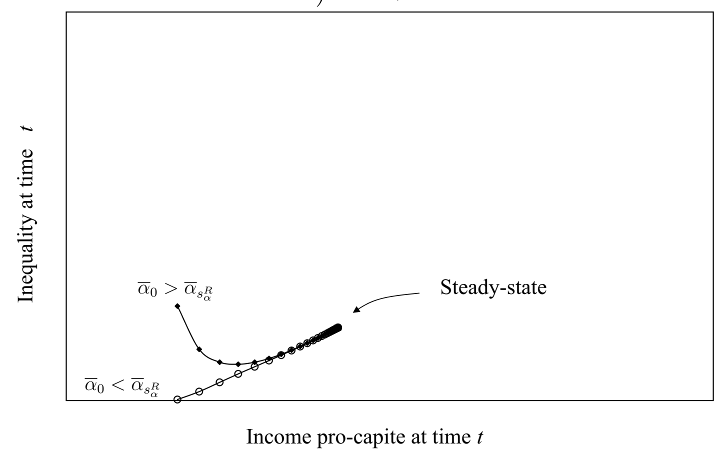
a) $\omega^N = 1$



b) $\omega^P > 1$



c) $\omega^R < 1$



In this paper, the nature of this relationship is based on the idea that a higher public education on one side increases growth by increasing the level of human capital, while on the other side it better shapes differences in human capitals due to talent, thus increasing pre-tax inequality. For the reason related to the mismatch, the political regime supported by the poor is the most inclined to public education, which induces more growth and more pre-tax inequality. At the same time, together with the "neutral" regimes, the regime of the "poor" is also the most favorable of redistribution; so under the regimes run by the poor, there is both maximum pre-tax inequality and minimum post-tax inequality.[36]

4.3 Social mobility

In our two social classes economy, social mobility is simply given by the probability $(1 - \widetilde{p}_{t+1})$ of class transition.

Proposition 5 . *Under all regimes $j = N, P, R$, social mobility is given by:*

$$(1 - \widetilde{p}^J_{t+1}) = 1 - c + d(1 - \gamma^J_t)\tau^J_t \tag{21}$$

For a time-invariant ω^J under each regime, the corresponding $\widetilde{p}^J_{t+1}$ is time-invariant with $\widetilde{p}^R_{t+1} > \widetilde{p}^N_{t+1} > \widetilde{p}^P_{t+1}$.

As expected, social mobility is the highest when the poor are more politically influent; it reaches an intermediate value when rich and poor have the same political influence; and it is lowest when the rich are more politically influent. Social mobility is in fact good for the poor (upward mobility), while it is bad for the rich (downwards mobility).

Bénabou (1996), and Perotti (1996) for classical surveys to both theorethical and empirical results of the political economy literature of growth and inequality.

[36] A similar result that in democracy higher growth rates may be associated with *both* higher pre-tax inequality *and* lower post-tax inequality has been obtained by Saint-Paul and Verdier (1993). However, since they only consider public education as a redistributive program, their result derives directly from the median voter theorem (namely, higher pre-tax inequality induces the median voter to choose a higher tax rate to finance public education, which in turn generates more growth and lower post-tax inequality). In our model instead individuals vote on both public education and a pure redistributive program. Interestingly, on one side the poor vote for a policy which will enhance growth and pre-tax inequality (namely, public education), while on the other side they also vote for a policy which will reduce as much as possible post-tax inequality. The flavor of this result is consistent with the Rawls' Difference Principle (1971); and it may be interesting for those finding some tensions between the notion equality of opportunity, intimately related to that of meritocracy, and that of other more classical notions social justice (see Arrow, Bowles and Durlauf 2000, for recent references on this issue).

5 The cost of the mismatch

An implication of the results of the previous section is that intergenerational mobility and economic growth are correlated, due to the asymmetric incentives created by the mismatch of people of the two social classes. The misallocation of human capital associated with the mismatch of talents however may generate an additional effect on growth (inefficiency), independent on individuals' incentives. Though clearly expressed by Plato, this effect has not been enough emphasized by the literature[37].

We illustrate this point in a simple model. We assume that individuals' human capitals, rather than determining directly their productivity, are perfect complement in the production process. Though this hypothesis would seem specific, we argue that the point is general. Suppose that there is a single industry employing all workers and producing all GDP using a basic Leontieff technology, which can be reproduced as many times one wishes. That is, pairing any two workers l and f of generation $t+1$, the technology produces an homogenous output $q_{t+1,lf}$ according to the production function:

$$q_{t+1,lf} = 2Min\{h_{t+1,l}; h_{t+1,f}\} \tag{22}$$

where $h_{t+1,l}$ and $h_{t+1,f}$ are the human capitals of the two workers. Clearly, since there are only two qualities of human capital in the economy, namely $h_{t+1}^L = e_t^{\xi} H_t^{\delta} A^L$ and $h_{t+1}^H = e_t^{\xi} H_t^{\delta} A^H$, it follows that any pair of workers can provide only two levels of output: a low output $q_{t+1}^L = 2e_t^{\xi} H_t^{\delta} A^L$ when either both or even only one of the two workers has low talent; or a high output $q_{t+1}^H = 2e_t^{\xi} H_t^{\delta} A^H$ only when both workers have high talent.

Thus, if society wishes to obtain the maximum overall output from all workers, it would be necessary to pair all individuals with low talent on one side, and all individuals with high talent on the other side. If society could recognize people's talent without any mistake, social classes could be formed accordingly, with incomes of people with low talent (namely the "poor") given by $y_{t+1}^P = \frac{q_{t+1}^L}{2} = e_t^{\xi} H_t^{\delta} A^L$; while income of people with high talent (namely the "rich") given by $y_{t+1}^R = \frac{q_{t+1}^H}{2} = e_t^{\xi} H_t^{\delta} A^H$. Notice that these would also be the incomes of the poor and of the rich, respectively, in a society in which people 's productivity is given by their human capital and all individuals are put in the correct social class.

[37]As far as we know, the few models which have studied the impact of the misallocation of human resources in immobile societies on growth have focused on the role of liquidity constraints (e.g. Maoz and Moav 1999). In particular, in societies in which education is privately acquired, liquidity constraints may prevent high talented people of poor families to access higher education, with a loss of efficiency. Thus, the misallocation of resources is before investing in human capitals. In our model instead misallocation occurs after the financing of public education. Its costs may therefore be relatively higher, as we explain in this section.

Suppose, however, that some mismatch of the form described in Section 2.4 occurs when forming the social classes.[38] Accordingly, it follows that a fraction $\overline{\alpha}_{t+1}$ of workers with h^L_{t+1} and a fraction $(1-\overline{\alpha}_{t+1})$ of workers with h^H_{t+1} enter the group of people "recognized" with low talent; while symmetric proportions enter the group of people "recognized" with high talent. By applying the Hardy-Weinberg Principle of the allele frequencies we then have that[39]: i) among the people recognized with low talent , namely the "poor", there are $(1-(1-\overline{\alpha}_{t+1})^2)$ pairs producing $q^L_{t+1} = 2e^{\xi}_t H^{\delta}_t A^L$ and $(1-\overline{\alpha}_{t+1})^2$ pairs producing $q^H_{t+1} = 2e^{\xi}_t H^{\delta}_t A^H$; while ii) among the people recognized with high talent, namely the "rich", there are $\overline{\alpha}^2_{t+1}$ pairs producing $q^H_{t+1} = 2e^{\xi}_t H^{\delta}_t A^H$ and $(1-\alpha^2_{t+1})$ pairs producing $q^L_{t+1} = 2e^{\xi}_t H^{\delta}_t A^L$.

Individual incomes for people of each class, which we take to correspond to the average levels of output produced by all people of the same class, are then given for the "poor" and the "rich" by, respectively:

$$y^P_{t+1} = (1-(1-\overline{\alpha}_{t+1})^2)e^{\xi}_t H^{\delta}_t A^L + (1-\overline{\alpha}_{t+1})^2 e^{\xi}_t H^{\delta}_t A^H \tag{23}$$

$$y^R_{t+1} = (1-\overline{\alpha}^2_{t+1})e^{\xi}_t H^{\delta}_t A^L + \overline{\alpha}^2_{t+1} e^{\xi}_t H^{\delta}_t A^H \tag{24}$$

The overall average output, i.e. per capita income, is equal to:

$$\overline{y}_{t+1} = 0.5e^{\xi}_t H^{\delta}_t[(1+2\overline{\alpha}_{t+1}-2\overline{\alpha}^2_{t+1})A^L + (1-2\overline{\alpha}_{t+1}+2\overline{\alpha}^2_{t+1})A^H] \tag{25}$$

Thus, in this new setting, per-capita income depends on the extent of the mismatch $\overline{\alpha}_{t+1}$. In fact, since $\frac{\partial \overline{y}_{t+1}}{\partial \overline{\alpha}_{t+1}} > 0$ (when $\overline{\alpha}_{t+1} \in [0.5, 1]$), the greater is the mismatch, the lower is average output.

Clearly, the mismatch generates here a loss of output because, when workers with high talent are paired with workers with low talent, the higher productivity of the former is constrained by the lower productivity of the latter, due the Leontieff technology. It is, however, important to emphasize that the role of Leontieff technology is here only to exemplify the general problem caused by the mismatch when the productivity of an individual does not depend only on the individual's human capital, but also on the use that the society is able to make of such human capital.[40]

[38] To be more consistent with the idea of the mismatch illustrated in Section 2.4, one should in fact add a random effect to the Leontieff production technology (22) (similar indeed to that assumed in equation (4) of footnote 14), justifying the hypothesis of imperfect information, namely that individuals' talents cannot be observed either *directly,* through inspection of human capitals, or even *indirectly* through the individuals' productivity.

[39] In particular, in its simplest form used here, the Hardy-Weinberg Principle of population genetics implies that randomly pairing all workers from a set containing a proportion q of workers with human capitals h^L_{t+1} and a proportion $(1-q)$ of workers with human capital h^H_{t+1}, the genotypic frequency of (h^L_{t+1}, h^L_{t+1}) is q^2, that of (h^L_{t+1}, h^H_{t+1}) is $2(1-q)q$, and that of (h^H_{t+1}, h^H_{t+1}) is $(1-q)^2$. By definining q and $(1-q)$ in terms of $\overline{\alpha}_{t+1}$ according to the prorportions specified for the two social classes (and applying the Leontieff production function to the various pairs), one obtains the results given in text.

[40] This framework resembles under many respects the literature on search and jobs

To this respect, the Leontieff example is quite useful since it provides also a simple setting to analyze the cost of the mismatch in terms of the waste of human capital it generates. To see this, first of all notice that the new setting hasn't affected the way in which human capitals in society are formed, so that average human capital continues to be determined according to formula $\overline{H}_{t+1} = 0.5e_t^{\xi}H_t^{\delta}[A^L + A^H]$. Substituting in equation (25), we obtain the following relationship between current average income and current human capital (the index J indicates the political regime):

$$\overline{y}_{t+1}^J = \overline{H}_{t+1}^J \cdot F(\overline{\alpha}_{t+1}^J) \tag{26}$$

where $F(\overline{\alpha}_{t+1}^J) = \frac{[(1+2\overline{\alpha}_{t+1}-2\overline{\alpha}_{t+1}^2)A^L+(1-2\overline{\alpha}_{t+1}+2\overline{\alpha}_{t+1}^2)A^H]}{[A^L+A^H]}$, so that $\overline{y}_{t+1}^J = \overline{H}_{t+1}^J$ if and only if $\overline{\alpha}_{t+1}^J = 1$; whereas (since $\frac{\partial \overline{y}_{t+1}}{\partial \overline{\alpha}_{t+1}} > 0$, for $\overline{\alpha}_{t+1}^J \in [0.5, 1]$) the lower is $\overline{\alpha}_{t+1}^J$, the lower is $\overline{y}_{t+1}^J$ relative to $\overline{H}_{t+1}^J$.

Moreover, we can compare the dynamics of the average human capital and the average income to see how the waste of human capital evolves in a society in which mismatch is costly. First of all we can derive the dynamics equation for the average income, which after simple manipulations can be written as:

$$\overline{y}_{t+1}^J = B^J(\overline{y}_t^J)^{\xi+\delta} \cdot \frac{F(\overline{\alpha}_{t+1}^J)}{F(\overline{\alpha}_t^J)^{\delta}} \tag{27}$$

where $B^{J\prime}s$ are under all regimes the same as in economies without costly mismatch; see Proposition 2.[41] Thus, when $\overline{\alpha}_{t+1}^J$ have reached the values of steady-state $\overline{\alpha}_v^J$, the conditions under the three political regimes: i) for the economies to be growing; ii) for existence of steady-state incomes $\overline{y}_s^J$'s; and iii) for characterizing the relationships amongst steady-states and long-rung growth rates, are here the same as in the economy without costly mismatch. Namely, they only depend on the sum $\delta + \xi$.[42]

Moreover, since we also know that in an economy without costly mismatch it is $\overline{y}_t^J = \overline{H}_t^J$ at all t, it follows that the distance between average

assignment in the labor market (Pissarides 2002). There is also a recent stream of this literature that studies the problem of mismatch at firms' levels (e.g. Farber and Gibbons, 1996). We extend a similar idea at the society's level. Notice however that in the firms' literature the mismatch is generally random, whereas here it is systematic.

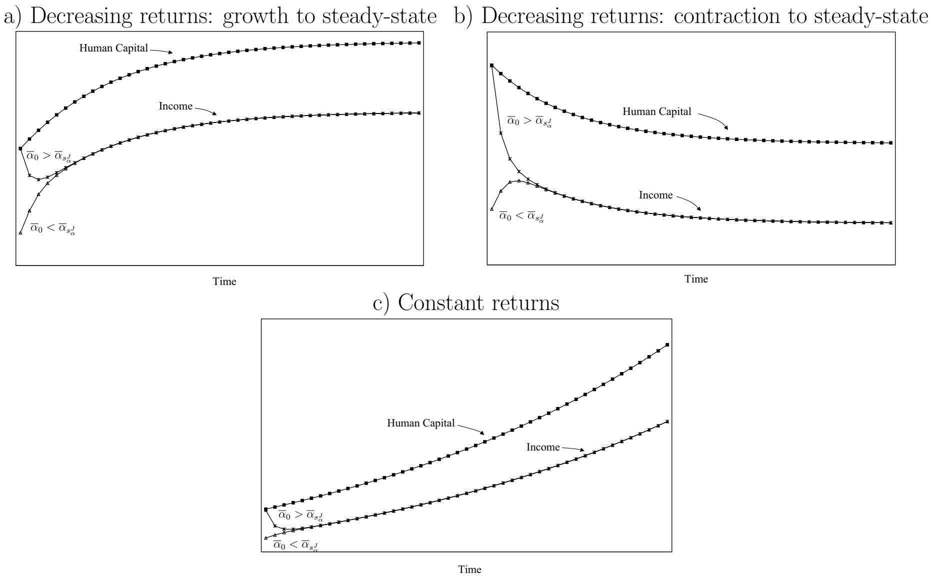
[41] In particular, from equation (25), mean income can be rewritten as:

$$\begin{aligned}\overline{y}_{t+1} &= 0.5e_t^{\xi}H_t^{\delta}[F(\overline{\alpha}_{t+1}^J)(A^L + A^H)] \\ &= B^J(\overline{y}_t^J)^{\xi}(H_t^J)^{\delta}F(\overline{\alpha}_{t+1}^J)\end{aligned}$$

where $B^J = 0.5(A^L + A^H)[(1-\gamma^J)\tau^J]^{\xi}$ as in Proposition 2. Substituting now equation $\overline{H}_t^J = \frac{\overline{y}_t^J}{F(\overline{\alpha}_t^J)}$ dated one period backwards one obtains equation (27).

[42] Clearly, this also depends on the fact that we have a Leontieff production function with constant returns. But again the point is more general and it can be easily accomated for cases in which the production function has increasing or decreasing returns.

FIGURE 5: Economic dynamics when mismatch is costly



income and average human capital in an economy with costly mismatch increases, stays constant or decreases, depending on whether the economy is growing, is in steady-state, or it is contracting.[43] Fig. 5 illustrates the point with three examples of: a) decreasing returns (in the formation of human capital) with the economy growing to the steady-state; b) decreasing returns with the economy contracting to the steady-state; and c) constant returns with the waste of human capital increasing over time.

Finally, it is worthwhile noticing that, although from a qualitative perspective the above arguments hold equally true for all political regimes, they nevertheless apply more strongly depending on the extent of the mismatch carried by $\overline{\alpha}^J_{t+1}$ under the three regimes. Thus, since we already know from Proposition 3 that $\overline{\alpha}^P_{t+1} > \overline{\alpha}^N_{t+1} > \overline{\alpha}^R_{t+1}$ at all t, it follows that the arguments of the costly mismatch reinforce the conclusions of the previous section, that regimes supported by the poor are better for growth than neutral regimes, which in turn are better than regimes favored by the rich.[44]

[43]This in particular applies when $\overline{\alpha}^J_{t+1}$ are in steady-state $\overline{\alpha}^J_v$. When $\overline{\alpha}^{J\prime}_{t+1}$'s are not yet in statedy-states, growth in the economies with and without costly mismatch may for sometimes be uncoordinated (that is, one economy may be growing while the other is contracting, and viceversa) depending on whether the initial condition $\overline{\alpha}_0$ is greater or lower than the statedy states $\overline{\alpha}^J_v$ of the different political regime (see also Fig. 5).

[44]A similar discussion holds regarding inequality. In particular, it can be shown that in the present setting with costly mismatch inequality is given by:

$$I^J_{t+1} = I^J_t \left(\frac{\overline{y}^J_t}{\overline{y}^J_{t-1}}\right)^{(\xi+\delta)} \left(\frac{\overline{\alpha}^J_{t-1}(A^H - A^L) + 2A^L}{\overline{\alpha}^J_t(A^H - A^L) + 2A^L}\right)^{\delta} \left(\frac{\overline{\alpha}^J_{t+1}}{\overline{\alpha}^J_t}\right)$$

6 Concluding remarks

We have presented a political economy model in which the two social classes of rich and poor compete over redistribution and public education policies. Since education promotes equality of opportunity by raising exchange mobility, preferences of both social classes are driven by strategic incentives, mainly for the poor to increase public education at the expense of pure redistribution in order to improve upward mobility, and for the rich to reduce public education to avoid downward mobility. As a consequence, the political economy equilibrium depends on which social class is more politically influent. Our model includes crucial additional effects of public education. First, as it is standard in the economic literature, education increases economic growth, which is positive for the all society. Second, and this is an original contribution of this paper, education affects the mismatch between talents and social classes. In particular, education reduces the probability that individuals with low talent but coming from rich families are placed in jobs which should be reserved to people with high talent (and viceversa).

We are aware of possible criticisms to our model: taxation is not distortionary; the society is formed by only two classes, each of them composed by individuals identical in all aspects, including in their beliefs of their kids' talent and their chances to go ahead in society; the assumption of "impure altruism" with myopic parents who care about their kids human capitals but not about their full welfare. In Section 3 we have discussed in some details these assumptions and suggested how some criticisms could be addressed by extensions of the basic model.

As any theoretical model, our contribution represents a simplification of the reality. As such, its strength depends on its ability to capture some stylized facts of the real world. To this respect, our model delivers several empirical predictions: some of them have a strong intuition, if not proper empirical support; other may be empirically investigated in the future. First, the mismatch between talents and allocation of people in social classes is a quite clear implication of any society which lacks of equality of opportunity. Any realistic economic model of education and social mobility should include a mismatch mechanism. However, despite a very large literature reasoning informally on the topic, we are not aware of previous contributions explicitly modelling such mismatch of talents. An advantage of our specification is also that mismatch is modelled in a quite general setting, independent from the political framework. Also, it can be easily generalized to include, further to

Given, however, that when $\overline{\alpha}_t^J$ is in steady-state, all factors containing $\overline{\alpha}_t^J$ are equal to 1, it follows that when $\overline{\alpha}_t^J$ is in steady-state, inequality evolves with economic growth as in the economy without costly mismatch, but with the different growth rates resulting from the effect of the mismatch. (When $\overline{\alpha}_t^{J\prime}$'s are not yet in statedy-states, the dynamics may be a bit more complex due the interaction between the two factors containing $\overline{\alpha}_t^J$ at different t).

education, other factors or public policies (like health, security, liberalization policies) possibly affecting mobility and the talents mismatch.

Second, recent empirical studies compare pure redistributive programs versus public education expenditures across countries (see e.g. Lindert 1996, for a comparison across OECD countries; or Poterba 1997, for the US). These studies have however so far focused on the effect of the size of cohorts of different age. They are therefore more relevant to study the intergenerational conflict on the demand of public education (Levy, 2005). It may be interesting instead to verify the impact of political influence. For example, to what extent the idea of a social classes conflict over mobility can explain different welfare models across countries? Specifically, is there any evidence that right-oriented governments (more likely to be supported by the rich) become increasingly more hostile to public education spending, while more morbid on pure redistributive policies, the greater is the degree of openness in society (as e.g. expressed by a lower value of parameter c in the present paper) and the higher the effect of education on mobility (parameter d)? Or, that more politically "neutral" governments spend more on redistribution and less on education than more left-oriented governments, even when they impose similar overall levels of taxation? Also, in a wider perspective, can differences in the political influences of social classes across countries contribute to explain cross-country differences in intergenerational income mobility (as for example in regard to the results reviewed in Solon 2002)?

Of specific empirical interest could also be the relationships between mobility, talents mismatch and economic growth, in particular, the results of Section 5, on the waste of social capital generated by the mismatch when people with low talent are allocated in jobs of higher potential productivity. This may for example be important to explain the recent poorer performance of some well-developed countries relative to others, which appears indeed characterized by very low levels of mobility (like notably Italy; Checchi, Ichino and Rustichini 1999).

Finally, the capacity of the model to capture real facts depends on economic interests as well as on ideological factors. In the past welfare models of developed countries have been largely influenced by the need of more extensive social policies. Things have been changing quite rapidly in the last fifteen years or so, and the idea of equality of opportunity is nowadays raising relevance in all political debates. In the future the capacity of the model to capture the reality may also depend on the way in which the intelligentsia of political parties, both right and left-wing oriented, may be able to solve the straggles between the notion of meritocracy, to which that of equality of opportunity is naturally related, and the others, more classical notions of social justice (see Arrow, Bowles and Durlauf 2000).

7 Appendix

7.1 Proof of Proposition 1

To be added.

7.2 Proof of Proposition 2.

From Proposition 1, substitute the political equilibrium values of e_t^J in equation (17) for the different time-invariant ω^J. For example, for $\omega^N = 1$, $e_t^N = \frac{\xi}{1+\xi}\overline{y}_t^N$ so that $\overline{y}_{t+1}^N = 0.5(A^L + A^H)(\frac{\xi}{1+\xi})^{\xi}(\overline{y}_t^N)^{\xi+\delta}$, and $B^N = 0.5(A^L + A^H)(\frac{\xi}{1+\xi})^{\xi}$ in equation (18). Similar substitutions when $\omega^P > 1$ and $\omega^R < 1$ imply $B^P > B^N > B^R$. The rest of the Proposition follows from basic properties of difference equations. (See also Fig. 3).

7.3 Proof of Proposition 3

Substitute for the generic time-invariant $\frac{e_t}{\overline{y}_t} = (1-\gamma_t)\tau_t$ of equation (13), the specific time-invariant $(1-\gamma^J)\tau^J$ derived from Proposition 1 under regimes $J = N, P, R$.

7.4 Proof of Proposition 4

Directly from: i) Proposition 2 showing that, under all possible combinations of $\xi+\delta$ (whether greater, lower or equal to 1), then $\frac{\overline{y}_t^P}{\overline{y}_{t-1}^P} > \frac{\overline{y}_t^N}{\overline{y}_{t-1}^N} > \frac{\overline{y}_t^R}{\overline{y}_{t-1}^R}$ for at least some t (otherwise they may be equal); ii) Proposition 3 indicating that $\overline{\alpha}_{t+1}^P > \overline{\alpha}_{t+1}^N > \overline{\alpha}_{t+1}^R$ at all $t = 1, 2, ...$; iii) equation (20) for the evolution of I_{t+1}^J.

7.5 Proof of Proposition 5

From Equation (12) and Proposition (1).

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