Università degli Studi di Macerata

Dipartimento di Studi sullo Sviluppo Economico

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Enzo Valentini
University of Macerata
Department of Studies on Economic Development

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Enzo Valentini
University of Macerata
Department of Studies on Economic Development[1]

Abstract

This paper investigates the supposed substitutability between equal opportunities and public redistribution. In the first part a theory which finds a substitutability between redistribution and equal chances in determining the extent of incomes inequality (Gini Index) is presented. This result is obtained including inequality of opportunities in the labor market, and preferences for leisure in the individual utility function. The model suggests that an optimal level of universalistic redistribution (maximizing average utility) exists, which is increasing with respect to inequality of opportunities. The subsequent empirical exercises offer a plausible measure of meritocracy, besides being a support for the validity of the theoretical model. Moreover, the empirical analysis suggests that there could be countries which should enhance redistribution and others which should reduce it, given their level of opportunities inequality.

JEL Classification: H23, H53, D63.
Keywords: Inequality, Meritocracy, Universalism, Redistribution, Taxation.

Department Informations:
Piazza Oberdan 3, 62100 Macerata - Italy Phone: +39 0733 258 3960 Fax: +39 0733 258 3970 e-mail: csampaoli@unimc.it

[1] University of Macerata, Department of Studies on Economic Development, Piazza Oberdan 3, 62100 Macerata-Italy; enzo.valentini@unimc.it

1 Introduction

Inequality has several dimensions, and it can be studied and analyzed from different points of view. Most of them can be summarized in two large categories: inequality of opportunity and inequality of outcomes (monetary and non-monetary).

As Sen (1980) points out, while most agree that some form of equality is desirable, there is less consensus about what should be equalized. Moreover, there are links and interactions between various dimensions of inequality. Inequality of opportunities affects income distribution (D'Addio, 2007), while wealth distribution can determinate the opportunities faced by pupils[2]. In turn, education is a major contributor to intergenerational income mobility (OECD, 2008).

In a context of such complex interactions, public policies aimed at to reduce a one specific dimension of inequality must be implemented by taking into account all the possible complementarity and/or substitutability effects of the adopted policy instruments. For example, an important debate in public policy concerns the question of whether equal opportunities for every one make redistributive policies unnecessary (Alesina et al, 2005). Empirical studies on individual preferences signal that the Meltzer and Richard (1981) approach is not sufficient to fully understand why people support, or do not, income redistribution. There is a large empirical support for the hypothesis of a substitutability between equal opportunities and income redistribution (Fong, 2001; Benabou et al., 2001): those who believe to live in a land of (equal) opportunities for every one do not support public redistribution. Instead, government intervention is claimed by those who think that social mobility is systematically biased.

People seem to agree with those philosophers of responsibility (for example: Roemer, 2000) who claim that inequalities emerging from individual's responsibility should not be corrected, while it is morally fair to aim at correcting inequalities if they derive from factors perceived as external to individual choices.

In order to justify this attitude, part of the literature looks at the concept of "reciprocity" (Fong 2001, Bowles et al. 2001), while Alesina et al. (2005) focus on the fact that poor people living in a highly mobile social context

[2]For example because of budget constraints which limit the opportunity to achieve high levels of education. (Becker et al., 1986; Bowles et al., 2002; Checchi, 2005)

may be convinced that they have good prospects of increasing their incomes.

A crucial distinction must be made: income redistribution is a typical policy instrument under control of public authorities, while the extent of equal opportunities in a society is the final result of complex interactions between individual preferences, cultural features, and governance instruments. Public governments have little control on the extent of meritocracy (an effective channel is constituted by education policies)[3]; nevertheless they can design more or less appropriate redistributive policies, given the level of meritocracy in the society.

In this paper, the interactions between inequality of opportunities and income distribution will be (theoretically and empirically) deepened. Moreover, it will be analyzed how redistributive policies should be designed, taking into account the connections between these two dimensions of inequality. In particular, there will be a focus on *universalistic* redistributive policies, even if most of the considerations made in the paper can be relevant about redistribution on the whole.

The paper is organized as follows. In section 2, a theoretical model will be presented, with the aim to formally emphasize the links between inequality of opportunities by one side and income inequality, social welfare and optimal level of redistribution by the other side. The first target of section 3 is to verify the robustness of crucial relations suggested by the model. The second one is to provide some new empirical information about meritocracy and redistribution. Section 4 concludes.

2 Theory

In this section, a model which formally emphasizes the relation between equal opportunities and income distribution is presented. Moreover, the model framework allows to identify what should be the width of (universalistic) redistribution which maximizes social welfare in a country with a given level of meritocracy.

[3] OECD (2008) identifies what kind of policies can affect the extent of equal opportunities: educational policy, early childhood investment, access to health care and immigration policy.

2.1 Microeconomics

First of all, firms ad agents behavior are analyzed, in order to determine the demands (conditionals to production) and supplies of productive factors (capital and labor).

2.1.1 Firms

The production sector is described by a representative firm which produces the final good (Y) combining labour (L) and capital (K) by a Cobb Douglas production function: $Y = K^{\alpha}L^{1-\alpha}$, where α is the "capital share".

This firm minimizes its costs, given a certain level of output demand (Y). Minimizing the well known Lagrangian, it is easy to obtain:

$$L_d(Y, r, w) = Y \left[\frac{r}{w} \frac{1-\alpha}{\alpha} \right]^{\alpha} \tag{1}$$

$$K_d(Y, r, w) = Y \left[\frac{w}{r} \frac{\alpha}{1-\alpha} \right]^{1-\alpha} \tag{2}$$

where r is the cost of a unit of capital and w is the wage of a unit (hour) of labor.

2.1.2 Agents

N agents living in this economy must choose how much hours of work supply in the labor market.

Those N individuals are differentiated: a fraction q of them shares an equal amount k of the overall stock of capital in the economy ($k = \frac{K}{N*q}$). The other fraction $(1 - q)$ has no capital. The first class of agents will be named *capitalists*, and *workers* the second one. The economy's overall endowment of capital depends on q (the share of population owning capital) and k (the equal amount of capital owned by each capitalist).

I'm assuming that the model covers only the *short run* (labor decisions). All the factors regarding capital at aggregate (capital stock of the economy) and individual levels (wealth/capital distribution) are considered as exogenous because they refer to the *long run* dynamic of the economic system.

The incomes, and consumption levels, of a capitalist and a worker are, respectively:

$$y_c = b + (rk + wh)(1 - t) \tag{3}$$

$$y_w = b + wh(1-t) \tag{4}$$

where h is the number of working hours, t is the share of taxation on (earned/unearned) income and b is the public transfer, equally distributed to all individuals.

What kind of redistributive policy does the model describe? b seems to have some features of a Basic Income, which is characterized by the followings traits: it is paid irrespective of any other income, it does not require any present or past work performance, it is not conditional on the willingness to accept a job, and it is paid to individuals rather than households (Van Parijs, 1992). The problem is that most of those features can not be considered in the model, for instance the second and the third traits. In the model there are no "unemployed" people but two representative agents (worker and capitalist) who can work more or less. Moreover, in the model there is not a formal distinction between individuals and households, even if the second concept is probably more appropriate, because agents are differentiated by the possess of k, which can be seen as a dynastic feature.

It is possible to say that b is a universalistic transfer because it is not dependent on work decisions and is equally distributed among all agents. The fact that b is funded by a flat income tax rate (t) allows to consider the modelled redistribution as similar to the Negative Income Tax proposal of Atkinson (1995), because it is fully characterized by the levels of b (Basic/Guaranteed Income) and t (tax rate).

Agents of this economy enjoy consumption and leisure. The utility function of a *capitalist* and of a *worker* are the following:

$$U_c = (y_c)^{\beta}(H-h)^{1-\beta} \tag{5}$$

$$U_w = (y_w)^{\beta}(H-\mu h)^{1-\beta} \tag{6}$$

where $0 < \beta < 1$ indicates agents' preferences for consumption (and income)[4], H is the overall endowment of hours (in the rest of the model H is normalized to one) and $\mu > 1$ is the "unequal opportunities" parameter.

It is assumed that when a *worker* works for x hours, he/she needs to renounce $\mu \times x$ hours of leisure, while a *capitalist* has not to sustain this additional transaction cost. For a given level of working hours, *capitalists* enjoy more free time than *workers*. This difference has two possible theoretical justifications. First, capital owners can benefit of better Social Networks

[4]Moreover, $0 < \beta < 1$ implies risk adverse individuals.

and connections helping them to find jobs more easily than workers without capital (Montgomery, 1991; Calvo'-Armengol et al., 2004). Second, capital owners can better face budget constraints driving education decisions (Becker et al., 1986; Carneiro et al., 2002, Staffolani et al., 2007), and more educated people find jobs more easily, meeting less transaction costs (and/or are more productive).

In other words, $\mu > 1$ can represent extra "job search costs" and/or extra "signalling costs" (in hours) to be sustained by *workers* and not by *capitalists.*

It is necessary to remark that, in this framework, only μ represents inequality of opportunities (deriving from possess of k), while the width of k does not affect meritocracy. The extent of k influences welfare distribution because it determines inequality in initial endowments, but it cannot be considered as an "opportunity" parameter, since agents do not face any possibility constraints. Actually, the Gini Index of the economy is not dependent on the width of k, as it will be clarified later.

Sen (2000) points out that "meritocracy may have many virtues, but clarity is not one of them", because "the concept of merit is deeply contingent on our views of a good society"[5]. In this model it is considered a very specific form of meritocracy, focusing on the labor market: in this case, "inequality of opportunities" means "unequal transaction costs" arising from the fact that some people own capital and other people do not possess it.

The presence of leisure in the utility function allows to deal with one possible positive aspect of universalistic redistribution, as signalled by Bowles (1992): "A further likely effect would be to reduce the aggregate hours of work and hence to reduce the importance of the consumption of commodities and enhance the importance of free time as components of individual welfare, thus helping to correct what Juliet Schor has termed the 'output bias of capitalism', namely the structurally determined overvaluation of the things that working for pay can secure". This topic will be deepened at the end of the model, commenting its welfare implications.

Substituting the definitions of y_c and y_w in equations 5 and 6, and maximizing them with respect to h the individual labor supplies (h_c and h_w) are found.

$$h_c = \beta - \left(\frac{b}{1-t} + rk\right)\frac{1-\beta}{w} \tag{7}$$

[5]See Roemer (2000) for a detailed description of different meanings of "meritocracy" and/or "inequality of opportunities".

$$h_w = \frac{\beta}{\mu} - \frac{b}{1-t}\frac{1-\beta}{w} \tag{8}$$

Then, it is possible to compute the overall labour supply ($Ls = Nqh_c + N(1-q)h_w$):

$$L_s(r,w) = \left[\frac{(\mu-1)q+1}{\mu}\beta - \frac{1-\beta}{w}\left(\frac{b}{1-t} + qrk\right)\right] \times N \tag{9}$$

while the overall capital supply is $K_s = K = Nqk$, as stated before.

2.2 Macroeconomics

At macro level, equilibrium conditions in the two factor markets must hold. These conditions are:

$$L_d(Y,r,w) = L_s(r,w) \tag{10}$$

in the labor market, and

$$K_d(Y,r,w) = K_s = K = Nqk \tag{11}$$

in the market of capital.

There is no ‘unemployment’ in this model, since factors markets clear. However, incomes are differentiated because *capitalists* earn no labor income and because the two representative agents (worker and capitalist) can be induced to work more or less, according to transaction costs and redistributive policies.

Assuming perfect competition and zero profits for firms, in the final market the amount of Y (production, national income) must be equivalent to the demand of the N agents:

$$[w(Y,t,b)L_d(Y,r,w) + r(Y,t,b)K](1-t) + bN = Y \tag{12}$$

In equation 12, there is another assumption of the model: both *workers* and *capitalists* allocate all the income to consumption. This fact, along with the public budget constraint, means that, in this framework, universalistic redistribution simply redistributes incomes produced by work and capital. It does not generate an extra-income, for instance enhancing aggregate demand because of the greater propensity to consumption of the poorest (in this model, the workers).

Finally, the following public budget constraint must hold:

$$[w(Y,t,b)L_d(Y,r,w) + r(Y,t,b)K]\,t = bN \tag{13}$$

2.3 Solutions

The system involving equations 10, 11, 12 and 13 has four equations and is solvable for the following four unknowns: w, r, Y and b, which will be function of t. In fact, the system has explicit solutions in $b(t)$, but not in $t(b)$; hence, in the rest of the paper, t will be considered as the policy variable.

By solving the system, it is possible to obtain the following results:

$$w(t) = (1-\alpha)\left[\frac{k}{\beta}\frac{1+\frac{1-\beta}{1-\alpha}\left(\alpha+\frac{t}{1-t}\right)}{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}\right]^{\alpha} \tag{14}$$

$$r(t) = \alpha\left[\frac{\beta}{k}\frac{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}{1+\frac{1-\beta}{1-\alpha}\left(\alpha+\frac{t}{1-t}\right)}\right]^{1-\alpha} \tag{15}$$

$$Y(t) = \left[\beta\frac{q+\frac{1-q}{\mu}}{1+\frac{1-\beta}{1-\alpha}\left(\alpha+\frac{t}{1-t}\right)}\right]^{1-\alpha}(qk)^{\alpha}N \tag{16}$$

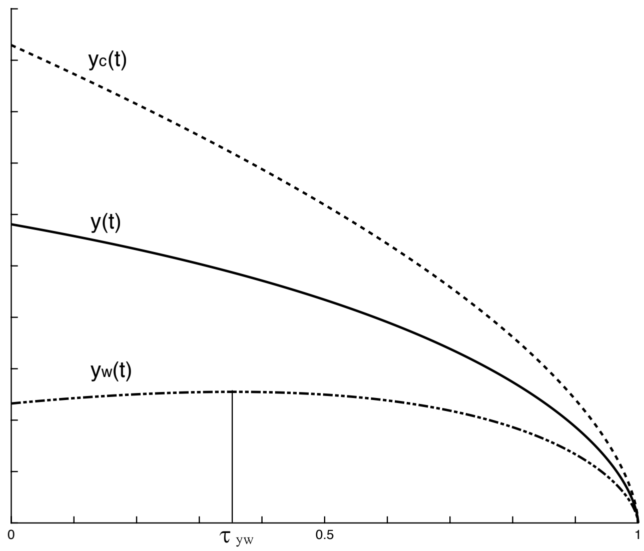
$$b(t) = \frac{Y(t)}{N}t \tag{17}$$

These solutions make clear the meaning of t in this model: it represents the share of average income per capita constituted by universalistic transfers. In the rest of the paper, there will be a focus on $y(t) = \frac{Y(t)}{N}$. Theoretically, given universalistic redistribution, an agent with the average income per capita ($y(t)$) should pay to government exactly the amount she/he receives by b. Actually, in the model there are no agents earning the average income, because *capitalists* have an income always over the average and *workers* always under (as we will see formally later).

Before to inspect other results of the model, it is useful to analyze the relation between b and t, using equation 17. It emerges (see Appendix A, Proof 1) that $b(t)$ is initially increasing in t, until $t = \tau_b$ (see equation ii in Appendix A), while is decreasing over this threshold. Hence, the revenues of t, and consequently $b(t)$, are affected by a "Laffer effect": if t is too high, demotivating effects of taxation predominate.

In the model the level of k (capital owned by every *capitalist*) has the expected implications: per capita average income is increasing in k, $r(t)$ is decreasing in k and $w(t)$ is increasing in k. Moreover, it is easily possible to proof that in this model α always represents the capital share, which is not dependent on taxation.

Figure 1: **Per capita incomes**



In the two following sections, model results will be analyzed: first, the overall production and income distribution are considered, then there will be a focus on welfare considerations. In particular, the implications of different levels of t and μ will be commented.

2.4 Overall income and its distribution

From equation 16 it clearly emerges that the overall production (and per capita income) is decreasing in t. This result derives from the fact that, in this framework, universalistic redistribution does not enhance aggregate demand, while it demotivates labor supply. Substituting $w(t)$ and $r(t)$ in equation 1 or 9 is possible to compute[6]:

$$L(t) = N\beta \frac{\frac{(\mu-1)q+1}{\mu}}{1+\frac{1-\beta}{1-\alpha}\left(\alpha+\frac{t}{1-t}\right)} \tag{18}$$

which is clearly decreasing in t.

[6]The amount of L employed in equilibrium it is straightforward derivable from equation 16, considering that $Y = L^{1-\alpha}K^{\alpha}$ and $K = Nqk$.

While average income is always decreasing in t, and the same holds for *capitalists* income $y_c(t)$ (see Appendix A, Proof 2), the *workers* income, $y_w(t)$, has a maximum in t (see Appendix A, Proof 3), which will be named τ_{yw}, and this threshold is greater then zero if $\beta \geq \frac{1-\alpha}{q(\mu-1)+1}$[7]. If this condition holds, model implications about incomes can generically be represented as in Figure 1, otherwise τ_{yw} is negative and also $y_w(t)$ is always decreasing in t[8].

Turning on the effects of μ, equation 16 highlights that average income is always decreasing in μ. Actually, $\mu > 1$ can be considered as a proxy of transaction costs to be faced in the labour market by those who do not possess capital: their reduction would be beneficial for the economic system on the whole. Moreover, $w(t)$ is increasing in μ and the opposite holds for $r(t)$.

While $y_w(t)$ is always decreasing in μ (Proof 4), $y_c(t)$ initially decreases with μ, but it begins to raise after a certain value of μ, hence it has a minimum in μ (Proof 5). If μ is over this threshold, *capitalists* lose because of the lower $r(t)$, but they benefit of the increased $w(t)$, and they replace with their work the lower labor supply of the *workers*. Despite the lower overall production and average income, the overall gain of *capitalist* is possible because it is very low and because the declining of $y(t)$ with respect to μ is marginally decreasing. In addition, both average income and *workers* income tend to stabilize for high μ; in particular, *workers* income tends to the value of the basic income $b(t)$ (they do not work, because of high transaction costs, and their income is only constituted by the public transfer).

The Gini Index of this economy is:

$$g(t) = \left[\alpha(1-t) + q(\mu-1)\left(\frac{1}{\beta} - t\right)\right] \frac{(1-q)\beta}{1+q(\mu-1)} \tag{19}$$

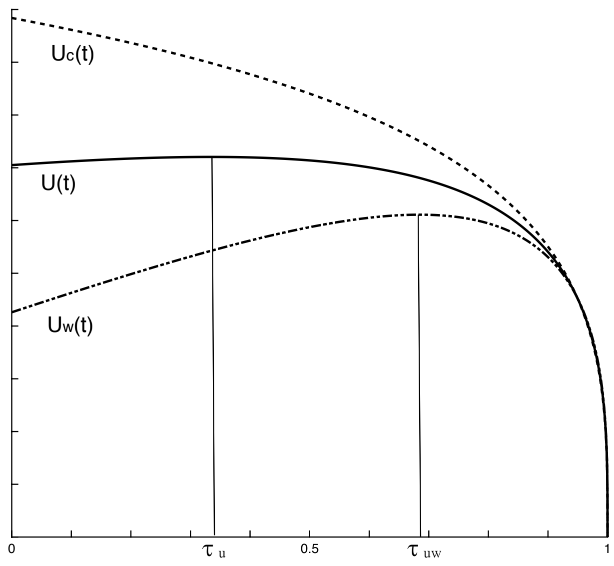
which is always decreasing in t and increasing in μ. Moreover, it is not dependent on k; the distribution of the overall capital (K) affects incomes inequality only trough q and μ.

Individuals can consider public redistribution as a substitute of equal opportunities because of "reciprocity" concerns (Fong, 2001) or because mer-

[7] In words, there exists a τ_{yw} greater than zero if the preference for consumption (β) is greater than a given threshold which is decreasing in the capital share (α), in the share of capitalists (q) and in inequality of opportunities (μ).

[8] More precisely, figure 1 refers to a framework with $\beta = 0.5$, $\alpha = 0.4$ (capital share), $q = 0.5$, and $\mu = 3$. k does not affect the lines shapes, as it is clear, for example, looking at equation viii in Appendix A.

Figure 2: **Welfare**



itocracy offers better prospects for people with low income (Alesina et al. 2005). This kind of preferences for redistribution finds a corresponding feature at macro level in the opposite effects of redistribution (t) and inequality of opportunities (μ) on the extent of income inequality.

It is useful to highlight that

$$\mu = 1 \quad \Rightarrow \quad g(t) = \alpha\beta(1-q)(1-t)$$

In case of fully equal opportunities, the Gini index is simply proportional to α (capital share), β (preference for income) and $1-q$ (share of *workers*), while it is decreasing in t.

2.5 Welfare

In Appendix A, it is shown that individual utility of *capitalists* $U_c(t)$ is always decreasing in t (Proof 6), while *workers* utility $U_w(t)$ and average welfare $U(t)$ have two different (always positive) maximums in t (respectively, τ_{u_w} and τ_u, Proofs 7 and 8).

The level of taxation, and redistribution, which maximizes average welfare (τ_u), is always increasing in μ (Proof 9). Again, public redistribution and equal opportunities can be considered as substitutes even under a welfare point of view: higher inequality of opportunities require higher taxation and redistribution. In the case of fully equal opportunities, the optimal taxation is $t = 0$.

Model implications about welfare and t can generically be represented as in figure 2[9]. The effects of t on average utility mainly pass trough a redistribution of individual h and, hence, of leisure: $h_w(t)$ is always decreasing in t (as it is clear from equation v in Appendix A), while $\frac{dh_c(t)}{dt}$ can be positive or negative according to parameter values. But if it is negative too, always holds that $\frac{dh_c(t)}{dt} > \frac{dh_w(t)}{dt}$: if also capitalists working hours decrease in t, they decrease more slowly than workers ones[10].

An interesting result of the model is to show that, if leisure preferences are taken into account, there exists a positive level of (universalistic) redistribution and taxation which maximizes social welfare, even diminishing per capita incomes. This result is consistent with the Bowles (1992) suggestion: universalistic redistribution can improve average welfare reducing the importance of the consumption of commodities and enhancing the importance of free time.

Moreover, the model highlights that the optimal level of taxation is increasing in opportunities inequality (μ).

3 Empirical exercises

The most relevant implications of the theoretical model are summed up by:

- the relation between model parameters by one side (paying particular attention to μ) and the Gini Index of the economy on the other side (equation 19), because it synthetises how incomes are formed in the described economy;
- the optimal level of universalistic redistribution and taxation (equation xvi in Appendix A), increasing in μ, because it synthetises the welfare implications of the model.

[9]More precisely, figure 2 refers to the same framework of figure 1, with $\beta = 0.5$, $\alpha = 0.4$ (capital share), $q = 0.5$, and $\mu = 3$. k does not affect the lines shapes, as it is clear, for example, looking at equation xvi in Appendix A.

[10]See Proof 10 in Appendix A.

In this section some empirical exercises are executed with the aim to verify the robustness of the model, deepening the realism of those two relations.

3.1 Gini index and meritocracy

Let's start with the study of equation 19. Assume to have proxies ($\widetilde{x}$) for the real level of t, for the Gini Index, and for the model parameters, except for μ. Solving equation 19 with respect to μ gives:

$$\widehat{\mu} = \frac{1 + \frac{\widetilde{g} - \widetilde{\alpha}\widetilde{\beta}(1-\widetilde{t})}{\widetilde{q}(1-\widetilde{\beta}\widetilde{t})}}{1 - \frac{\widetilde{g}}{(1-\widetilde{q})(1-\widetilde{\beta}\widetilde{t})}} \tag{20}$$

Now, I try to "estimate" the $\widehat{\mu}$ implied by the model for a set of OECD countries, using the following proxies[11]:

- $\widetilde{g}$: gini indexes provided by OECD (2008)[12];
- $\widetilde{\alpha} = 1 - l$: where l is the Labour Income Share provided by OECD[13];
- $\widetilde{q} = 1 - G_W$: where G_W is the Wealth Gini, provided by Davies et al. (2006)[14]. Given k and $\overline{K} = Nqk$, $\overline{K}$ is shared between the q fraction of the population. The higher is q, the fewer the inequality of capital's distribution. Obviously, "capital" is different from "wealth", but $\widetilde{q}$ could be considered a good proxy of the meaning of k in the model (its possess guarantees no labor earnings and best access to labour market);
- $\widetilde{t}$: household taxes expressed as a share of household disposable as given in OECD (2008); data refer to Mid 2000s. Obviously, this proxy can describe the extent of redistribution but not of universalistic redistribution, but it remains the best available resource;
- $\widetilde{\beta}$: finally, it is not easy to approximate β.
  - First, I try to calibrate the model.
    It is not possible to observe β, but it is possible to find a proxy for the mean share of working hours ($h(t)$)[15] and use it to go back to a plausible value of $\widetilde{\beta}$. I approximate the mean share of time

[11] The full dataset is reported in Appendix C.

[12] Data refer to mid-2000s

[13] http://stats.oecd.org, data refer to year 2005.

[14] Data refer to year 2000.

[15] Remember that the overall endowments of hours is normalized to 1.

dedicated to work ($\widetilde{h}$) dividing the annual working hours provided by OECD (2009)[16] by the total annual hours (8760). From the definitions of $h_c(t)$ and $h_w(t)$[17], and substituting the relation between Gini Index and μ (equation 20) it is easy to obtain

$$h(t) = qh_c(t) + (1-q)h_w(t) = \beta \frac{(1-\alpha)(1-t)}{(1-t\beta) + \frac{g-\alpha\beta(1-t)}{q}}$$

and then it is possible to use this definition, and $\widetilde{h}$, to calculate $\widetilde{\beta}$:

$$\widetilde{\beta}_{cal} = \frac{1 + \frac{\widetilde{g}}{\widetilde{q}}}{\widetilde{t} + (1-\widetilde{t})\left(\frac{1-\widetilde{\alpha}}{\widetilde{h}} + \frac{\widetilde{\alpha}}{\widetilde{q}}\right)} \tag{21}$$

In other words, I'm calibrating the model using proxies for q, α and t, plus the observed Gini Index and the actually worked hours, to go back to the "unobservable" μ and β[18].

- Secondly, I get data from the last wave (2008)[19] of the World Values Survey. In particular I use the question "How important it is leisure in your life?", which possible answers range from 1 (very important) to 4 (not all important). I consider the mean value answered in each country (obviously, divided by 4), as a proxy of β ($\widetilde{\beta}_{wvs}$);
- Real Business Cycle literature deals with preferences on consumption and leisure, and with the tradeoff between them. With regard to developed countries, the weight of consumption in the utility function (our β) is often rounded, more or less, to $0.35(\widetilde{\beta}_{rbc})$[20].

It is useful to signal that, for all the countries, the following relation holds: $\widetilde{\beta}_{rbc} < \widetilde{\beta}_{wvs} < \widetilde{\beta}_{cal}$. Therefore, the three proxies of $\widetilde{\beta}$ can be considered as three generic scenarios: low, middle and high preferences for consumption.

Applying those proxies to equation 20, the "estimated" $\widehat{\mu}$ are those shown in Table 1, where countries are ranked by the one with more equal opportunities to the less meritocratic one, according to the values of $\widehat{\mu}_{cal}$. Otherwise, it is interesting that the estimated $\widehat{\mu}$ highlights an high degree of qualitative

[16] Data refer to 2005.

[17] Equations iii and v in Appendix A

[18] The values of $\widetilde{\beta}_{cal}$ are presented in Table 5 in Appendix B.

[19] Data refer to 2005-2007.

[20] See Kydland et al. (1982), Cooley et al. (1995), Backus et al. (1995).

Table 1: **Estimated $\widehat{\mu}$**

Country	$\widehat{\mu}_{cal}$ ($\widetilde{\beta}_{cal}$)	$\widehat{\mu}_{wvs}$ ($\widetilde{\beta}_{wvs}$)	$\widehat{\mu}_{rbc}$ ($\widetilde{\beta}_{rbc} = 0.35$)
Slovak Republic	2.27		2.54
Luxembourg	2.35	2.41	2.52
Czech Republic	2.55		2.74
Netherlands	2.87	2.89	2.90
Norvay	2.87		2.97
Sweden	2.94	2.93	2.93
Finland	2.94	2.97	2.97
France	3.00	3.06	3.12
Austria	3.06		3.02
Australia	3.18	3.27	3.30
Belgium	3.32		3.20
South Korea	3.40	3.45	3.54
Switzerland	3.43	3.53	3.56
Canada	3.45	3.53	3.57
Denmark	3.49		3.08
Germany	3.72	3.68	3.60
New Zealand	3.72	3.88	3.91
Ireland	3.75		3.88
Japan	3.91	3.97	4.00
UK	4.04	4.04	4.04
Poland	5.23	5.03	4.96
USA	5.32	5.45	5.47
Italy	5.68	5.26	5.01

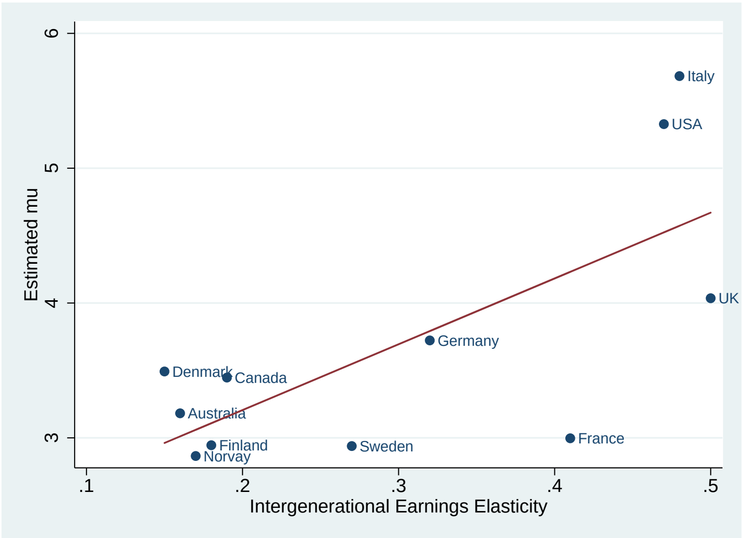
homogeneity between the results obtained by the assumption of $\widetilde{\beta}_{cal}$ and the ones obtained with $\widetilde{\beta}_{wvs}$. Only the relative rank of Italy and USA changes. Also $\widetilde{\beta}_{rbc}$ gives similar results (except for Denmark)[21].

How much arbitrary are coefficients in table 1? A good way to test their realism is to compare them with an other available measure of inequality of opportunities.

Intergenerational earnings elasticity can be considered as logically comparable with μ, because in the model μ represents labour market extra transaction costs which must be faced by agents without capital. This exogenous endowment of capital can be seen as a dynastic feature. In other words, both

[21]The $\widetilde{\mu}$ of UK is not exactly the same in the three frameworks, but it exhibits few changes: its values are 4.035 (Cal), 4.041 (Wvs) and 4.043 (Rbc).

Figure 3: **Comparing $\widehat{\mu}$ and Intergenerational Earnings Elasticity**



Regression results, dependent variable: $\widehat{\mu}_{cal}$

Variable	Coef.	Std. Err.	t	$P > \|t\|$
Earnings Elasticity	4.88	1.60	3.04	0.014
Intercept	2.23	.53	4.23	0.002

$N = 11,\ F(1,9) = 9.25,\ P > |F| = 0.01,\ R^2 = 0.51.$

$\widehat{\mu}$ and Intergenerational Earnings Elasticity can be considered as proxies for opportunities inequality.

OECD (2008) furnishes homogenous and comparable estimates of intergenerational elasticities: the comparison between them and $\widehat{\mu}$ values in Table 1 gives the results shown in Figure 3, which refers to the case with $\widehat{\mu}_{cal}$. The results obtained using $\widehat{\mu}_{wvs}$ and $\widehat{\mu}_{rbc}$ are almost equivalent (see Table in Appendix B).

Despite the fact that a low number of countries can be included in the analysis, its results seem to suggest a robust relation between $\widehat{\mu}$ emerging from the model and intergenerational earnings elasticity. This fact allows to consider as realistic the ranking in Table 1 and constitutes a relevant element in support of the theoretical model.

Moreover, the analysis presented here reinforces the picture given by

OECD(2008) data on inequality of opportunities in USA[22]: with regard to the "land of opportunities", a puzzle emerges about the divergence between empirical analyses and people perceptions on inequality of opportunities (Fong, 2001; Alesina et al. 2005).

3.2 Optimal taxation and redistribution

Assuming $\widehat{\mu}$ as a good proxy of the real μ, it is now possible to compute what should be the optimal rate of taxation and redistribution ($\widehat{\tau_u^*}$), given the level of inequality of opportunities, as a function of $\widetilde{\beta}$, $\widetilde{q}$, $\widetilde{\alpha}$ and $\widehat{\mu}$ (using equation xvi in Appendix A).

Moreover, comparing $\widehat{\tau_u^*}$ with the effective level of taxation $\widetilde{t}$ it is possible to obtain the absolute error in taxation

$$t_{gap} = \widetilde{t} - \widehat{\tau_u^*}$$

and the relative one

$$\%t_{gap} = \frac{|t_{gap}|}{\widehat{\tau_u^*}}$$

which is not dependent on the "quality" of the error (too much or too less taxation) and it is useful for the successive empirical analysis.

Table 2 shows which countries are likely to tax and redistribute too much ($t_{gap} > 0$) and which countries should enhance redistribution ($t_{gap} < 0$), given their levels of inequality opportunities ($\widehat{\mu}$).

Before to comment Table 2 it is necessary to verify the realism of the $\widehat{\tau_u^*}$ definition, since Table 2 is computed assuming it as realistic and because this would be another test of the model robustness.

With the aim to test if the optimal level of taxation identified by the model can actually be considered a proxy of the one maximizing average utility, I run a regression with the average "satisfaction with life" as dependent variable[23] and $\%t_{gap}$ as regressor[24].

Table 3 shows analyses conducted using the three specifications of $\widetilde{\beta}$.

[22]See Pistolesi (2009) for a further investigation.

[23]Source: last wave of the World Values Survey. Data refer to 2005-2007. The question used is: "All things considered, how satisfied are you with your life as a whole these days?" and answers go from 1(dissatisfied) to 10 (satisfied).

[24]In this empirical analysis I find more appropriate to use the relative error $\%t_{gap}$, but the results are almost the same using the absolute value of t_{gap}.

Table 2: **Actual and Optimal Taxation**

		$\widehat{\mu}_{cal}$			$\widehat{\mu}_{wvs}$			$\widehat{\mu}_{rbc}$		
Country	$\widetilde{t}$	$\widehat{\tau_u^*}$	t_{gap}	$\%t_{gap}$	$\widehat{\tau_u^*}$	t_{gap}	$\%t_{gap}$	$\widehat{\tau_u^*}$	t_{gap}	$\%t_{gap}$
Australia	.234	.343	-.109	.319	.383	-.149	.389	.398	-.164	.412
Austria	.334	.308	.026	.086				.335	-.001	.003
Belgium	.383	.329	.054	.166				.359	.024	.067
Canada	.258	.354	-.096	.272	.398	-.140	.351	.422	-.164	.388
Czech Republic	.216	.284	-.068	.239				.341	-.125	.367
Denmark	.525	.310	.216	.696				.336	.189	.564
Finland	.301	.313	-.012	.039	.339	-.038	.112	.352	-.051	.145
France	.260	.311	-.051	.164	.329	-.069	.210	.350	-.090	.257
Germany	.355	.360	-.005	.014	.371	-.016	.042	.393	-.038	.097
Ireland	.194	.391	-.197	.504				.451	-.257	.570
Italy	.302	.405	-.103	.253	.442	-.140	.317	.470	-.168	.358
Japan	.197	.388	-.191	.493	.427	-.230	.539	.452	-.255	.564
Luxembourg	.238	.301	-.063	.210	.319	-.081	.254	.351	-.113	.321
Netherlands	.247	.316	-.069	.219	.328	-.081	.247	.333	-.086	.257
New Zealand	.290	.380	-.090	.236	.477	-.187	.391	.495	-.205	.414
Norvay	.332	.358	-.026	.072				.414	-.082	.198
Poland	.277	.391	-.114	.292	.470	-.192	.410	.511	-.234	.458
S. Korea	.080	.300	-.220	.734	.315	-.235	.746	.348	-.268	.770
Slovak Republic	.200	.305	-.105	.343				.376	-.176	.468
Sweden	.432	.289	.144	.498	.322	.110	.342	.326	.106	.325
Switzerland	.360	.314	.046	.147	.362	-.002	.006	.378	-.018	.048
UK	.241	.357	-.116	.324	.392	-.151	.385	.406	-.165	.407
USA	.256	.359	-.103	.286	.450	-.194	.431	.394	-.101	.344

The results seem to suggest that the optimal level of taxation identified by the model can actually describe some features of the real world. Like in the previous analysis on intergenerational income elasticity and $\widetilde{\mu}$ (see Appendix B), the framework with $\widetilde{\beta}_{rbc}$ seems to be the best one to conform to the empirical data.

This fact allows to briefly comment Table 2. With the aim of summing up the informations of Table 2, countries are split in four categories in Table 4, which is built-up assuming that the empirical analysis can be a rough outline of the real world under a quantitative point of view, but it can provide an interesting information under a qualitative perspective.

4 Conclusions

This paper investigates the substitutability between public redistribution and equal opportunities, as supposed by Alesina et al. (2005) and Fong (2001).

"Inequality" is a complex concept, where different dimensions overlap each other (Sen, 1980). Public government can have much control over some fea-

Table 3: **Tax Error ($\%t_{gap}$) and average Satisfaction with Life**

Dependent variable: Satisfaction with Life			
$\%t_{gap}(\widehat{\mu}_{cal})$	-1.23^{*} (0.64)		
$\%t_{gap}(\widehat{\mu}_{wvs})$		-1.37^{**} (0.59)	
$\%t_{gap}(\widehat{\mu}_{rbc})$			-1.50^{**} (0.59)
Constant	7.75^{***} (0.21)	7.84^{***} (0.22)	7.93^{***} (0.23)
	N=16 $F(1,14) = 3.76$ $P > \|F\| = 0.07$ $R^2 = 0.21$	N=16 $F(1,14) = 5.44$ $P > \|F\| = 0.035$ $R^2 = 0.28$	N=16 $F(1,14) = 6.40$ $P > \|F\| = 0.02$ $R^2 = 0.31$

Standard errors in brackets.
Significance: $\star$: 10%, $\star\star$: 5%, $\star\star\star$: 1%.

Table 4: **Summary**

Countries that, *given their level of meritocracy*, exhibit...

...a very too high level of taxation and redistribution	$t_{gap} > 0$ $\%t_{gap} > 0.50$	Denmark
...a too high level of taxation and redistribution	$t_{gap} > 0$ $0.25 < \%t_{gap} < 0.50$	Sweden
...the optimal level of taxation and redistribution	$\%t_{gap} < 0.25$	Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands, Norvay, Switzerland
...a too low level of taxation and redistribution	$t_{gap} < 0$ $0.25 < \%t_{gap} < 0.50$	Australia, Canada, Czech Republic, Italy, New Zealand, Poland, Slovak Republic, UK, USA
...a very too low level of taxation and redistribution	$t_{gap} < 0$ $\%t_{gap} > 0.50$	Ireland, Japan, South Korea

tures of inequality, like the final distribution of incomes, using appropriate redistributive policies. On the contrary, the degree of inequality of opportunities is a social product, determined by individual behaviors, formal and informal institutional features (for example: culture), and, finally, by public policies. OECD (2008) sums up what kind of policies can affect the extent to which the social and economic position of individuals in society is determined by their skills and ambitions rather than by inherited characteristics: educational policy, early childhood investment, access to health care and immigration policy.

In this paper the policies that could enhance meritocracy are not studied. It is simply deepened how the presence of a certain level of inequality of opportunities in the society should lead governments to design appropriate redistributive policies.

The theory presented in the first part, including inequality of opportunities and preferences for leisure, finds a substitutability between redistribution and equal chances in determining the extent of incomes inequality (Gini Index). Moreover, the model suggests that there exists an optimal level of universalistic redistribution (maximizing average utility), which is increasing in inequality of opportunities.

The empirical exercises, besides being a support for the validity of the theoretical model, offer a plausible measure of meritocracy (Table 1) and suggest that, given their level of inequality of opportunities, there could be countries which should enhance redistribution and others which should reduce it. On the whole, in developed economies, income redistribution seems to be lower than the one required by the extent of inequality of opportunities.

Appendix A: Proofs

Proof 1 : $b(t)$ ***has a maximum in*** t

The derivative of $b(t)$ (equation 17) with respect to t gives:

$$\frac{db(t)}{dt}=\left[\frac{(1-\alpha\beta)(1-t)}{1-\alpha}-t(1-\beta t)\right]\left[\beta\frac{1+q(\mu-1)}{\mu}\right]^{1-\alpha}\left[\frac{qk}{1-t}\right]^{\alpha}\left[\frac{1-\alpha}{1-\beta\left[t(1-\alpha)+\alpha\right]}\right]^{2-\alpha}$$

The second, the third and the fourth elements of this product have a positive sign. Only the first element can be positive or negative. Solving:

$$\frac{(1-\alpha\beta)(1-t)}{1-\alpha}-t(1-\beta t)\geq 0 \tag{i}$$

it emerges that:

$$\frac{db(t)}{dt}\geq 0 \quad if \quad t\leq\tau_b=\left[1-\sqrt{1-\frac{4\beta\frac{1-\beta\alpha}{1-\alpha}}{\left(1+\frac{1-\beta\alpha}{1-\alpha}\right)^2}}\right]\frac{1+\frac{1-\alpha\beta}{1-\alpha}}{2\beta} \tag{ii}$$

Note that equation i holds also for :

$$t\geq\left[1+\sqrt{1-\frac{4\beta\frac{1-\beta\alpha}{1-\alpha}}{\left(1+\frac{1-\beta\alpha}{1-\alpha}\right)^2}}\right]\frac{1+\frac{1-\alpha\beta}{1-\alpha}}{2\beta}$$

which is greater than one (proof available from the author).

Proof 2 : ***Capitalists income is always decreasing in*** t

First of all, it is necessary to compute $h_c(t)$ substituting $b(t)$ (equation 17), $r(t)$ (equation 15) and $w(t)$ (equation 14) in the definition of h_c (equation 7). The result is:

$$h_c(t)=\beta\left[1-\left(q+\alpha\frac{1-t}{t}\right)\frac{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}{1+\frac{1-\alpha\beta}{1-\beta}\frac{1-t}{t}}\right] \tag{iii}$$

Now, $y_c(t)$ is computable substituting $h_c(t)$ (equation iii), $b(t)$ (equation 17), $r(t)$ (equation 15) and $w(t)$ (equation 14) in equation 3:

$$y_c(t)=\left[\left(\frac{\alpha}{q}(1-t)-t(\mu-1)\right)\frac{1-q}{\mu}\beta+1\right]\left[\beta\frac{1-\alpha}{(1-\beta)\frac{t}{1-t}+1-\alpha\beta}\right]^{1-\alpha}\left[\frac{k}{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}\right]^{\alpha} \tag{iv}$$

which is clearly always decreasing in t.

Proof 3 : ***Workers income has a maximum in*** t

First of all, it is necessary to compute $h_w(t)$ substituting $b(t)$ (equation 17) and $w(t)$ (equation 15) in the definition of h_w (equation 8). The result is:

$$h_w(t) = \frac{\beta}{\mu}\left[1 - \frac{1+q(\mu-1)}{1+\frac{1-\alpha\beta}{1-\alpha}\frac{1-t}{t}}\right] \tag{v}$$

Now, $y_w(t)$ is computable substituting $h_w(t)$ (equation v), $b(t)$ (equation 17) and $w(t)$ (equation 14) in equation 4:

$$y_w(t) = \frac{1+\beta\left[\left(q(\mu-1)+\alpha\right)t-\alpha\right]}{\mu}\left[\beta\frac{1-\alpha}{(1-\beta)\frac{t}{1-t}+1-\alpha\beta}\right]^{1-\alpha}\left[\frac{k}{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}\right]^{\alpha} \tag{vi}$$

The derivative of $y_w(t)$ with respect to t gives:

$$\frac{dy_w(t)}{dt} = \left[\beta t^2 - t\left(1+\frac{1-\alpha\beta}{1-\alpha}\right) + \frac{1-\alpha\beta}{q(\mu-1)+\alpha}\left(\frac{1+q(\mu-1)}{1-\alpha} - \frac{1}{\beta}\right)\right]\times$$

$$\times\frac{q(\mu-1)+\alpha}{\mu(1-t)^2}\left[\frac{\beta(1-\alpha)}{\frac{t(1-\beta)}{1-t}+1-\alpha\beta}\right]^{2-\alpha}\left[\frac{k}{1+\frac{1}{\mu}\left(\frac{1}{q}-1\right)}\right]^{\alpha}$$

where the second, the third and the fourth elements have a positive sign. Only the first element can be positive or negative. Solving:

$$\beta t^2 - t\left(1+\frac{1-\alpha\beta}{1-\alpha}\right) + \frac{1-\alpha\beta}{q(\mu-1)+\alpha}\left(\frac{1+q(\mu-1)}{1-\alpha} - \frac{1}{\beta}\right) \geq 0 \tag{vii}$$

it emerges that:

$$\frac{dy_w(t)}{dt} \geq 0 \quad if \quad t \leq \tau_{yw} = \left[1 - \sqrt{1 - \frac{\frac{4\beta(1-\alpha\beta)}{q(\mu-1)+\alpha}\left(\frac{q(\mu-1)+1}{1-\alpha} - \frac{1}{\beta}\right)}{\left(1+\frac{1-\alpha\beta}{1-\alpha}\right)^2}}\right]\frac{1+\frac{1-\alpha\beta}{1-\alpha}}{2\beta} \tag{viii}$$

It is easy to proof that $\tau_{yw} \geq 0$ if $\beta \geq \frac{1-\alpha}{q(\mu-1)+1}$.

Note that condition vii holds also for:

$$t \geq \left[1 + \sqrt{1 - \frac{\frac{4\beta(1-\alpha\beta)}{q(\mu-1)+\alpha}\left(\frac{q(\mu-1)+1}{1-\alpha} - \frac{1}{\beta}\right)}{\left(1+\frac{1-\alpha\beta}{1-\alpha}\right)^2}}\right]\frac{1+\frac{1-\alpha\beta}{1-\alpha}}{2\beta}$$

which is ever greater than one (proof available from the author).

Proof 4 : ***Workers income is always decreasing in*** μ

Deriving $y_w(t)$ (equation vi) with respect to μ gives:

$$\frac{dy_w(t)}{d\mu} = -\left[\frac{\beta(1-\alpha)}{\frac{t(1-\beta)}{1-t}+1-\alpha\beta}\right]^{1-\alpha}\left[\frac{k}{1+\frac{\frac{1}{q}-1}{\mu}}\right]^{\alpha}\times$$

$$\times\frac{\mu\left[1-\beta\left[\alpha+(1-\alpha)qt\right]\right]+\left(\frac{1}{q}-1\right)(1-\alpha)\left[1-\beta\left[tq+(1-t)\alpha\right]\right]}{\mu^2\left[\mu+\frac{1}{q}-1\right]}$$

which is always negative.

Proof 5 : ***Capitalists income has a minimum in*** μ

Deriving $y_c(t)$ (equation iv) with respect to μ gives:

$$\frac{dy_c(t)}{d\mu} = \left[\frac{\beta(1-\alpha)}{\frac{t(1-\beta)}{1-t}+1-\alpha\beta}\right]^{1-\alpha}\left[\frac{k}{1+\frac{\frac{1}{q}-1}{\mu}}\right]^{\alpha}\frac{\beta(1-\alpha)}{\mu\left(1+\mu\frac{q}{1-q}\right)}\times$$

$$\times\left[\frac{\alpha}{1-\alpha}\frac{1-\beta}{\beta}-tq-\frac{1-q}{\mu}\left[t+(1-t)\frac{\alpha}{q}\right]\right]$$

where only the last element can be positive or negative. Solving

$$\frac{\alpha}{1-\alpha}\frac{1-\beta}{\beta}-tq-\frac{1-q}{\mu}\left[t+(1-t)\frac{\alpha}{q}\right]\geq 0$$

it results that

$$\frac{dy_c(t)}{d\mu}\geq 0 \quad if \quad \mu\geq\frac{q+\frac{1-t}{t}\alpha}{\frac{\alpha}{1-\alpha}\frac{1-\beta}{\beta}\frac{1}{t}-q}\frac{1-q}{q}$$

Proof 6 : ***Capitalists welfare is always decreasing in*** t

Capitalists utility is easily computable substituting equations iii and iv in equation 5, and it results to be:

$$U_c(t) = \frac{q\mu+\beta(1-q)\left[\alpha(1-t)-tq(\mu-1)\right]}{\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]^{1-\alpha\beta}}(1-t)^{\beta(1-\alpha)}\times\frac{A}{(q\mu)^{1-\beta}} \qquad \text{(ix)}$$

where A is a positive parameters combination not dependent on t:

$$A=(1-\beta)^{1-\beta}\left[\left(\frac{\beta(1-\alpha)}{q\mu}\right)^{1-\alpha}\left(\frac{k}{1+q(\mu-1)}\right)^{\alpha}\right]^{\beta}$$

The derivative of $U_c(t)$ with respect to t can be written as:

$$\frac{dU_c(t)}{dt} = -\frac{t(1-t)^{\beta(1-\alpha)-1}\beta(1-\beta)(1-\alpha)}{\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]^{2-\alpha\beta}} \times A \times$$

$$\times \left[\frac{\alpha+q(\mu-1)}{1-\alpha}\frac{(1-t)(1-q)}{t}\frac{1-\beta\left[\alpha+t(1-\alpha)\right]}{1-\beta} + \beta(1-q)\left[\alpha(1-t)+tq\right] + q\mu\left[1-\beta t(1-q)\right]\right]$$

which is always negative.

Proof 7 : ***Workers welfare has a maximum in*** t

Workers utility is easily computable substituting equations v and vi in equation 6, and it results to be:

$$U_w(t) = \frac{1-\beta\left[\alpha(1-t)-tq(\mu-1)\right]}{\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]^{1-\alpha\beta}}(1-t)^{\beta(1-\alpha)} \times A \tag{x}$$

The derivative of $U_w(t)$ with respect to t can be written as:

$$\frac{dU_w(t)}{dt} = \left[q(\mu-1)+\alpha-\frac{t(1-\beta)(1-\alpha)\left[1-\beta\left[\alpha(1-t)-tq(\mu-1)\right]\right]}{(1-t)\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]}\right] \times$$

$$\times \frac{\beta(1-t)^{\beta(1-\alpha)}}{\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]^{1-\alpha\beta}} \times A$$

where only the the first element can be positive or negative. Solving:

$$q(\mu-1)+\alpha-\frac{t(1-\beta)(1-\alpha)\left[1-\beta\left[\alpha(1-t)-tq(\mu-1)\right]\right]}{(1-t)\left[1-\beta\left[\alpha+t(1-\alpha)\right]\right]} \geq 0 \tag{xi}$$

and defining:

$$B = 1+\left(\frac{1}{\beta}-\alpha\right)\left[\frac{1}{1-\alpha}+\frac{1-\beta}{q(\mu-1)+\alpha}\right]$$

it emerges that

$$\frac{dU_w(t)}{dt} \geq 0 \quad if \quad t \leq \tau_{u_w} = \left[\frac{1}{2}-\sqrt{\frac{1}{4}-\frac{\beta}{B^2}\frac{\frac{1}{\beta}-\alpha}{1-\alpha}}\right]\frac{B}{\beta} \tag{xii}$$

It is easy to proof that τ_{u_w} is always greater than zero.

Note that condition xi holds also for:

$$t \geq \left[\frac{1}{2}+\sqrt{\frac{1}{4}-\frac{\beta}{B^2}\frac{\frac{1}{\beta}-\alpha}{1-\alpha}}\right]\frac{B}{\beta}$$

which is always greater than one (proof available from the author).

Proof 8 *: **Average welfare has a maximum in** t*

The average utility is given by:

$$U(t) = qU_c(t) + (1-q)U_w(t) \tag{xiii}$$

using equations ix and x, it results to be:

$$U(t) = \left[1 + q(\mu^\beta - 1) - \beta(1-q)\left[\alpha(1-t) - tq(\mu-1)\right]\left[1 - \frac{1}{\mu^{1-\beta}}\right]\right] \times$$

$$\times \frac{q^\beta (1-t)^{\beta(1-\alpha)}}{\left[1 - \beta\left[\alpha + t(1-\alpha)\right]\right]^{1-\alpha\beta}} \times A \tag{xiv}$$

the derivative of $U(t)$ with respect to t gives:

$$\frac{dU(t)}{dt} = \frac{q^\beta \beta(1-q)(1-t)^{\beta(1-\alpha)}}{\left[1 - \beta\left[\alpha + t(1-\alpha)\right]\right]^{1-\alpha\beta}} \times A \times$$

$$\times \left[q(\mu-1) + \alpha - \frac{t}{1-t}\frac{(1-\beta)(1-\alpha)}{1-\beta\left[\alpha + t(1-\alpha)\right]}\left[\frac{1}{1-\frac{1}{\mu^{1-\beta}}}\frac{q(\mu^\beta-1)+1}{1-q} - \beta\left[\alpha(1-t) - tq(\mu-1)\right]\right]\right]$$

where only the last element can be positive or negative. Solving:

$$q(\mu-1)+\alpha-\frac{t}{1-t}\frac{(1-\beta)(1-\alpha)}{1-\beta\left[\alpha+t(1-\alpha)\right]}\left[\frac{1}{1-\frac{1}{\mu^{1-\beta}}}\frac{q(\mu^\beta-1)+1}{1-q} - \beta\left[\alpha(1-t)-tq(\mu-1)\right]\right] \geq 0 \tag{xv}$$

and defining:

$$C(\mu) = \frac{1+\beta(1-2\alpha)}{1-\alpha} + \frac{1-\beta}{q(\mu-1)+\alpha}\left(\frac{1+q(\mu^\beta-1)}{1-q}\frac{1}{1-\frac{1}{\mu^{1-\beta}}} - \beta\alpha\right)$$

it emerges that

$$\frac{dU(t)}{dt} \geq 0 \quad if \quad x \leq t \leq \tau_u = \left[\sqrt{1 + \left(\frac{2\beta}{C(\mu)}\right)^2 \frac{1-\alpha\beta}{1-\alpha}} - 1\right]\frac{C(\mu)}{2\beta^2} \tag{xvi}$$

where x is a negative number: for our analysis, it is sufficient to consider $t \leq \tau_u$, and it is easy to proof that τ_u is always positive and minor than one.

Finally, considering equation xiii and that $\frac{dU_c(t)}{dt}$ is always negative, it is easy to conclude that $\tau_u < \tau_{u_w}$.

Proof 9 : ***Optimal taxation,*** τ_u***, is increasing in*** μ

From equation xvi it is possible to obtain:

$$\frac{d\tau_u}{d\mu} = \left[\frac{1}{\sqrt{1 + 4\beta^2 \frac{1-\alpha\beta}{C(\mu)^2(1-\alpha)}}} - 1 \right] \frac{\frac{dC(\mu)}{d\mu}}{2\beta^2}$$

where the first element is negative (the first addend in parenthesis is minor than one) and $\frac{dC(\mu)}{d\mu}$ is negative too:

$$\frac{dC(\mu)}{d\mu} = \frac{(1-\beta)q}{\alpha^2 \left[1 + (\mu - 1)\frac{q}{\alpha}\right]^2} \times$$

$$\times \left[\frac{\mu^{1-\beta}}{(1-q)\left[\mu^{1-\beta} - 1\right]^2} \left[-(1-\alpha)\left(1 - \frac{1}{\mu^{1-\beta}}\right) - \left[q(\mu - 1) + 1\right] \frac{1-\beta}{\mu} \left(\mu - 1 + \frac{\alpha}{q}\right) \right] - (1-\alpha\beta) \right]$$

where the first element is always positive, while the second one have all negative addends.

Proof 10 : ***Dynamics of*** $h_c(t)$ ***and*** $h_w(t)$ ***with respect to*** t

Equation v clearly shows that $\frac{dh_w(t)}{dt} < 0$.
Computing $\frac{dh_c(t)}{dt}$ from equation iii, it results:

$$\frac{dh_c(t)}{dt} = \left[\alpha \left[1 - \beta(1-q)\right] - q\right] \frac{\beta(1-\beta)\left[1 + q(\mu - 1)\right]}{\mu q \left[1 - t\beta - \alpha\beta(1-t)\right]^2}$$

where the first element determines the expression's sign and it results that:

$$\frac{dh_c(t)}{dt} > 0 \quad if \quad q < \frac{1-\beta}{\frac{1}{\alpha} - \beta}$$

Even in the case $\frac{dh_c(t)}{dt} < 0$, computing $\frac{dh_w(t)}{dt}$ from equation v, it is easy to show that:

$$\frac{dh_c(t)}{dt} > \frac{dh_w(t)}{dt} \quad if \quad \alpha(1-\beta) > 0$$

and this condition is always satisfied.

Appendix B: Additional Tables

Table 5: $\widetilde{\beta}_{cal}$

Australia	.53	Luxembourg	.49
Austria	.52	Netherlands	.42
Belgium	.54	New Zealand	.65
Canada	.57	Norvay	.52
Czech Republic	.55	Poland	.69
Denmark	.66	S. Korea	.54
Finland	.53	Slovak Republic	.52
France	.52	Sweden	.60
Germany	.52	Switzerland	.65
Ireland	.51	UK	.56
Italy	.60	USA	.74
Japan	.53	Mean	.57

Table 6: **Comparing $\widehat{\mu}$ and Intergenerational Earnings Elasticity (2)**

Regression results, dependent variable: $\widehat{\mu}_{wvs}$

Variable	Coef.	Std. Err.	t	$P > \|t\|$
Earnings Elasticity	4.85	1.87	2.60	0.036
Intercept	2.19	.66	3.30	0.013

$N = 9$, $F(1,7) = 6.74$, $P > |F| = 0.04$, $R^2 = 0.49$.

Regression results, dependent variable: $\widehat{\mu}_{rbc}$

Variable	Coef.	Std. Err.	t	$P > \|t\|$
Earnings Elasticity	4.54	1.37	3.31	0.009
Intercept	2.28	.45	5.05	0.001

$N = 11$, $F(1,9) = 10.93$, $P > |F| = 0.009$, $R^2 = 0.54$.

Appendix C: Dataset

	Gini Index	Wealth Gini	Labour Share	Household Taxes	Intergen. Income Elasticity	Satisfaction with Life	Preferences	Annual Hours
	$\widetilde{g}$	G_W	l	$\widetilde{t}$			$\widetilde{\beta}_{wvs}$	
		$\widetilde{q} = 1 - G_w$	$\widetilde{\alpha} = 1 - l$					$\widetilde{h} = \frac{hours}{8760}$
Australia	.301	.622	.605	.234	.16	7.3	.4	1732
Austria	.265	.644	.692	.334	.	.	.	1652
Belgium	.271	.66	.673	.383	.	.	.	1565
Canada	.317	.663	.601	.258	.19	7.8	.43	1738
Czech Republic	.268	.624	.613	.216	.	.	.	2002
Denmark	.232	.765	.685	.525	.15	.	.	1556
Finland	.269	.621	.641	.301	.18	7.8	.41	1718
France	.281	.73	.671	.26	.41	6.9	.44	1559
Germany	.298	.671	.666	.355	.32	7.1	.47	1435
Ireland	.328	.581	.572	.194	.	.	.	1654
Italy	.352	.609	.669	.302	.48	6.9	.46	1819
Japan	.321	.547	.576	.197	.	7	.42	1775
Luxembourg	.258	.649	.549	.238	.	7.9	.44	1570
Netherlands	.271	.649	.671	.247	.	7.8	.37	1362
New Zealand	.335	.651	.496	.29	.	7.9	.4	1827
Norvay	.276	.633	.517	.332	.17	.	.	1417
Poland	.372	.656	.567	.277	.	7	.47	1983
S. Korea	.312	.579	.767	.08	.	6.4	.48	2364
Slovak Republic	.268	.627	.502	.2	.	.	.	1708
Sweden	.234	.776	.675	.432	.27	7.7	.38	1575
Switzerland	.276	.803	.659	.36	.	8	.43	1669
UK	.335	.697	.701	.241	.5	7.6	.41	1676
USA	.381	.801	.66	.256	.47	7.3	.43	1795
Mean	.2959	.6634	.6299	.2935	.3	7.4	.43	1706

Gini Index - source: OECD (2008); years: mid-2000s.
Wealth Gini - source: Davies et al. (2006), research of the United Nations University; year: 2000.
Labour share - source: http://stats.oecd.org; year: 2005.
Household taxes - source: OECD (2008); years: mid-2000s.
Intergenerational Income Elasticity - source: OECD (2008); years: early 2000s.
Satisfaction with Life - source: World Values Survey, last wave (2008); years: 2005-2007, "All things considered, how satisfied are you with your life as a whole these days?", 1(dissatisfied) - 10 (satisfied).
Preferences - source: World Values Survey, last wave (2008); years: 2005-2007. "How important it is leisure in your life?", 1 (very important) - 4 (not all important), $\widetilde{\beta}_{wvs} = \frac{mean}{4}$.
Annual Hours (of work) - source: OECD(2009); year 2005.

References

Alesina A. and La Ferrara (2005), "Preferences for Redistribution in the Land of Opportunities", *Journal of Public Economics*, Volume 89, Issues 5-6, June 2005, Pages 897-931.

Atkinson, A.B. (1995), "Public Economics in Action. The Basic Income/Flat Tax Proposal", Oxford, Clarendon Press.

Backus, D., P. Kehoe, and F. Kydland. 1995, "International Business Cycles: Theory and Evidence", in Frontiers of Business Cycle Research, edited by T. Cooley. Princeton University Press.

Becker, G.S., Tomes, N., (1986), "Human capital and the rise and fall of families", *Journal of Labor Economics"*, 4, S1–S38.

Benabou, R. and E. Ok (2001), "Social Mobility and the Demand for Redistribution: The Poum Hypotesis", *The Quarterly Journal of Economics*, MIT Press, vol. 116(2), pp. 447-487.

Bowles, S. (1992), "Is Income Security Possible in a Capitalist Economy?", *European Journal of Political Economy*, 8, 557-578.

Bowles, S. and H. Gintis (2002), "The Inheritance of Inequality", *Journal of Economic Perspectives*, Vol. 16, No. 3.

Bowles S., Gintis H. and Fong C. (2001), "Reciprocity and the Welfare State", in J. M. Ythier, Handbook of the economics of giving, reciprocity and altruism, ed. North Holland-Elsevier.

Carneiro, P. and Heckman, J. (2002). The Evidence on Credit Contraints in Post-secondary Schooling, *Economic Journal*,112: 989-1018.

Calvó-Armengol, A. and Jackson, M. (2004),"The Effects of Social Networks on Employment and Inequality", *American Economic Review*, 94, 426-455.

Checchi, D., (2005), "The Economics of Education: Human Capital, Family

Background and Inequality", Cambridge University Press.

Cooley T. F. and Prescott E. C. (1995), "Economic Growth and Business Cycles" in Frontiers of business cycle research, Cooley, T.F. Ed. Princeton University Press. Princeton.

D'Addio, A.C. (2007), "Intergenerational Transmission of Disadvantage: Mobility or Immobility across Generations? A Review for OECD countries", OECD Social, Employment and Migration Working Paper, No. 52, OECD, Paris.

Davies J.B., Sandstrom S., Shorrocks A., and Wolff E.N (2006), "The World Distribution of Household Wealth", Research of the United Nations University (UNU-WIDER). Helsinki, World Institute for Development Economics.

Fong C., (2001) "Social Preferences, Self-interest, and the Demand for Redistribution", *Journal of Public Economics*, 82, pp. 225-246.

Kydland, F.E. and Prescott, E.C. (1982), "Time to Build and Aggregate Fluctuations", *Econometrica*, 50(6), pp. 1345-1370.

Meltzer, R. (1981), "A Rational Theory of the Size of Government", *Journal of Political Economy*, n. 89, pp. 914-927.

Montgomery J. (1991), "Social Networks and Labor Market Outcomes: Toward an Economic Analysis," *American Economic Review*, 81(5):1408-18.

OECD (2008), Growing Unequal? Income distribution and poverty in Oecd Countries.

OECD (2009), OECD Factbook 2009: Economic, Environmental and Social Statistics.

Pistolesi Nicolas, (2009) "Inequality of opportunity in the land of opportunities, 1968–2001", *Journal of Economic Inequality*, Vol. 7, n.4, 411-433.

Roemer, J. (2000), "Equality of Opportunity", in Meritocracy and Economic

Inequality, Arrow K. (ed.), Bowles S.(ed.), Durlauf S., (ed.), Princeton University Press, 2000.

Sen, A. (1980), "Equality of What?", in S. M. McMurrin (Ed.), Tanner Lectures on Human Values, Vol. I, Cambridge University Press, Cambridge.

Sen, A. (2000), "Merit and Justice", in Meritocracy and Economic Inequality, Arrow K. (ed.), Bowles S.(ed.), Durlauf S., (ed.), Princeton University Press, 2000.

Staffolani S., Valentini E. (2007), "Bequest Taxation and Efficient Allocation of Talents", *Economic Modelling*, 24, pp. 648-672.

Van Parijs, P., editor (1992) Arguing for basic income. Clarendon Press, Oxford.

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