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WEALTH DISTRIBUTION, INVESTMENT IN HUMAN CAPITAL AND OCCUPATIONAL CHOICE WHEN CAPITAL MARKETS ARE IMPERFECT

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Abstract

In order to study the long-run effects of agents' heterogeneity we consider overlapping generations of individuals who differ from one another in wealth and inefficiency level. When young, agents choose whether to invest or not in human capital. Since the net return of human capital investment is positive, agents who can afford such an investment, do invest. In the second period of life, agents make an occupational choice. They choose to be workers or entrepreneurs. There exists a critical level of inefficiency below which becoming entrepreneur is profitable. The wealth distribution and the occupational structure of agents changes over time, the former being the cause and the effect of the latter. The long run wealth distribution is stationary and can be either ergodic or not, with long-run occupational mobility or not. We show how the economy's structural parameters and the types of intergenerational transmission of skills affect the dynamic patterns and the long-run equilibria.

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INTRODUCTION

"The study of income inequality - its causes, its consequences, and its potential policy implications - has a long history in economics, although it has not always had a high profile among researchers and policymakers. To borrow a phrase from Professor Atkinson, income distribution in recent years has been « brought in from the cold» ." (Alan Greenspan, opening speech at the Symposium on "Income Inequality", organized by Federal Reserve Bank of Kansas City).

In neoclassical growth models, the assumptions of complete markets and perfect competition lead to ergodic dynamics of income and wealth. Therefore the long-run equilibrium does not depend on initial conditions and income heterogeneity disappears, a conclusion which is clearly inconsistent with the empirical evidence.

The endogenous growth literature has revived the interest of macroeconomists on the issue of income distribution. In fact, if the representative agent hypothesis is abandoned in these models, heterogeneity persists because of differences in technologies, which agents have access to, or because of different degrees in the rate of human capital accumulation.

Recent empirical analysis has emphasized a negative relation between growth and inequality. Moreover, empirical evidence supports the view that redistributive policies in many cases favorite growth.

Since the early 90's, the New Growth literature has stimulated a rich literature on the long-run effects of inequality. Two channels have been detected, which inequality and growth interact through.

The first is the political-economic channel, which interprets redistributive policy as the result of a majority vote in order to choose a tax rate proportional to capital income. Since voters benefit equally from public spending while pay in proportion to their capital income, the lower their tax base relatively to the mean, the higher the tax rate they prefer. Therefore, the more unequal the wealth distribution, the tighter the redistributive policy. Taxation has anyway a disincentive effect on capital accumulation, since it reduces private return from capital, and gives rise to lower savings, investment and growth. Therefore, most of the models belonging to this literature claim that the redistribution from capitalists to workers negatively affects growth.

The second channel, which inequality and growth interact through, is based on the imperfection of capital markets. If investment decisions take place in a context of inequality and incomplete markets for capital there exists the possibility that human and/or physical capital accumulation is not efficient. This is due to differences in investment opportunities which may perpetuate inequality itself. Models belonging to this branch of literature address the consequences of capital market imperfections for human capital investment (Galor and Zeira 1993; Owen and Weil 1998; Benabou 1996a and 1996b), or for investment in fixed capital is developed (Banerjee and Newman 1993; Aghion and Bolton 1997; Piketty 1997; Bhattacharya 1998).

In this paper a model is developed which explores the long-run effects of income and wealth inequality via capital market imperfections affecting both human capital and physical capital investment. The results may, at least in a way, interpret the different cross-countries dynamics of wealth distribution as far as multiple equilibria are obtained. One country may take off and converge to a high level of wealth with the whole population highly qualified, while another, because of its worse initial condition (highly unequal wealth distribution and low average wealth), may be trapped into poverty and into non qualification. Moreover the model may explain social mobility, since changes in occupational classes may be both the cause and the effect of the accumulation. In particular the model can provide a rationale for the familiar determinants of social mobility. Both the empirical and the theoretical literature has stressed that these determinants are both genetic and altruistic. The stronger these components, the more sons' income and wealth are related to fathers' ones. Genetic components consists in the ability to earn (productivity) inherited from fathers. Altruistic components make sons' income depending on fathers' ones thanks to fathers' investments in sons' education and upgrading. In the model developed in this paper, if skills are inheritable and incomes are skill-dependent, sons' income is related to the fathers' one. Analogously, the more fathers bequeath their sons, the more sons' income and wealth destiny is downward rigid, that is the worst sons can do is to remain in their fathers' income and wealth classes. In other words a high altruism implies upward mobility between income, wealth and occupational classes.

The model yelds different dynamic patterns (see section 3) according to the economy's structural parameters and to the transmission of entrepreneurial skills, that is individual technical ineffeciency. Individual inefficiency is the sum of two components: the first one is genetic, resulting from the joint influence of genetics and familiar environment where potential entrepreneur grows up. The second component is totally random, due to the joint action of Fortune and Nature. If the degree of inheritability of the inefficiency is low, the dynamics of wealth accumulation is ergodic and long-run distribution does not depend on initial conditions. On the contrary, the higher the genetic component, the more the dynamics is non-ergodic and may depend or not on initial conditions. There may exist multiple equilibria.

1 ASSUMPTIONS

Let's consider a closed economy, with two goods: the output good which can be either consumed or invested and the capital good, which can be used only in the production of the output good.

There exist overlapping generations of a countable infinity of two-period lived agents. Population is constant over time. Young agents are endowed with one unit of labour and differ ex-ante from one another in their degree of technical inefficiency (ν_t) and wealth (b_t), that is the bequest received from their fathers. The cumulative distribution function of progenitors' wealth $G(b)$ is exogenously given. $G(b)$ represents the share of the population having initial wealth lower or equal to b. I assume that wealth is uniformly distributed among progenitors on the support $(0, 1)$.

The progenitors' technical inefficiency is randomly assigned by Nature according to a uniform distribution on $(0, 1)$. The degree of technical inefficiency is transmitted from a generation to the other according to the following law of motion:

$$\nu_{t+1} = \rho\nu_t + (1 - \rho) u_{t+1} \tag{1}$$

with $0 < \rho < 1$ and $u_{t+1} \sim U(0, 1)$. According to (1) each agents' degree of inefficiency is a linear combination of his father's technical inefficiency and of a random component whose realizations are extracted from a time-invariant uniform distribution. ρ measures the degree of inheritability of technical inefficiency. This implies that, only if technical inefficiency were a pure random quality $(\rho = 0)$ or a pure genetic quality $(\rho = 1)$, each generation would be characterized by the same distribution of abilities. The stochastic component of technical inefficiency could be interpreted as the effect of congenital skill randomly chosen by Nature according to a time-invariant distribution.

1. Note that

$$E(\nu_{t+1}) = \rho^{t+1} E(\nu_0) + \left(1 + \rho + ... + \rho^t\right)(1 - \rho) E(u_{t+1})$$

$$\lim_{t \to +\infty} E\left(\nu_{t+1}\right) = 0.5$$

The higher the degree of inheritability of ν, the more volatile the degree of technical inefficiency from a generation to the other are greater. The maximum oscillation is $(1 - \rho)$. Therefore, the lower ρ, the wider the intergenerational oscillations in the degree of technical inefficiency, that is the variance of ν

$$Var\left(\nu_t\right) = \tfrac{1}{12}\left[(1 - \rho)^2 \left((\rho)^{2(t-1)} + (\rho)^{2(t-2)} + \ldots + 1\right) + \rho^{(2t)}\right]$$

$$\lim_{t \to \infty} Var\left(\nu_t\right) = \frac{1}{12}\left(1 - \rho\right)^2$$

Preferences are homogeneous among the population. The individual utility function is the following:

$$u = c_{t+1}^{(\gamma)} b_{t+1}^{(1-\gamma)} \tag{2}$$

where c_{t+1} represents individual consumption in the second period of life and b_{t+1} represents the level of bequests left to each agent's son.

In the first period of life, agents choose whether to save the whole inheritance, or to invest it (at least in part) in human capital. The investment is indivisible and equal to $\underline{h}$. Therefore agents face a binary ("all or nothing") choice. Assuming that agents cannot borrow to finance education, poor agents, with $b_t < \underline{h}$, are not able to undertake any kind of human capital investment.

Education makes agents more efficient and more productive. The second-period level of inefficiency (ν^o) [1], is lower for agents who have undertaken investment in education, while it remains the one assigned by Nature for unskilled agents: $\nu^o = \nu - h = \begin{cases} \nu \text{ for } h = 0 \\ \nu - \underline{h} \text{ for } h = \underline{h} \end{cases}$.

In the second period of life agents choose whether to become entrepreneurs or to supply their own endowment of labour. The marginal productivity of skilled workers, exogenous and constant, is equal to $\underline{w} + \delta \underline{h}$, and it is higher than that of unskilled workers.. Labour is remunerated according to marginal productivity. Therefore the wage rate at an exogenous and constant rate. In

[1] "o" stands for "old".

particular, the rate of reward of unskilled workers is $\underline{w}$, and the rate of return of skilled labour is $\underline{w} + \delta \underline{h}$, where $\delta \underline{h}$ is a sort of college premium.

Each agent is endowed with an entrepreneurial project and therefore is a potential entrepreneur. The more inefficient the agent, the lower the outcome of his project. The undertaking of the investment project requires x units of the output good as input and one unit of labour, the entrepreneur's one.[2] The physical capital investment technology transforms period t output in period $t+1$ capital. Each project outcome is negatively related to the entrepreneur's level of inefficiency according to the following equation:

$$k_{t+1} = \bar{K}(1 - \nu^o) = \begin{cases} \bar{K}(1 - \nu) & \text{for } h = 0 \\ \bar{K}(1 - \nu + \underline{h}) & \text{for } h = \underline{h} \end{cases}$$

Technical inefficiency is an entrepreneurial characteristic, à la Bernanke e Gertler (1989): the more an agent is technically inefficient, the lower the outcome of his entrepreneurial investment project[3].

All the progenitors are all liquidity constrained, that is their wealth is lower than the input requirement x. Therefore they cannot self finance their investment project and must ask for credit. The interest rate on loans is exogenously given. The gross interest rate is i. Agents who do not become entrepreneurs offer their labour endowment and invest their savings in the capital market getting a return equal to i. The lending policy is accommodating since the interest rate is exogenously fixed by the Central Bank and lenders accommodate the demand for funds at that rate. This implicitly means that there always exists excess supply of loanable fund.

At the end of the production process, in period $t+1$, the entrepreneur sells the capital good at the relative price q, exogenous and constant. The gross return from the investment project (ϕ) is therefore

$$\phi = q\bar{K}(1 - \nu^o)$$

Aggregate capital produced in the economy is used in the production of the output good. Once the capital good is produced and sold, entrepreneurs/debtors must refund the loan they got. The entrepreneur's profit is therefore

$$\pi_{t+1} = q\bar{K}(1 - \nu^o) - i(x - b_t^o)$$

[2] An entrepreneur can be interpreted as a self-employed worker à la Banerjee and Newman.

[3] In Bernanke e Gertler (1989), the more an agent is inefficient, the higher the input requirement he needs in order to invest.

where b_t^o, the individual wealth when old, is equal to b_t if the agent has not invested in education; to $b_t - \underline{h}$ if he has invested in education.

Given the hypotheses on wages and on profit, the marginal return from education is constant and equal to δ for workers and it is equal to $q\overline{K}$ for entrepreneurs. Capital depreciates completely in each period. Therefore, in each period, aggregate capital is the sum of all the undertaken projects. Inputs in the production of the output good are skilled (L_q) and unskilled labour (L_{nq}) and capital (K). Given the hypotheses on factors rewards, aggregate output is

$$Y = \underline{w}L_{nq} + (\underline{w} + \delta\underline{h})\, L_q + qK \tag{3}$$

2 HUMAN CAPITAL INVESTMENT AND OCCUPATIONAL CHOICE

From the maximization of utility (2) subject to the budget constraint $c_{t+1} + b_{t+1} \leq y_{t+1}$ it is immediate to conclude that each agent bequeaths his son with a share $(1 - \gamma)$ of his second-period income (y_{t+1}), while the residual is consumed: $b_{t+1} = (1 - \gamma)\, y_{t+1}$; $c_{t+1} = \gamma y_{t+1}$. The indirect utility function therefore is linear in income:

$$u = \gamma^{(\gamma)}\,(1 - \gamma)^{(1-\gamma)}\, y_{t+1}$$

Indirect utility maximization is therefore equivalent to income maximization.

If a non-qualified agent chooses to become worker, his income is the sum of the unskilled labour wage and the return on investment of his savings in the capital market at the gross interest rate i. Therefore $y_{t+1}^{w,nq} = ib_t + \underline{w}$ [4]. Analogously a qualified worker's income is: $y_{t+1}^{w,q} = i\,(b_t - \underline{h}) + \underline{w} + \delta\underline{h}$. Net return from education is therefore $(\delta - i)\,\underline{h}$, that is the college premium $\delta\underline{h}$ less the opportunity cost of education $i\underline{h}$.

If a qualified agent chooses to become entrepreneur, his second-period income is equal to the gross return on investment less the debt burden, i.e. $y_{t+1}^{e,q} = q\bar{K}\,(1 - \nu + \underline{h}) - i\,(x - b_t + \underline{h})$. A non-qualified entrepreneur's income

[4] w stands for worker, nq stands for non-qualified. Symmetrycally, q stands for qualified, e stands for entrepreneur.

is $y^{e,nq}_{t+1} = q\bar{K}(1-\nu) - i(x-b_t)$ [5]. Net return from education for entrepreneurs is $q\bar{K} - i\underline{h}$, that is, as above, the gross return less the opportunity cost of education.

Each agent, if sufficiently rich to afford education, finds it effectively profitable to invest in human capital. In fact I assume that the net marginal return from education is positive both for entrepreneurs and for workers. The net marginal return from education is positive if benefits (higher incomes) are greater than costs (direct costs ($\underline{h}$) and indirect costs (i)), i.e. $\delta > i$ and $q\bar{K} > i$.

Given the assumptions above, and because of the non-convexity of human capital investment technology, educational choice depends only on the level of initial individual wealth: all the agents who can self-finance education do invest in human capital. The qualified percentage of the population is therefore $[1 - G(\underline{h})]$, since $G(\underline{h})$ is the percentage of the population having initial wealth lower than $\underline{h}$. In particular, given the hypothesis according to which progenitors' wealth is uniformly distributed on the support $(0,1)$, the qualified percentage of the first generation is $1 - \underline{h}$, whereas $\underline{h}$ is the non-qualified progenitors' share.

Given the interest rate, the wage, the relative price of capital and physical capital investment technology, occupational choice exclusively depends on the individual degree of technical inefficiency. Actually, given individual preferences, it is profitable to undertake the entrepreneurial project if and only if entrepreneurial income is not lower than worker's income.

A qualified agent chooses to become entrepreneur if his degree of technical inefficiency is lower or equal to a threshold level $\bar{\nu}_{e,nq} = \frac{q\overline{K} - ix - \underline{w}}{q\bar{K}}$, with

$$\begin{cases} \bar{\nu}_{e,nq} = 0 \text{ for } q\overline{K} < ix + \underline{w} \\ 0 \leq \bar{\nu}_{e,nq} \leq 1 \text{ for } q\overline{K} \geq ix + \underline{w} \end{cases}.$$

This threshold level is a decreasing function of the interest rate, of the input requirement and of the unskilled labour wage, while it increases with $q\overline{K}$. The higher the interest rate, the input requirement and the wage and the lower the gross return from investment per unit of efficiency $q\overline{K}$, the

[5] Note that entrepreneurial income is formally the same either he is liquidity constrained or not. Actually if he can self-finance his project, he invests x in the project and the rest $(b_t - \underline{h})$ in the capital market, at the gross interest rate i. The income of a self-financed qualified entrepreneur is therefore $y^{e,q}_{t+1} = q\bar{K}(1 - \nu + \underline{h}) + i(b_t - \underline{h} - x)$. The income of a self-financed non-qualified entrepreneur is $y^{e,nq}_{t+1} = q\bar{K}(1 - \nu) + i(b_t - x)$. The human capital investment choice described below rules out the existence of a fully collateralized non-qualified entrepreneur anyways.

less profitable is entrepreneurship relatively to becoming a worker. Because of the hypothesis according to which progenitors' entrepreneurial technical inefficiency is uniformly distributed on $(0,1)$, the percentage of non-qualified progenitors who decide to become entrepreneurs is $\bar{\nu}_{e,nq}$. Equivalently, the percentage of non-qualified progenitors becoming workers is $1-\bar{\nu}_{e,nq}$.

Analogously, it is easy to demonstrate that a qualified agent finds it profitable to become entrepreneur if and only if he is characterized by a degree of inefficiency lower or equal to the qualified threshold level $\bar{\nu}_{e,q} = \frac{q\overline{K}(1+\underline{h})-ix-(\underline{w}+\delta\underline{h})}{q\overline{K}}$, with $\begin{cases} 0 \leq \bar{\nu}_{e,q} \leq 1 & \text{for } \frac{ix+\underline{w}+\delta\underline{h}}{1+\underline{h}} \leq q\overline{K} \leq \frac{ix+\underline{w}+\delta\underline{h}}{\underline{h}} \\ \bar{\nu}_{e,q} = 1 & \text{for } q\overline{K} > \frac{ix+\underline{w}+\delta\underline{h}}{\underline{h}} \\ \bar{\nu}_{e,q} = 0 & \text{for } q\overline{K} < \frac{ix+\underline{w}+\delta\underline{h}}{1+\underline{h}} \end{cases}$.

Also in this case the threshold level of inefficiency is a decreasing function of the interest rate and of the input requirement, while it is an increasing function of the difference between the gross return from education for entrepreneurs $q\overline{K}\underline{h}$ and the gross return from education for workers $(\delta\underline{h})$.

The qualified threshold degree of inefficiency is higher than the non-qualified threshold level. Actually, if an individual is non-qualified, he becomes entrepreneur if his degree of inefficiency is lower than $\bar{\nu}_{e,nq}$; education implies an increase in wage equal to the college premium $\delta\underline{h}$, which would decrease entrepreneurial profitability. Anyway education increases also profit, and the profit enhancement $q\overline{K}\underline{h}$ is greater than wage enhancement $\delta\underline{h}$. In other words the gross return from human capital investment is higher for entrepreneurs than for workers. The net effect of education is therefore a higher profitability of undertaking the entrepreneurial investment. The threshold degree of inefficiency is therefore higher for educated agents. Formally

$$\bar{\nu}_{e,q} - \bar{\nu}_{e,nq} = \frac{\left(q\overline{K} - \delta\right)\underline{h}}{q\overline{K}} > 0 \tag{4}$$

A poor agents who cannot afford human capital investment may find it profitable to undertake the investment project, but he has to be naturally more efficient than a rich/qualified agent.

Since wealth and technical inefficiency are stochastically independent, the percentage of qualified workers among progenitors is $(1-\underline{h})\,\bar{\nu}_{e,q}$. Non-qualified entrepreneurs are instead the $\underline{h}\bar{\nu}_{e,nq}$ percent. The percentage of qualified workers is $(1-\underline{h})\,(1-\bar{\nu}_{e,q})$ and finally non-qualified workers are the $\underline{h}\,(1-\bar{\nu}_{e,nq})$ percent of progenitors.

Progenitors are distributed as in Table 1 according to education and occupation.

	NQ.	Q	marg. distr.
W	$\underline{h}(1-\bar{\nu}_{e,nq})$	$(1-\underline{h})(1-\bar{\nu}_{e,q})$	$1-(1-\underline{h})\bar{\nu}_{e,q}-\underline{h}\bar{\nu}_{e,nq}$
E	$\underline{h}\bar{\nu}_{e,nq}$	$(1-\underline{h})\bar{\nu}_{e,q}$	$\underline{h}\bar{\nu}_{e,nq}+(1-\underline{h})\bar{\nu}_{e,q}$
marg. distr.	$\underline{h}$	$1-\underline{h}$	1

Table 1: progenitors' occupational distribution.

3 DYNAMICS ...

The long-run effects of inequality depend on the hypothesis about the intergenerational transmission of technical inefficiency. In particular, if the transmission of entrepreneurial ability is due only to genetics (i.e. it is unaffected by stochastic shocks), dynamics are determined exclusively by each progenitor's characteristics (wealth and technical inefficiency), the long-run distribution of wealth is strictly dependent on initial conditions and there exist multiple equilibria. On the other hand, if technical inefficiency has a stochastic component the dynamics of accumulation of wealth are a Markov Process. The lower the genetics, the higher the probability, for each generation, to converge to any steady state. The long-run distribution is ergodic.

Each panel of figure 1 sketches the accumulation functions for each kind of progenitor: non-qualified worker, qualified worker, non-qualified entrepreneur, qualified entrepreneur.

Given preferences and human capital investment, the law of motion of a non-qualified worker's wealth is:

$$b_{t+1} = (1-\gamma)(ib_t + \underline{w}) \qquad \begin{cases} b_t \in (0, \underline{h}) \\ \bar{\nu}_{e,nq} < \nu_t \leq 1 \end{cases} \tag{5}$$

The law of motion of a qualified worker's wealth is instead:

$$b_{t+1} = (1-\gamma)\left[i(b_t - \underline{h}) + \underline{w} + \delta\underline{h}\right] \qquad \begin{cases} b_t \in (\underline{h}, x) \\ \bar{\nu}_{e,q} < \nu_t \leq 1 \end{cases} \tag{6}$$

If the progenitor is a non-qualified entrepreneur, the dynasty accumulates wealth according to the following equation:

$$b_{t+1} = (1-\gamma)\left[q\bar{K}(1-\nu_t) - i(x-b_t)\right] \qquad \begin{cases} b_t \in (0,\underline{h}) \\ 0 \le \nu_t \le \overline{\nu}_{e,nq} \end{cases} \tag{7}$$

This equation and the corresponding function is parametrized to the entrepreneur's level of technical inefficiency, since that is a pure entrepreneurial quality.

Finally a qualified entrepreneur's dynasty accumulates wealth according to the following equation:

$$b_{t+1} = (1-\gamma)\left[q\bar{K}(1-\nu_t+\underline{h}) - i(x-b_t+\underline{h})\right] \qquad \begin{cases} b_t \in (\underline{h},x) \\ 0 \le \nu_t \le \overline{\nu}_{e,q} \end{cases} \tag{8}$$

Also in this case each function is parametrized to a specific level of technical inefficiency.

The economy's structural parameters determine different long-run scenarios (see figures 1). Each scenario corresponds to different occupational structure of the population in each generation.

The transmission mechanism of technical inefficiency finally affects the evolution of the distribution of income and wealth and the evolution of the occupational structure of the population.

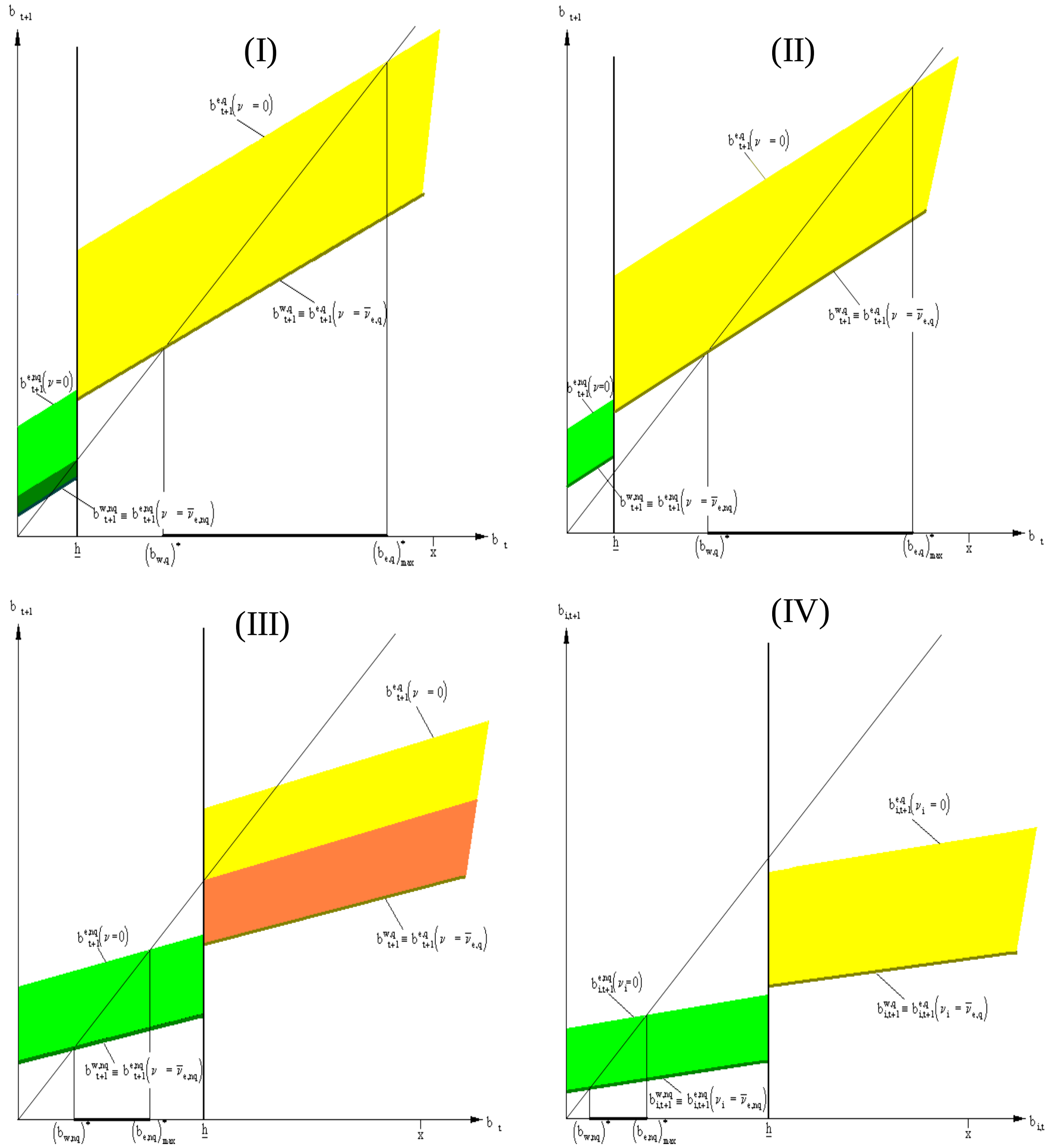


Figure 1: the four possible dynamics of wealth accumulation according to the economy's structural parameters.

The first panel can be the result of the following parameters

Parameters	Values
γ	0.6
$q\overline{K}$	15
x	10
i	1.05
$\underline{h}$	0.7
$\underline{w}$	1
δ	4.2857

which give rise to the following values for key variables in the model:

	Values
$\overline{w}+\delta\underline{h}$	4
$\overline{\nu}_{e,q}$	$0.7\overline{33}$
$\overline{\nu}_{e,nq}$	$0.2\overline{33}$

Therefore, non-qualified workers are 53.66% of progenitors, non-qualified entrepreneurs 16.33%, qualified workers 21.99%. The qualified percentage of the population is 3%. Most of the agents are therefore non-qualified workers and most of the qualified agents are entrepreneurs.

The second scenario is the result, ceteris paribus, of a decrease in the cost of education, which implies a decrease of qualified entrepreneurs' profit and of qualified workers' wage. Vice versa the decrease in the cost of education implies an increase in the threshold level of inefficiency. Analogously the share of entrepreneurs among qualified people increases. The parameters which determine this scenario are the following:

Parameters	Values
γ	0.6
$q\overline{K}$	15
x	10
i	1.05
$\underline{h}$	$\mathbf{0.5}$
$\underline{w}$	1
δ	4.2857

From these parameters it follows that:

	Values
$\underline{w}+\delta\underline{h}$	$\mathbf{3.1428}$
$\overline{\nu}_{e,q}$	$\mathbf{0.59}$
$\overline{\nu}_{e,nq}$	0.23333

The reduction of the cost of education implies a reduction of the non-qualified share of the population. 11.66% of the population consists of non-qualified entrepreneurs, non-qualified workers are 38.33%. Qualified workers are instead 20.5% and qualified entrepreneurs 29,5%. The decrease in the cost of education has therefore determined an increase of the qualified percentage of the population and a reduction of the disproportion among occupational classes. In particular there has been an increase in the share of qualified workers.

The third scenario could derive from a simultaneous increase in the cost of education and a decrease in people's altruism:

Parameters	Values
γ	$\mathbf{0.9}$
$q\overline{K}$	15
x	10
i	1.05
$\underline{h}$	$\mathbf{0.9}$
$\underline{w}$	1
δ	4.2857

It follows:

	Values
$\underline{w}+\delta\underline{h}$	$\mathbf{4.857}$
$\overline{\nu}_{e,q}$	$\mathbf{0.8762}$
$\overline{\nu}_{e,nq}$	$0.2\overline{33}$

Liquidity constraints strengthen because of the increase in the cost of education and are an obstacle for the 90% of progenitors. 20.99% of progenitors consists of non-qualified entrepreneurs and 69% are non-qualified workers, 8.76% is instead made of qualified entrepreneurs and finally 1.239% is composed by qualified workers.

The last possible scenario could finally be brought about by a further increase in agents' egoism and from a decrease in the gross return per unit of efficiency:

Parameters	Values
γ	$\mathbf{0.99}$
$q\overline{K}$	$\mathbf{11.55}$
x	10
i	1.05
$\underline{h}$	$\mathbf{0.9}$
$\overline{w}$	1
δ	4.2857

which gives rise to:

	Values
$\overline{w}+\delta\underline{h}$	4.857
$\overline{\nu}_{eq}$	$\mathbf{0.5704}$
$\overline{\nu}_{enq}$	$\mathbf{0.00433}$

The reduction of the gross return per unit of efficiency implies a decrease of the profitability of entrepreneurship. Actually qualified entrepreneurs are 5.7%, while non-qualified entrepreneurs are 0.39% of the population. Non-qualified workers are 89.6% and qualified workers are 4.3% of progenitors.

Table 2 summarizes the occupational structure of progenitors in each scenario

	I	II	III	IV
W,NQ	0.5366	0.3833	0.69	0.896
E,NQ	0.1633	0.1166	0.2099	0.0039
W,Q	0.08	0.205	0.01239	0.0426
E,Q	0.2199	0.295	0.0876	0.057

Table 2: progenitors' occupational structure.

3.1 ...WHEN TECHNICAL INEFFICIENCY IS EXCLUSIVELY GENETIC $(\rho = 1)$

I start analyzing the wealth accumulation dynamics and long-run equilibria when technical inefficiency is exclusively genetic. This implies $\rho = 1$ in equation 1. In this case the wealth accumulation process is deterministic and exclusively determined by progenitors' characteristics (degree of inefficiency and wealth). Graphically it means that a dynasty accumulates wealth according to a unique accumulation function.

The long-run distribution of wealth, in each scenario, is represented in figure 2.

With parameters which give rise to scenario I, a non-qualified worker's dynasty remains in this category because it cannot accumulate sufficient wealth to afford education. The descendants from a non-qualified workers do not change occupation and converge to the steady state wealth $(b^{w,nq})^* = \frac{(1-\gamma)w}{1-(1-\gamma)i}$. Given parameters which could give rise to that scenario, $(b^{w,nq})^* = 0.69$.

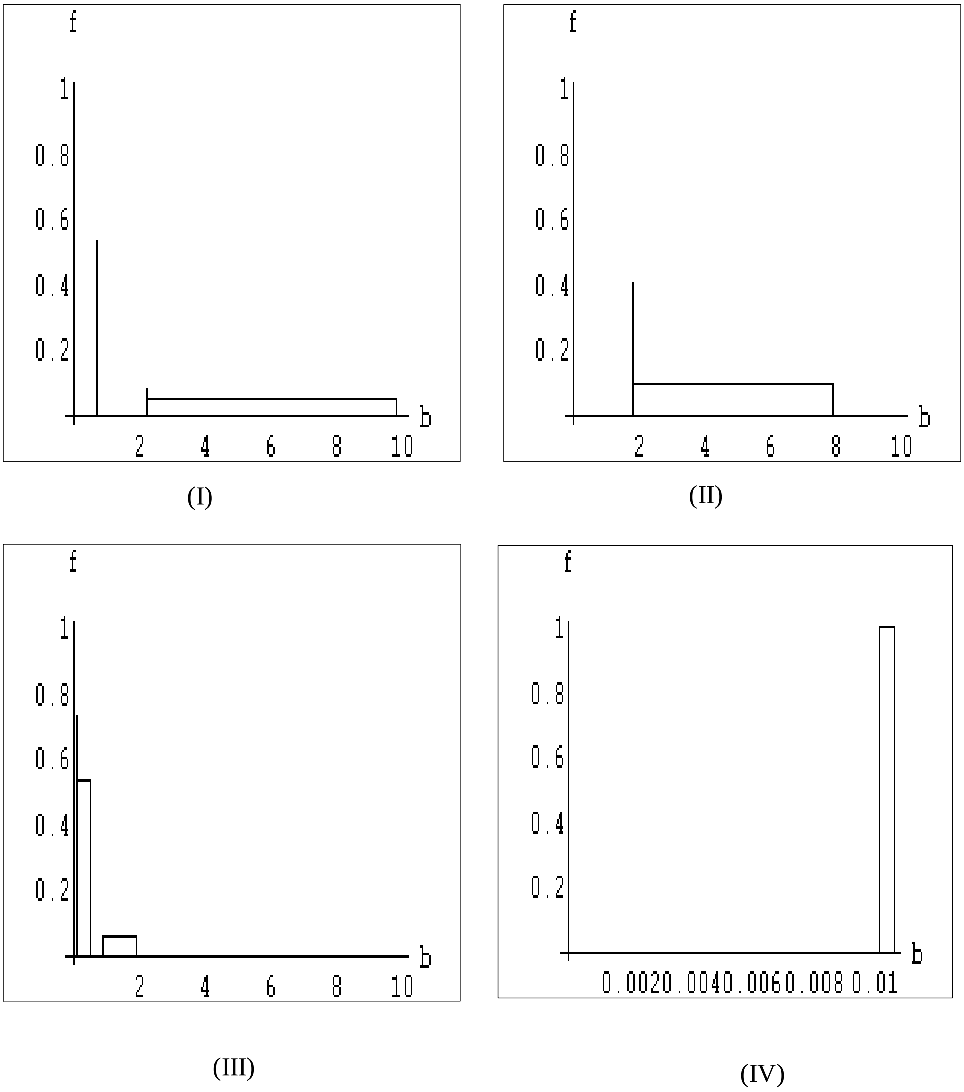


Figure 2: long run distribution of wealth in each scenario.

Also dynasties descending from qualified workers and qualified entrepreneurs do not experience occupational mobility. Descendants from a qualified worker converge to $(b^{w,q})^* = \frac{(1-\gamma)(\underline{w}+\delta\underline{h}-i\underline{h})}{1-(1-\gamma)i} = 2.25$. Descendants from a qualified entrepreneur converge to a steady state which is parametrized to the dynasty's degree of technical inefficiency $(b^{e,q})^* = \frac{(1-\gamma)\left[q\bar{K}(1-\nu_i+\underline{h})-i(x+\underline{h})\right]}{1-(1-\gamma)i}$. The less inefficient the dynasty, the higher the steady state wealth: $(b^{e,q})^* \in (2.25, 9.83]$.

The dynamics of the dynasty coming from non-qualified entrepreneur are a little bit more complex. In this case dynasties characterized by a level of inefficiency lower than $\underline{\nu} = 1 - \frac{i(x-b)(1-\gamma)-\underline{h}}{q\bar{K}(1-\gamma)} = 0.232\overline{33}$ succeed in accumulating enough wealth in order to invest in human capital. They become qualified entrepreneurs, whereas dynasties characterized by a degree of technical inefficiency $\underline{\nu} \leq \nu \leq \overline{\nu}_{e,nq}$ accumulate wealth converging to $(b^{e,nq})^* = \frac{(1-\gamma)\left[q\bar{K}(1-\nu_i)-ix\right]}{1-(1-\gamma)i}$ and remain non-qualified. Even in this case, the higher the degree of inefficiency, the lower steady state wealth: $(b^{e,nq})^* \in [0.69, 0.7)$.

The evolution of the occupational structure of the population is summarized in table 2-3: in the long-run 54% of the population do not invest in education. 53.66% of the population consists of unskilled workers. The remaining 46% of the population is qualified. The major share of the qualified population is made of entrepreneurs: they are 38.26% of the population. Only entrepreneurs experiment occupational mobility: 16.26% of non-qualified entrepreneurs become qualified entrepreneurs.

	NQ	Q	marg. distr.
W	$0.5366 \to \mathbf{0.5366}$	$0.08 \to \mathbf{0.08}$	$0.6166 \to \mathbf{0.6166}$
E	$0.1633 \to \mathbf{0.0007}$	$0.22 \to \mathbf{0.382633}$	$0.3833 \to \mathbf{0.3833}$
marg. distr.	$0.7 \to \mathbf{0.5373}$	$0.3 \to \mathbf{0.462633}$	1
GINI	$0.263 \to \mathbf{0.367}$		

Table 3: evolution of occupational distribution in scenario I (progenitors → long-run).

Average wealth increases, from 0.5 to 2.86, thanks to the increase of the qualified entrepreneurial share of the population[6].

[6] Average wealth is also an indicator of aggregate utility. Actually, given preferences, aggregate utility is an increasing function of aggregate income. If population is constant, aggregate utility is also an increasing function of average income and wealth.

Concentration of wealth increases as well. The Gini coefficient goes from 0.263 to 0.367. This is due to the fact that the majority of the population is trapped in a low level of wealth, which does not allow them to undertake human capital investment. Only few dynasties (16.2%) can get out of non-qualification and poverty and go up the income and education ladder accumulating more wealth and increasing concentration.

As for scenario II, we obtain the following dynamics: qualified dynasties remain in the same educational and occupational categories of their progenitors. Descendants from non-qualified entrepreneurs accumulate wealth and undertake human capital investment, becoming, in the long-run, qualified entrepreneurs. Some of the descendants from non-qualified workers ($(\overline{\nu}_{eq} - \overline{\nu}_{enq})$ share of the non-qualified population, that is 18% of the whole population) become qualified workers, the others become qualified entrepreneurs. Actually all the non-qualified workers may afford education in the long-run but some of them are sufficiently efficient to find it profitable to become entrepreneurs when qualified. In the long-run the whole population is qualified.

Table 4 summarizes occupational distribution in this case.

	NQ	Q	marg. distr.
W	$0.3833 \rightarrow$ **0**	$0.20475 \rightarrow$ **0.4095**	$0.58805 \rightarrow$ **0.4095**
E	$0.1166 \rightarrow$ **0**	$0.29525 \rightarrow$ **0.5905**	$0.41185 \rightarrow$ **0.5905**
marg. distr.	$0.5 \rightarrow$ **0**	$0.5 \rightarrow$ **1**	1
GINI	$0.263 \rightarrow$ **0.25**		

Table 4: evolution of the occupational distribution in scenario II (progenitors $\rightarrow$ long-run).

Relatively to scenario I, the reduction of the cost of education has implied the possibility, for all the dynasties, to become educated. Anyway $\underline{h}$ represents human capital itself, and its reduction implies also a lower accumulation of wealth for educated people. Actually, in this scenario, qualified workers converge to 1.805. The set of steady states for qualified entrepreneurs is instead $(1.805; 7.914]$, while it was $(2.25; 9.83]$ in scenario I.

Long-run distribution of wealth is sketched in figure 2-4 (II). In this case, the possibility for the entire population to become educated determines an increase in the mean wealth (3.6) and a decrease in the concentration (Gini coefficient becomes 0.25).

Summing up, we can state the following:

- when the transmission of technical inefficiency is genetic there may exist multiple equilibria. The higher the liquidity constrained share of the progenitors, the higher the long-run share of the population trapped in poverty and in non-qualification;

- a reduction in the cost of education, ceteris paribus, implies an increase in equity and in aggregate efficiency, allowing the whole population to qualify and implying an increase in the mean wealth and in aggregate utility. In that case the long-run distribution does not depend on initial conditions;

- ceteris paribus, the most efficient dynasties would be worse off due to the reduction in the cost of education, which means a decrease in human capital and a decrease in qualified people's income.

Multiple equilibria resulting from the first scenario are the same as Galor and Zeira's and Owen and Weil's, and can interpret different cross-countries dynamics in the distribution of income and wealth. In fact different cross-country performances may be explained by different initial conditions. A country characterized by a more equal distribution and a higher level of average wealth may take off and converge to a high long run equilibrium, whereas a country with a very unequal distribution and a low level of average wealth would inevitably be trapped in poverty and non-qualification.

As far as scenario III is concerned, descendants from non-qualified workers and entrepreneurs remain in the progenitors' educational and occupational categories. Only qualified entrepreneurs characterized by technical inefficiency lower than $\hat{\nu} = (1+\underline{h}) - \frac{ix(1-\gamma)+h}{q\bar{K}(1-\gamma)}$ remain in this category. Entrepreneurs with a degree of inefficiency such that $\hat{\nu} < \nu \leq \overline{\nu}_{eq}$ decumulate wealth and cannot afford education anymore in the long-run, becoming non-qualified workers. Dynasties descending from qualified workers experience only downward mobility as far as education is concerned.

The long-run occupational distribution is summarized in Table 5.

	NQ	Q	marg. distr.
W	$0.69 \to \mathbf{0.73}$	$0.01238 \to \mathbf{0}$	$0.70238 \to \mathbf{0.73}$
E	$0.21 \to \mathbf{0.21}$	$0.08762 \to \mathbf{0.06}$	$0.29762 \to \mathbf{0.27}$
marg. distr.	$0.9 \to \mathbf{0.94}$	$0.1 \to \mathbf{0.06}$	1
GINI	$0.263 \to \mathbf{0.332}$		

Table 5: evolution of occupational distribution in scenario III (progenitors → long-run).

In this case, in the long-run, only 6% of the population is qualified and consists only of entrepreneurs. Generation after generation, 4% of the population decumulates wealth and cannot afford human capital investment anymore. 2.7% of them moves downward along the occupational ladder. The remaining 1.3% moves downwards only between educational classes.

Descendants from non-qualified people do not change either occupational, or educational class.

Workers' dynasties converge to $(b^{w,nq})^* = 0.111732$.

Non-qualified entrepreneurs' dynasties converge to the set of steady states $(b^{e,nq})^* \in (0.111732, 0.5028]$, parametrized to each dynasty's degree of inefficiency. Qualified entrepreneurs' dynasties, with a degree of inefficiency lower than 0.6, converge to $(b^{e,q})^* \in (0.9, 1.9056)$.

The long-run distribution of wealth is sketched in Figure 2 (III). Liquidity constraints for the majority of the population, due to the increase in the cost of education, become binding during the accumulation process because of the low individual altruism. The increase in the cost of education and in the individual egoism forces the great majority of the population into poverty and non-qualification. In other words the increase in the qualified people's income due to the increase in $\underline{h}$ does not offset the cost of education itself and the low share of individual income left as bequests.

Long-run average wealth is 0.23 and the long-run distribution of wealth is more concentrated (Gini coefficient is 0.332).

In the last long-run scenario the whole population is trapped in poverty and non-qualification. In this case non-qualified progenitors' dynasties do not change educational and occupational class. Descendants from qualified workers become non-qualified workers while some descendants from qualified entrepreneurs remain entrepreneurs, but they do not qualify anymore. The others move downward along educational and occupational classes: they become non-qualified workers. These are characterized by a degree of technical inefficiency which guarantees the profitability of entrepreneurship only if they qualify, when they fall into non-qualification they are not enough efficient to find it still profitable to undertake the entrepreneurial investment project. They are 99.567% of the population. 4.33% of the population experiments only downward mobility between educational classes. In the long-run 99.567% of the population is composed by non-qualified workers, 0.433% consists of non-qualified entrepreneurs. Moreover the very high egoism reduces income dispersion and long-run wealth distribution almost collapses to a single steady state (see figure 2-4 (IV)). Actually the set of steady states is $[0.010106, 0.01061]$.

Table 6 summarizes long-run occupational distribution in this last scenario.

	NQ	Q	marg. distr.
W	$0.896103 \to \mathbf{0.99567}$	$0.04296 \to \mathbf{0}$	$0.939063 \to \mathbf{0.99567}$
E	$0.003897 \to \mathbf{0.00433}$	$0.05704 \to \mathbf{0}$	$0.060937 \to \mathbf{0.00433}$
marg. distr.	$0.9 \to \mathbf{1}$	$0.1 \to \mathbf{0}$	1
GINI	$0.263 \to \mathbf{0}$		

Table 6: evolution of occupational distribution in scenario IV (progenitors → long-run).

It is therefore possible to state the following:

- the decrease of individual altruism forces a very high share of the population to poverty and non-qualification. This condemnation is higher, the more the progenitors cannot afford human capital investment;

- for sufficiently high egoism and low levels of gross return per efficiency unit, the whole population, independently from initial conditions, almost collapses to a unique occupation (non-qualified workers) and wealth.

These results can provide a rationale for the familiar determinants of social mobility. Both the empirical and the theoretical literature has stressed that these determinants are both genetic and altruistic. The stronger these components, the more sons' income and wealth are related to fathers' ones. Genetic components consists in the ability to earn (productivity) inherited from fathers. Altruistic components make sons' income depending on fathers' ones thanks to fathers' investments in sons' education and upgrading. In the model developed in this paper, if skills are inheritable and incomes are skill-dependent, sons' income is related to the fathers' one. Analogously, the more fathers bequeath their sons, the more sons' income and wealth destiny is downward rigid. The worst sons can perform is to remain in their fathers' income and wealth classes. In other words a high altruism implies upward mobility between income, wealth and occupational classes.

The perfect inheritability of technical inefficiency therefore can give rise to long-run distributions of wealth which are either strictly dependent on initial conditions or not, according to the configuration of structural parameters.

3.2 ... WHEN TECHNICAL INEFFICIENCY IS EXCLUSIVELY STOCHASTIC $(\rho = 0)$

If the degree of technical inefficiency is stochastic, wealth accumulation is a Markov Process. The set of states can be decomposed in a set of transient states and in an irreducible and closed set of persistent states. Once the Markov Chain visits one persistent state, it remains in that class of states and does not abandon it anymore. In the long-run transient states disappears and the state space coincides with the closed and irreducible set of states. Each dynasty visits each of the persistent state with a positive probability. All the long-run states are therefore non-null persistent states and the long-run distribution of wealth is unique, stationary and ergodic, independent from initial conditions. Each dynasty may move among wealth classes without implying any change in the mean wealth.

The long-run distribution of wealth for each scenario is represented in figure 3. This is the result of a numeric simulation based on the parameters said above. I have plotted the distribution of wealth of 1500 dynasties after 200 periods.

The support and the first moment of the distributions, when parameters give rise to the II and IV scenarios, do not change relatively to the perfect genetic case. The only difference is that in the long-run there exists occupational mobility. Each family does not converge to a unique steady state, but moves among states. The absence of the familiar determinant of intergenerational occupational and income persistence determines an extreme social fluidity.

Summing up:

- when the transmission of technical inefficiency is stochastic, the long-run distribution of wealth is ergodic. Each dynasty visits with a positive probability each steady state. The long-run distribution is unique and stationary, but each family moves among occupational and wealth classes;
- in scenarios II and IV, when, in the genetic transmission case, the long-run distribution of wealth does not depend on initial condition, the hypothesis of stochastic transmission of technical inefficiency does not

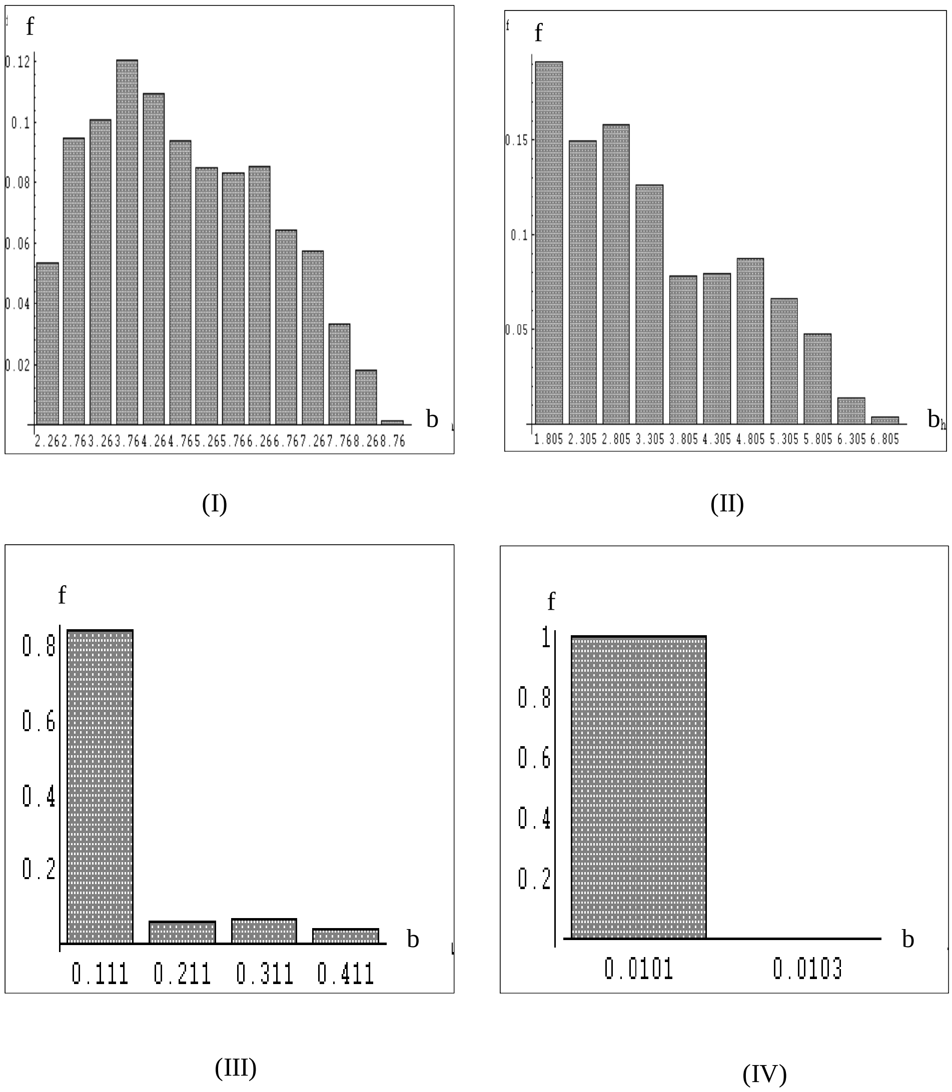


Figure 1: Figure 3: long run distribution of wealth.

modify the long-run occupational structure, the support of the long-run distribution and the long-run average and aggregate income and wealth.

Things changes in scenarios I and III. In scenario I, the closed and irreducible set of persistent states is the interval $\left[(b_{w,q})^*;(b_{e,q})^*_{\max}\right]=[2.25,9.83]$. In the long-run all the people are quali…ed and long-run average wealth increases with respect to the genetic transmission hypothesis. It goes from 2.863 to 5.05. Moreover wealth concentration decreases: the Gini coe¢ cient becomes 0.1759.

The fact that technical ine¢ ciency is purely stochastic, opens up a way out of poverty and non-quali…cation to the sons of non-quali…ed agents. In the long-run the whole population is quali…ed and the great majority consists of entrepreneurs (73% of the population). Anyway entrepreneurs are not always belonging to the same dynasties, since there always exists occupational mobility. Table 7 summarizes the evolution of the occupational distribution in this case.

	NQ	Q	marg. distr.
W	$0.5366 ! \mathbf{0}$	$0.08 ! \mathbf{0.2666}$	$0.6166 ! \mathbf{0.2666}$
E	$0.1633 ! \mathbf{0}$	$0.22 ! \mathbf{0.7333}$	$0.3833 ! \mathbf{0.7333}$
marg. distr.	$0.7 ! \mathbf{0}$	$0.3 ! \mathbf{1}$	1
GINI	$0.263 ! \mathbf{0.1759}$		

Table 7: evolution of occupational distribution in scenario I (progenitors → long-run)

Therefore the stochastic transmission of technical ine¢ ciency brings about the possibility of social climbing. In the long-run the whole population is quali…ed.

In scenario III the situation is symmetric: in the long-run the whole population is trapped in poverty and in non-quali…cation and distributed on the support $[0.111732; 0.5028]$. Most of the people are workers (76.66%). The mean wealth is lower (0.156). The long-run occupational distribution is summarized in Table 8.

	NQ	Q	marg. distr.
W	$0.69 ! \mathbf{0.7666}$	$0.01238 ! \mathbf{0}$	$0.70238 ! \mathbf{0.7666}$
E	$0.21 ! \mathbf{0.2333}$	$0.08762 ! \mathbf{0}$	$0.29762 ! \mathbf{0.2333}$
marg. distr.	$0.9 ! \mathbf{1}$	$0.1 ! \mathbf{0}$	1
GINI	$0.263 ! \mathbf{0.1993}$		

Table 8: evolution of occupational distribution in scenario III (progenitors → long-run)

In other words the pure stochasticity of technical inefficiency can be a condemnation for dynasties who, sooner or later, even if descending from a very efficient progenitor, are trapped in poverty and non-qualification.

Concluding, the perfect stochasticity hypothesis makes ergodic long-run distribution of wealth and, according to the economy's structural parameters, can be either a way out or a condemnation to poverty and non-qualification.

The evolution of occupational structure, the support of the long-run distribution, the mean wealth and the Gini coefficient for each scenario are summarized in the following table:

		I	II	III	IV
Progen.	W,NQ	0.5366	0.3833	0.69	0.896103
	E,NQ	0.1633	0.1166	0.21	0.003897
	W,Q	0.08	0.20475	0.01238	0.04296
	E,Q	0.22	0.29525	0.08762	0.05704
	supp.	$[0;1]$	$[0;1]$	$[0;1]$	$[0;1]$
	mean	0.5	0.5	0.5	0.5
	Gini	0.263	0.263	0.263	0.263
$\boldsymbol{\rho = 1}$	W,NQ	0.5366	0	0.73	0.99567
	E,NQ	0.0007	0	0.21	0.00433
	W,Q	0.08	0.4095	0	0
	E,Q	0.382633	0.5905	0.06	0
	supp.	$[0.69;0.7]\,U$ $[2.25;9.83]$	$[1.805;7.914]$	$[0.111;0.503]\,U$ $[0.9;1.9]$	$[0.0101;0.0106]$
	mean	2.863	3.6	0.23	0.010107
	Gini	0.367	0.25	0.332	0
$\boldsymbol{\rho = 0}$	W,NQ	0	0	0.766	0.99567
	E,NQ	0	0	0.233	0.00433
	W,Q	0.266	0.4095	0	0
	E,Q	0.733	0.5905	0	0
	supp.	$[2.25;9.83]$	$[1.805;7.914]$	$[0.111;0.503]$	$[0.0101;0.0106]$
	mean	5.05	3.6	0.156	0.010107
	Gini	0.1759	0.1993	0.231863	0

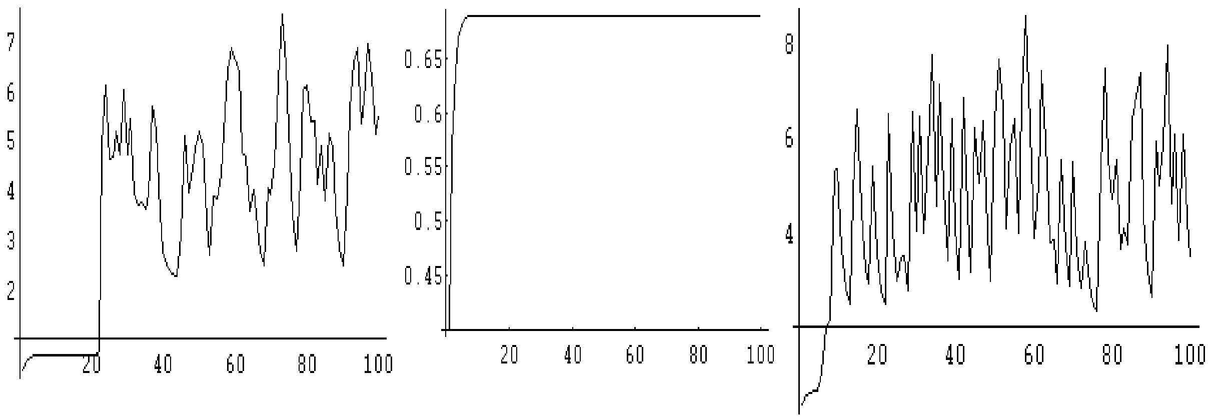
Table 9

3.3 ... WHEN $0 < \rho < 1$

I have run simulations for the intermediate case in which technical inefficiency is neither totally genetic nor totally stochastic, in other words under the hypothesis that $0 < \rho < 1$.

Figure 4 sketches the results of the dynamics of a single dynasty's wealth over 100 period, for different values of persistence. Panel (a) is obtained with $\rho = 0.5,$ panel (b) with $\rho = 0.9$ and panel (c) with $\rho = 0.0001.$

Only when entrepreneurial skills are highly inheritable the dynasty does not qualify and converges to 0.69, that is to the steady state wealth of non-qualified workers.



(a) (b) (c)

Figure 4: wealth accumulation dynamics for a single dynasty over 100 periods.

I have also run numerical simulations for 1500 dynasties over 200 periods. The distribution of wealth after 200 periods, in each scenario, is sketched in figure 5. Panels I (b), II, III (b) and IV are based on $\rho = 0.5.$ Panels I (a) and III (a) instead are based on $\rho = 0.9.$ Comparing panels I (a) and I (b) and comparing III (a) and III (b), we can easily notice that, the higher the degree of skills inheritability, i.e. the greater $\rho,$ the more plausible multiple equilibria are and the dynamics are similar to the perfect genetic case $(\rho = 1)$.

When $\rho = 0.5$, The dynamics and the long-run scenarios are similar to the perfect stochastic case.

Moreover the higher ρ, the fewer the non-null persistent steady states and therefore the long-run distribution is no more ergodic. In other words, the higher the persistence among generations, the lower the social mobility.

Summarizing, when the level of technical inefficiency is determined both by genetics and by Nature, the long-run distribution is strictly dependent on the degree of persistence: the more the skills are inheritable, the more plausible are multiple equilibria and non-ergodic distributions.

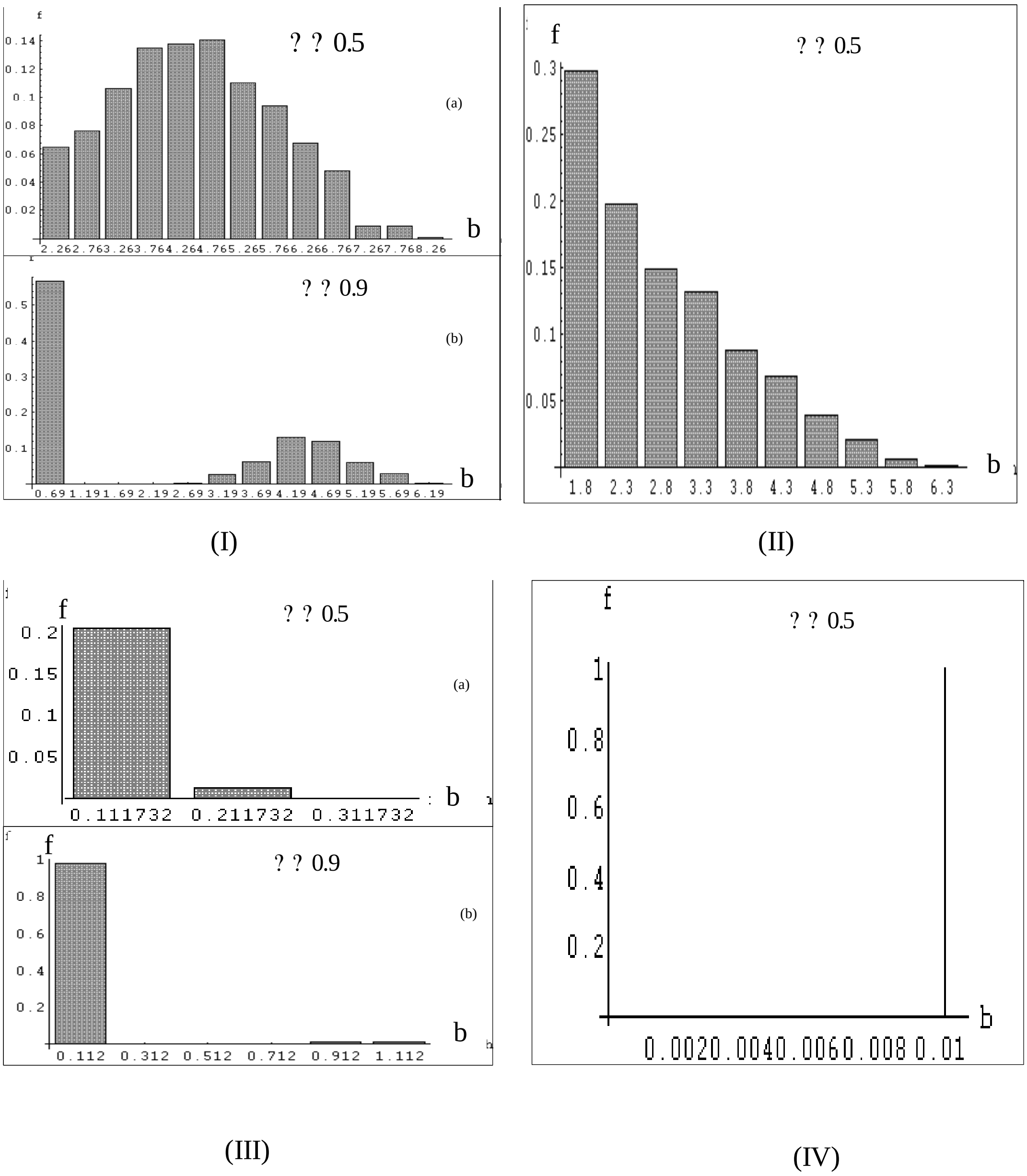


Figure 2: Figure 5: long run distribution of wealth when $0 < \rho < 1$.

CONCLUSIONS

In this paper a model has been developed which explores the long-run effects of income and wealth inequality via capital market imperfections affecting both human capital and physical capital investment. The dynamic patterns are different according to the economy's structural parameters and according to types of intergenerational transmission of the technical inefficiency. Dynamics can be either ergodic or non-ergodic, with long-run social mobility or immobility. The higher the inheritability of entrepreneurial skills and the higher the individual altruism, the more plausible intergenerational income and wealth persistence. Sons' occupation, wealth and income are non-lower than fathers' ones. In this case multiple equilibria are possible and therefore long-run distribution may depend on initial conditions: the higher the non-qualified share of progenitors, the higher the long-run share of population which is trapped into poverty and non-qualification. The decrease of individual altruism forces a greater share of the population into poverty and non-qualification. Moreover, for particular economy's structural parameters, the whole population almost converges to unique occupation (non-qualified workers) and to a unique low wealth in the long-run, whatever the technical inefficiency transmission hypothesis.

If technical inefficiency has also a stochastic component, there always exists social mobility. Long run distributions may be ergodic or not. The total stochasticity of technical inefficiency may either be a way out or a condemnation to poverty and to non-qualification, according to the economy's structural parameters.

The results may give a rationale for different cross-countries dynamics of wealth distribution as far as multiple equilibria are obtained. One country may converge to a high level of wealth with the whole population highly qualified, while another, because of its worse initial condition (highly unequal wealth distribution and low average wealth), may be trapped into poverty and into non qualification. Moreover the model may explain social mobility, since changes in occupational classes may be both the cause and the effect of the accumulation. In particular the model can provide a rationale for the familiar determinants of social mobility. If skills are inheritable and incomes are skill-dependent, sons' income is related to the fathers' one. Analogously, the more fathers bequeath their sons, the more sons' income and wealth destiny is downward rigid. In other words a high altruism implies upward mobility between income, wealth and occupational classes.

REFERENCES

Aghion P. - Bolton P. (1997), A Trickle-Down Theory of Growth and Development with Debt Overhang. Review of Economic Studies, 64(2).

Aghion P. - Caroli E. - Peñalosa C. (1997), Inequality and Economic Growth. Raffaele Mattioli Lectures, Ottobre.

Alesina A. - Rodrick D. (1994), Distributive Politics and Economic Growth. Quarterly Journal of Economics, 109.

Ashenfelter O. - Krueger A. (1994), Estimates of the Economic Returns to Schooling from a New Sample of Twins. American Economic Review, 84(5)

Atkinson A. B. (1998), The Distribution of Income in Industrialized Countries. Federal Reserve Bank of Kansas City: Symposium on "Income Inequality".

Atkinson A. B. - Maynard A. K. - Trinder C. G. (1983), Parents and Children: Incomes in Two Generations. London: Heinmann Educational Books.

Banerjee A. - Newman A. (1993), Occupational Choice and the Process of Development. Journal of Political Economy, 58.

Becker G. - Tomes N. (1979), An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility. Journal of Political Economy, 87(6).

Benhabib J. -Spiegel M. (1994), The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data. Journal of Monetary Economics, 24.

Benabou R.(1996a), Unequal Societies. NBER Working Paper, 5583.

Benabou R.(1996b), Inequality and Growth. NBER Working Paper, 5658.

Bernanke B. - Gertler M. (1989), Agency Costs, Net Worth and Business Fluctuations. American Economic Review, 79 (1).

Bertola G. (1993), Factor Share and Savings in Endogenous Growth. American Economic Review, 83(5).

Bertola G. (1998), Macroeconomics of Distribution and Growth. Atkinson A. B - Bourguignon F. (eds.) "Handbook of Income Distribution".

Bhattacharya J. (1998), Credit Market Imperfections, Income Distribution, and Capital Accumulation. Economic Theory.

Binswanger H. - Deininger K. (1995), Towards a Political Economy of Agriculture and Agrarian Relations. World Bank Economic Review, September.

Binswanger H. - Rosenzweig M. (1995), Are Small Farmers Too Small to be E¢cient?. World Bank Economic Review, October.

Birdsall N, Ross D., Sabot R. (1995), Inequality and Grawth Reconsidered: Lessons from East Asia. World Bank Economic Review, 9 (3).

Bourguignon F. (1994), Growth, Distribution, and Human Resources. "En Route to Modern Growth" Ranis G. ed., Baltimore, John Hopkins University Press.

Checchi D. - Ichino A. - Rustichini A. (1996), More Equal but Less Mobile? Education Financing and Intergenerational Mobility in Italy and in the United States. CEPR Discussion Paper, 1496.

Clarke. (1992), More Evidence on Income Distribution and Growth. World bank Working Paper, 1064.

Cozzi G. (1998), Distribuzione e Crescita. Una Rassegna della Letteratura Recente. Rivista Italiana degli Economisti / a. III, n. 1. Aprile.

Deininger K. - Squire L. (1996), A New Data Set Measuring Income Inequality. World Bank Economic Review, September 10 (3).

Devarajan S.-Swaroop V. - Zou H.F. (1993), What Do Government Buy?. World Bank Working Paper, 1082, Policy, Research and External A¤airs, February.

Easterly W. - Rebelo S. (1993), Fiscal Policy and Economic Growth: An Empirical Investigation. Journal of Monetary Economics, 32 (3).

Fiaschi D. (1998), Crescita e Distribuzione: un'Interpretazione Unitaria dei Recenti Contributi. n. 19 Progetto d'Ateneo, Dipartimento di Scienze Economiche, Università degli Studi di Bologna, November.

Furman J. - Stigliz J. (1998), Economic Consequences of Income Inequality. Federal Reserve Bank of Kansas City: Symposium on "Income Inequality".

Galor O. - Tsiddon D. (1997), The Distribution of Human Capital and Economic Growth. Journal of Economic Growth, 2.

Galor O. - Zeira J. (1993), Income Distribution and Macroeconomics. Review of economic Studies, 60 (1).

Greenwald B. - Salinger M. - Stiglitz J. (1990), Imperfect Capital Markets and Productivity Growth. NBER Conference in Vail, Colorado, Aprile.

Grossman H. (1995), Robin Hood and the Redistribution of Property Income. European of Political Economy, 11.

Jonsson, J. O. (1993), Education, Social Mobility, and Social Reproduction in Sweden: Patterns and Changes. Swedish Institute for Social Research, 398.

Jonsson, J. O. - Mills C. (1993), Social Mobility in the 1970's and 1980's: A Study of Men and Women in England and Sweden. Swedish Institute for Social Research, 419

Keane T. - Rouse C. (1995), Labour Market Returns to Two and Four-Year College: is a Credit a Credit and do Degrees Matter?. American Economic Review, 85(3).

Keefer P. - Knack S. (1995), Polarization, Property Rights and the Links Between Inequality and Growth. World Bank mimeo, October.

Kuznets S. (1955), Economic Growth and Income Inequality. American Economic Review, 45.

Lindbeck, A. (1998), How can Economic Policy Strike a Balance between Economic Efficiency and Income Inequality? Federal Reserve Bank of Kansas City: Symposium on "Income Inequality".

Loury G. (1981), Intergenerational Transfers and the Distribution of Earnings. Econometrica, 49.

Lucas R. (1993), Making a Miracle. Econometrica, 61.

McCallum J. - Blais A. (1987), Government, Special Interest Groups, and Economic Growth. Public Choice, 54.

Meltzer A. - Richards S. (1981), A Rational Theory of the Size of Government. Journal of Political Economy, 89.

Mirrlees J. (1971), An Exploration in the Theory of Optimum Income Taxation. Review of Economic Studies, 38.

Owen A. L. - Weil D. N. (1998), Intergenerational Earnings Mobility, Inequality and Growth. Journal of Monetary Economics, 41.

Perotti R. (1992), Fiscal Policy, Income Distribution, and Growth. Columbia University Working Paper 636, November.

Perotti R. (1993), Political Equilibrium, Income Distribution and Growth. Review of Economic Studies, 60.

Perotti R. (1994), Income Distribution and Investment. European Economic Review, 38.

Perotti R. (1996), Growth, Income Distribution and Democracy: What the Data Say. Journal of Economic Growth, 1.

Piketty T. (1997), The Dynamics of Wealth Distribution and Interest Rate with Credit Rationing. Review of Economic Studies, 64.

Persson T. - Tabellini G. (1992), Growth, Distribution, and Politics. Cuckierman - Hercowitz and Lederman, eds., Political Economy, Growth, and Business Cycles. MIT Press, Cambridge, MA.

Persson T. - Tabellini G. (1996), Is Inequality Harmful for Growth? Theory and Evidence. American Economic Review, 48.

Psacharopoulos G. (1994), Returns to Investment in Education: A Global Update. World Development, 22(9).

Sala i Martin X. (1992), Public Welfare and Growth. Yale Economic Growth Center, Discussion Paper 666, June.

Stiglitz J. (1994), Endogenous Growth and Cycles. Shionoya and Perlman (eds.) "Innovation in Technology, Industries and Institutions", Ann Arbor: The University of Michigan Press.

Stiglitz J. - Weiss A. (1981), Credit Rationing in Markets with Imperfect Information. American Economic Review, 71.

Venieris Y.P. - Gupta D.K. (1986), Income Distribution and Sociopolitical Instability as Determinants of Savings. Journal of Political Economy, 94(4).