The Distribution of wealth and real growth in Italy: a post-Keynesian perspective[1]

by

Pasquale Lucio Scandizzo and Maria Rita Pierleoni

ABSTRACT

We considered the problem of the determinants of income distribution in the light of the recent hypotheses advanced by Piketty on the evolution of the capitalistic system. We first reinterpret Piketty's analysis in the context of a modified Cambridge model, where functional income distribution can adjust to ensure equality between a warranted rate and a natural rate of growth. We show that this model yields some of the effects depicted by Piketty's analysis through the rate of return to capital and the exogenous growth rate, if not only the functional, but also the personal distribution of income reacts to equilibrate the economy in response to divergent growth in the goods and labor markets. We also demonstrate that these results imply that the capital share of income and the share of the richer part of the population tend to move in the opposite direction in response to growth, so that, especially under declining growth, the fiscal treatment of capital and wealth should be different, with lower taxation for productive capital and increasing progressivity for income taxes. We finally test the main results of our analysis on data for the last 40 years of performance of the Italian economy, finding some significant consistency between our hypotheses and the empirical evidence.

JEL: 023, 041, 047;

Keywords: Post-Keynesian, Functional, Personal, Income Distribution, Growth

1. Introduction

The distribution of wealth is one of the most important and debated issues of our times, both because economic growth in advanced countries has suffered repeated delays over the past 40 years, and because in those years the inequalities within the rich countries. particularly in the United States, have increased. Furthermore, the first decade of the twenty-first century was characterized by a deep economic crisis that has affected almost all industrialized countries. This crisis was mainly caused by striking imbalances in the financial markets, oil and real estate, with heavy consequences on the less affluent social classes. The economic inequality arises then as a central theme of economic analysis. The recent book by Piketty (2014), together with a monumental set of historical data, attempts to squarely face this issue, and seeks to answer three fundamental questions: a) What can be said of the long-term development and growth of inequality? b) The dynamics of accumulation inevitably leads to increasingly strong concentration of wealth and power in a few hands? c) Or balancing the dynamics of growth, competition and technical progress leads to a spontaneous reduction of inequalities?

The answers suggested by Piketty, well summarized in a recent contribution by Targetti Lenti (2015), are based on comparatively very large historical data sets, the most important conclusion being that the modern growth and dissemination of knowledge have avoided the Marxist apocalypse but have not altered the deep structure of capital and inequality. This is explained by the fact that the process of

[1] Conference paper: 56-ma Annual Scientific Meeting, Ottobre 2015 – Società Italiana degli Economisti.

accumulation and distribution of wealth in itself contains factors of convergence and divergence. Factors of convergence - which lead to a greater egalitarianism between social classes - are well represented by the spread of knowledge and investment in skills and training. These factors are only partly natural and spontaneous as they depend heavily on the policies pursued in the field of education and access to training and appropriate skills, and the institutions responsible. The divergence factors that push towards the multiplication of inequalities. According to Piketty have become in the twentieth century more and more powerful and can, therefore, at any time take over as seems to happen at the beginning of the XXI century. Among them there are some that could arise in a world where all investments appropriate for the maturing of skills may have already taken place and in which all conditions of efficiency of the market economy made appear. This class covers the difference between the rate of return on capital and the growth rate of the economy and is, therefore, the main factor of divergence in the distribution of wealth. According to Piketty, when the rate of return on capital regularly exceeds the growth rate of the economy, capitalism automatically produces deep and unsustainable inequalities. This constitutes a serious threat to democratic society based on meritocratic principles.

In order to explain the importance of the factors of divergence in the process of accumulation and distribution of wealth. Piketty analyzes the dynamics of the distribution of income in advanced economies in a very long time span (1870-2010) and with two indexes measuring extreme inequality, consisting of the share of the top 1% and 10% of the distribution of national income - in some countries (United States, France, Germany and the United Kingdom) and their coevolution with the capital output ratio (K/Q). According to statistics collected and estimates developed by the economist, inequality in the European countries and the United States was high on average until 1910, and then decreased until 1970, when it recovered to rise in inequality consistent way. In particular, in the European countries analyzed (United Kingdom, Germany, France and Sweden). Piketty argues that the temporary decrease in income inequality was due to the destruction of the capital that took place in the years 1914-1945. The United States in the period 1900-1910 recorded a lower level of inequality than Europe. Which, however, became a higher level in the years 50-60's and a much higher level at the beginning of the XXI. The analysis of K/Q – which appears to be an indicator even more decisive for the distribution of wealth – is presented for the period 1870-2010 for France, Germany and the United Kingdom with a U-shaped high amplitude since the fifties steadily increasing. The return of the high ratio between the capital stock and the flow of national income is due in large part to the return to a regime of slow growth that is associated with a rate of return on capital that has reached substantial and lasting levels.

The divergence between the rate of return on capital and the growth rate – $\rho > g$ – according to Piketty, holds a crucial role in explaining the processes of accumulation and distribution of wealth. The author focuses its analysis on the study of this divergence, based on two ratios which he calls "the two fundamental laws of capitalism." The first law states:

$$(1) \quad \alpha = \rho \frac{K}{Q}$$

where α is the share of capital income in GDP (or national income = Q), and, as defined before, ρ is the rate of return on capital and $\frac{K}{Q}$ the capital output ratio. This "law" is only an accounting identity. but allows us to connect the three most important variables of the capitalist system in a single expression implying that an increase in the share of capital depends positively on the growth rate of ρ and the stock of capital and inversely on national income.

The second law establishes a long-term dynamic equilibrium equality the capital output ratio K/Q, and the ratio between the economic growth rate g and the marginal propensity to save s:

(2) $$\frac{dK}{dQ} = \frac{dK}{Q}\frac{Q}{dQ} = \frac{s}{g} = \beta \;\rightarrow \frac{K}{Q}$$

According to this equation, a country that saves and grows very slowly accumulates over the long term a stock of capital large enough to significantly affect the social structure and the distribution of wealth. Piketty points out that this law applies only under very specific hypotheses. In the first place. it is an asymptotic law that represents a level of dynamic equilibrium to which the economy tends in the long run, since the accumulation of assets takes time. Second, the law is only valid when applied to forms of capital accumulated by man and does not apply, for example, to natural resources.

Taking into account the second law, the first law can be rewritten as follows:

(3) $$\alpha = \rho\beta = \rho\frac{s}{g}$$

an expression which shows that the share of capital income grows in periods of slow growth even with limited savings.

From the observation of historical data Piketty notes:

- ρ has always been historically above g; in other words the capital has grown faster than income. Moreover, according to Piketty such divergence is perfectly verifiable in standard economic models. with higher margins of certainty the more efficient are the operations of the capital market;

- g worldwide has followed an inverted U-curve of remarkable breadth. falling between 1990 and 2012 to below 3.5%, despite the very strong growth in emerging countries;

- s has maintained consistent and lasting levels over time.

According to the two laws above the direct consequences are the increase of capital output ratio and the increase in the share of income claimed by capitalists. In other words, given the historical realities, the individual who inherits wealth can save a lower share of capital because the latter will grow faster than income. In such conditions it is almost inevitable that the assets received as inheritance prevail largely on assets accumulated over a lifetime of work and capital concentration reaches very high levels potentially incompatible with merit values and principles of social justice. To counter these effects, Piketty believes that it is essential that institutions and public policies play a role to introduce a progressive world capital tax, even if this involves international coordination that is not easy to accomplish.

2. A Keynesian interpretation of Piketty's model

As noted by Lance Taylor (2014), Piketty presents his model as entirely based on the "incredible" tale of neoclassical full employment, with the additional assumption of a high (>1) elasticity of substitution between capital and labor. However, Piketty's argument is by its nature more general for at least two reasons. First, it is based on the idea that income distribution and the capital output ratio both adjust to an exogenously given combination of capitalists' returns and growth. Second, at least part of the argument can be interpreted as deriving from the empirical finding that the rate of return on capital tends to exceed and diverge from the rate of growth, thus implying that capital gains will tend to grow progressively faster than the incomes of wages resulting in a worsening of the income distribution. Although several economic models can be formulated in support of this position, and Piketty calls explicitly for the neoclassical model, both the exogeneity of the growth rate (or some of its components) and the role of income distribution as a reacting variable seem more in line with the tradition of so-called Cambridge models (Harrod-Domar, Kalecki, Pasinetti), which have traditionally considered income distribution as a variable co-defined with exogenous economic growth.

Consider, in fact the original Harrod-Domar (HD) model, where demand is defined by the Keynesian multiplier, Y is expected income (demand side), dK investment and s the marginal propensity to consume. Production capacity Q is proportional to the stock of capital through the so-called capital output ratio $k = \frac{K}{Q}$. In general, demand and supply will achieve equilibrium (investment equal to savings and expenditure equal to income) only at the so-called "warranted rate" of growth, which is equal to the marginal propensity to save divided by the capital output ratio : $g = \frac{s}{k}$. This balance can be matched to the rate of growth of the labor force g^*, or any other autonomous component of growth (the so-called "natural rate" of growth) and maintained at the level of full employment if at least one of the two parameters s, k can be adjusted. The solution proposed in a series of contributions of the Cambridge school, first by Kaldor and then by Pasinetti is the use of the income distribution as a way to change the marginal propensity to save. Robert Solow, on the other hand, on behalf of the neoclassical school, set out a benchmark growth model where the flexibility of the capital output ratio through a neoclassical production function was used to achieve full employment.

The case examined by Piketty can be seen as an alternative interpretation of the basic H-D equation, in the presence of an exogenous growth rate. The inverse of the capital output ratio 1 / k, in fact, is equal to:

(4) $$\frac{1}{k} = \frac{Q}{K} = \frac{P+W}{K} = \rho + \frac{(1-\alpha)}{k}$$

where P and W are, respectively, the profits of the capitalists and labor income, ρ is the rate of return on equity and α the share of capital income in total income. Solving for k yields:

(5) $$k = \frac{\alpha}{\rho}$$

Substituting (5) in the expression of the warranted growth rate $g = \frac{s}{k}$, we promptly obtain:

(6) $$g = \frac{s\rho}{\alpha}$$

i.e. the same expression that Piketty obtains combining the two “laws of capitalism” . So $g < \rho$ if $s < \alpha$, a condition that is satisfied in all the so-called "capitalist" countries, where s is of the order of 10% and α of 40%.

Expression (6), however, does not take into account the fact that capitalists and workers have different propensities to save, so that the marginal propensity to save is itself dependent on the share of income accruing to capitalists. In order to examine this issue, consider the Kaldor-Pasinetti solution, which comes from the relationship between the profits and the capital stock of the capitalists:

(7) $$\frac{P_c}{K} = \rho \frac{K_c}{K}$$

In (7), P_c is the profit obtained by capitalists and K_c the capital stock owned by them. In dynamic equilibrium, the ratio in (7) must comply with the equality relationship between the flows of savings:

(8) $$\frac{K_c}{K} = \frac{S_c}{S} = \frac{s_c P_c}{I}$$

Where S_c and s_c are respectively the savings and the propensity to save of capitalists and S and I are, respectively total savings and investment. Because we have assumed $S = I$, the last expression in (8) is consistent with both dynamic equilibrium (stocks =flows) and with static equilibrium (income = expenditure). Substituting (8) into (7), and simplifying, we immediately obtain the Kaldor-Pasinetti result:

(9) $$\frac{dK}{K} = g = \rho s_c$$

In this result, the income share of capitalists is no longer involved, as in the basic H-D equation and in Piketty’s combined laws, except, possibly through a theory of the rate of return to capital. Equation (9) thus indicates the value of the warranted growth rate, which has the additional property (not required in the original H-D model) of ensuring dynamic equilibrium between stocks and flows. According to (9), however, the relationship between growth rate and interest rate depends only on the propensity to save of capitalists, so that no variable can apparently be used to ensure equality between the warranted and the natural (or any other exogenous) rate of growth. By adopting a particular theory of formation for the rate of return, we can, however, try to identify one or more factors that may bring together the warranted and the exogenous rate.

Consider first Pasinetti’s hypothesis (reiterated by Piketty), that the rate of return to capital equals the profit rate, at least in the long term. In this case, the (functional) income distribution can play the role of the flexibility variable that adapts to achieve the full employment equilibrium. In fact, substituting $\frac{P}{K}$ for ρ in (9), and breaking down the total profit in the components obtained by the capitalists and workers, after some simplifications, we obtain the expression:

(10) $$\alpha^* = \frac{g^* k}{s_c}$$

where α^* is the income share of the capital at full employment equilibrium growth g^*. If this rate, or at least one or more of its components, is exogenous, the higher the rate of growth, the more skewed will become income distribution in favor of capitalists. Contrary to Piketty's expression in (3) and what might be construed on the basis of Harrod-Domar expression in (6), therefore, the capital share α^* is a positive, and not a negative, function of the exogenous growth rate. Note, however, that α^* is the income share accruing to the owners of capital, and these can be both pure capitalists and workers, so that equation (10) does not necessarily imply that personal income distribution will be deteriorating with growth falling, since the capital income share could be increased and the share of capital owned by the workers could be increased or decreased, depending on other circumstances.

While the profit rate may be achieved by capital owners in the long run, an alternative theory of the rate of return to capital, explicitly adopted by Piketty, and consistent with his neoclassical set up, is that the expected rate of return is given by Ramsey equation:

(11) $\rho^{**} = \theta + \eta g^{**}$

This rate is the return required from capital on the basis of a neoclassical utility function, and is typically used in cost benefit analysis with the name of "accounting rate of interest" (Little and Mirrlees, 1969). It is equal to the sum of the "pure" rate of time preference θ and the expected rate of growth g^{**}, weighted by the elasticity of the marginal utility of income (η), a parameter measuring the curvature of the utility function and thus, by implication, risk aversion. This rate represents the level of unit return expected by economic agents and the only one that measures their willingness to forego present for future consumption. By substituting (11) into (9), we obtain the rate of growth that ensures equality between the expected, warranted and full employment growth:

(12) $g^* = \dfrac{\theta s_c}{1 - \eta s_c}$

In this expression, as in the original H-D formulation, we again have the problem of finding a parameter that can adjust to achieve equality with an exogenous rate of growth. In this case, however, in order to obtain equality between the RHs of (12) and an exogenous growth rate g^*, we can only resort to personal income distribution, since the rate of pure time preference θ and the elasticity of the marginal utility of consumption η can be both considered a weighted average of the corresponding parameters of the individuals of the population considered. In particular, we can divide the population into two categories corresponding to "the rich" and "the other". For example, we can consider the top 1% of income distribution and the rest. Assuming for simplicity that the rate of pure time preference is the same for the two categories, the elasticity can be written:

(13) $\eta = \omega \eta_R + (1 - \omega)\eta_P$

Where η_R, η_P are, respectively, the average elasticity of the marginal utility of consumption for the rich (individuals in the top 1%, 10% or any other upper quantile deemed to be sensitive to disequilibrium) and for the others and ω is the share of total income of the richest.

Substituting (13) into (12), we obtain the expected growth rate that ensures equilibrium in all markets:

(14) $g^{*} = \dfrac{\theta s_c}{1+[\omega^{*}(\eta_P - \eta_R) + \eta_P]s_c}$

and solving for the income share of the rich:

(15) $\omega^{*} = [(\dfrac{\theta}{g^{*}} - \eta_P)s_c - 1]/(\eta_P - \eta_R)s_c$

According to this equation, from the point of view of the consumption-savings nexus, personal income distribution (and not in the functional one as in Kaldor-Pasinetti) is the only variable able to balance the three growth rates (the guaranteed rate, the natural rate and the expected rate). If we consider the case, more plausible a priori, that the parameter of the concavity of the utility function (equivalent to the degree of relative risk aversion RRA) is lower for the richest and higher for the poorest[2], it is clear from (14) and (15) that both the income share of the rich and the rate of return on capital will tend to increase if growth decreases. From (15) we obtain in fact:

(16) $\dfrac{\partial \omega^{*}}{\partial g^{*}} = -(\dfrac{\theta}{g^{*2}})/(\eta_P - \eta_R)$

Expression (16) establishes a negative relationship between the income share of the richest and the growth rate, while the rate of return of capital in (11) also exhibits a negative relationship with the income share of the rich, being a positive function of g^{*} and η, whose decrease causes this share to go up. The share of capital α^{*}, however, exhibits a relationship of the opposite sign and tends to decrease as growth is reduced. According to these results, therefore, declining exogenous growth would have two different effects on the distribution of income: (i) in the long run, assuming that the rate of return to capital converges to the profit rate, it would reduce the share of capital and thus change the functional distribution in favor of wages and, (ii) both in the short and in the long run, to achieve equilibrium at the expected consumption rate of interest, declining growth would increase the share of income claimed by the richer part of the population. This suggests that capital and wealth, unlike what is implied by Piketty's conjecture, behave differently in relationship to growth and thus should be treated differently by government fiscal policies.

Instead than through a redistribution between two particular groups, the whole income distribution may change to ensure equilibrium between exogenous and endogenous growth components. For example, assume that RRA decreases with individual income y according to the expression:

(17) $\eta = \eta_0 / y$

and that the distribution of income follows Pareto law, so that its density function is:

(18) $f(y) = y_m^{\lambda} y^{-(1+\lambda)}$

[2] Existing evidence is consistent with the idea that the RRA is decreasing with income. For example, Guiso, Jappelli, and Terlizzese (1996) find that the share of risky assets in household portfolio is positively correlated with income and wealth level in data for Italian households. Kessler and Wolff (1991) find that the share of wealth invested in risky assets is, in general, increasing with wealth for French and American households.

for $y \geq y_m$ and zero otherwise, y_m being minimum income and λ the tail parameter linked to the Gini coefficient G by the relationship:

(19) $$G = \frac{1}{2\lambda - 1}$$

The average RRA is given by:

(20) $$\eta = \int_{y_m}^{\infty} \eta_0 \lambda y_m^{\lambda} y^{-(2+\lambda)} dy \qquad = \eta_0 \lambda \frac{y_m^{-1}}{1+\lambda}$$

so that, substituting into (12) and solving for λ:

(21) $$\lambda^* = \frac{\theta s_c - g^*}{g^*(1 - \eta_0 y_m^{-1}) - \theta s_c}$$

This expression shows that the tail parameter of the Pareto distribution (which is a measure of relative equality and is inversely related to the Gini coefficient) is a positive function of the growth rate, as it can be seen also by differentiating λ^* with respect to g^*:

(22) $$\frac{\partial \lambda^*}{\partial g^*} = \frac{\theta s_c \eta_o / y_m}{D^2}$$

where D denotes the denominator of (21).

As for the difference between ρ and g, which plays a very strong role in Piketty's story, expression (11) shows that ρ tends to fall less than proportionally than g, provided that $\eta < 1$, so that this relation will be less than proportional and all the more reduced the higher the inequality (the greater) and the greater the fall in growth rate. In other words, if the growth rate is reduced for exogenous reasons, namely demographic transition, lower technical progress or even a negative evolution of expectations, the share of the richest will rise, worsening the income distribution.

Consider now the profit rate. In general, this quantity will not equal the rate of return of capital, except in the long run. The rate of return of capital, in fact, is the return as a proportion of the original investment $\rho = dP / dK$, while the rate of profit is the profit made as a proportion of capital at replacement value $r = P / K$. Differentiating this expression, we find:

(23) $$dr = d(\frac{P}{K}) = \frac{P}{K}(\frac{dP}{P} - g)$$

and:

(24) $$\frac{dP}{P} = \frac{dP}{dK}\frac{dK}{K}\frac{K}{P} = \frac{\rho g}{P / K}$$

Substituting (24) into (23):

(25) $$dr = d(\frac{P}{K}) = g(\rho - r)$$

And substituting (11) into (25):

(26) $dr = d(\frac{P}{K}) = -(\frac{P}{K} - \theta)g + \eta g^2$

The change in the profit rate in practice will be dominated by the first term in expression (26), which will generally be negative ($\frac{P}{K} > \theta$), while the second term will be smaller, especially if income inequality is high ($\eta < 1$). The profit rate will thus tend to decrease if growth goes down and contribute to the fall of the capital share ($\alpha = k\frac{P}{K}$) by virtue of equation (5).

To sum up, by combining personal and functional income distribution adjustments to achieve equilibrium growth (that imply equality between warranted growth rate and natural one), we find that a reduction in the (natural or any other exogenously defined) growth rate is followed by: (i) a less than proportional reduction in the rate of return to capital, (ii) a deterioration in the personal distribution of income, (iii) a reduction in the rate of profit of capital and, (iv) a decrease in the share of income claimed by capital owners. These results agree with some of Piketty's conclusions but, at the same time, significantly differ from them in one important respect: the divergence between the behavior of productive capital from accumulated wealth. This last variable is not explicitly present in our analysis, but is the obvious candidate to explain why, when the functional income distribution turns against capital, and investment presumably falls, the richer part of the population tends to become richer. This also implies that under declining growth it is not productive capital that should be taxed, as Piketty proposes, but income deriving from unproductive assets.

3. Policy Implication

According to Harrod, the H-D growth framework displays a contradictory effects of expansionary fiscal policies that can be summarized as follows: "Measures calculated to influence actual growth rates upwards or downwards have the opposite effect, to the extent that they have any effect, on the normal warranted growth...Any rise in the savings ratio raises the warranted growth rate, while, of course, tending to depress the actual one...On the fiscal side a shift towards reducing a budget surplus or increasing a deficit will assuredly reduce the warranted growth rate, while raising the actual one (Harrod 1973, p. 102)".

This is what Harrod calls the *central paradox* of expansionary policies. In fact, suppose that the warranted growth rate (g_w) is above the natural growth rate (g_n) but the actual growth rate (g_a) is below the former ($g_w > g_a > g_n$). In this situation, the desired social savings rate (which determines the warranted growth rate) exceeds that rate which is necessary to bring about full employment. Harrod calls this the *oversaving scenario*. The economy has more savings than it needs in order to employ all its workers. In terms of the Kaldor-Pasinetti theory, this means that the share of income appropriated to capitalists, who have the largest propensity to save, is too large. The adjustment to equilibrium would thus imply a reduction in the profit rate as well as in the share of capital owned by the capitalists. An increase in the budget deficit raises the actual growth rate, but, at the same time helps to lower the warranted rate toward the natural rate, so that the share of capital and the profit rate do not have to fall too much to achieve equilibrium. However, the adjustment through the profit rate will only work in the long run. In the short run, the fall in the growth rate necessary to bring down the actual rate of growth toward the natural one can only be achieved by a deterioration of personal income distribution, i.e. by transferring income (and wealth) to the richer part of the population. The reason for this, as we have seen, is that richer people are less risk averse and thus more willing to accept a lower rate of return for the same level of growth. The "oversaving " scenario, therefore, exhibits a tendency to procure the adjustment to equilibrium through two undesirable social outcomes: (1) a fall in the share of capital and the rate of profit, with an associated fall in the investment rate, and, (2) a deterioration in the personal distribution of income by shifting wealth toward the economic agents with lower risk aversion. These two effects combined will also imply that the richer part of the population will find its portfolio increasing made of unproductive wealth rather than by productive capital. Government policies to avoid these two undesirable effects, and to pursue sustainable growth, therefore, could usefully combine a deficit- budget stimulus with lower taxation on capital and an increase in progressive income or wealth taxation.

If warranted growth is less than natural growth ($g_n > g_w > g_a$), on the other hand, we are in what Harrod calls the *undersaving scenario*. An increase in the budget deficit will be beneficial for the actual growth rate since it will raise it above the warranted rate. This rate will not be sustainable, since the budget deficit, by lowering the social savings rate, will lower the warranted growth and thus drive the economy further away from the full employment growth path. However, an increasing growth rate will be associated with a decline in the share of wealth of the richer population and, at least as a long run tendency, in an increase in the capital share. Both effects will tend to increase savings and investment and reconstitute equilibrium, especially if the budget deficit is supplemented by some relief on both higher income brackets and capital taxation

In sum, within a post-Keynesian perspective, our model suggests that in case of an "oversaving" scenario equilibrium can be reached by long term functional income distribution adjustments and personal income distribution adjustments that are not socially desirable, since they lead to investment decline and an increase in the wealth of the rich. To influence this scenario, a deficit budget stimulus combined with a capital subsidy (or tax relief) and an increase in fiscal pressure on the richer part of the population may thus be recommended. On the other hand, in case of an undersaving scenario, adjusting to a higher rate of growth will put in motion changes that are at least partly socially desirable, since they involve an improvement in the personal income distribution. In this situation the deficit budget stimulus may be combined with a tax reduction on capital and/or on the rich, which may help achieving more speedily equilibrium growth.

In the case where lack of total demand makes growth be low and/or declining, income inequality will increase. The role of the state is thus crucial, not only to support full employment and technical progress, but also to avoid that income distribution deteriorates. For this, appropriate fiscal stimuli and discriminating taxation will be in order. In particular, our model suggests a dual tax policy differently related to the functional and personal income distribution. This policy implication diverges from Piketty's indication in favor of a taxation on all types of capital, both productive and non-productive. Moreover, under declining exogenous growth, it also appears that fiscal policy should try to attenuate the fall of the income share accruing to the owners of productive capital (pure capitalists and workers). In other words, our model suggests that capital and wealth, unlike what is implied by Piketty's conjecture, behave differently in relationship to growth and thus should be treated differently by government fiscal policies.

4. An application to Italy

Given this theoretical background, the work presented below aims to test the hypotheses developed and Piketty's suggestions, with a data set collected for Italy. The focus of the analysis is to examine empirically whether the growth rate and the rate of return on capital (defined both as interest rate and profit rate) and some key indicators that explain the processes of accumulation and distribution of wealth. The first of these indicators is the income from capital as a share of national income ; other indicators are represented by several variables related to the distribution of wealth, such as the Gini index and the share of income held by the 1%, 5% and 10% of the richer population.

Our work is organized as follows: in the following section we describe the construction of the database and present some indicators of the key variables characterizing the Italian economic system in the period 1970-2009. In the next section, we present and discuss the results of the empirical analysis. The last section presents some conclusions.

4.1 The basic data and key indicators

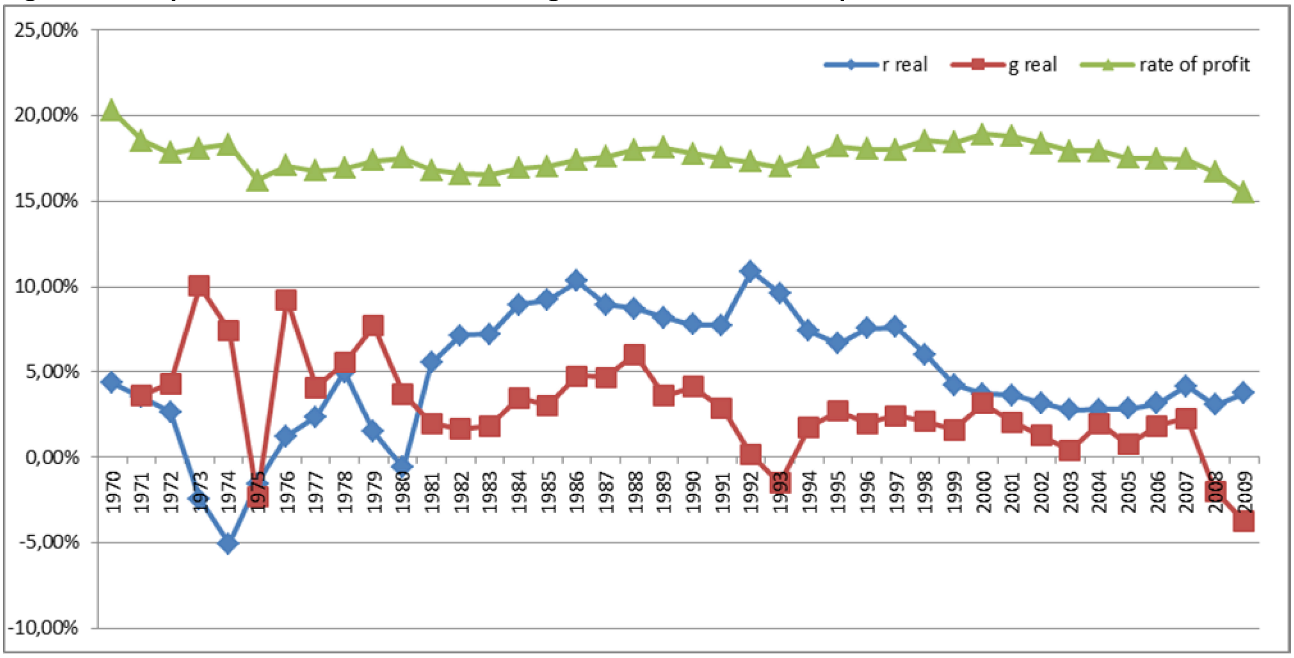
The data collected for this work refer to the main macroeconomic variables recorded for Italy over the period 1970-2009. The time series examined were extracted from the following databases: Istat, Bank of Italy, the World Bank, International Monetary Fund and World Top Incomes Database. In particular, the economic variables considered in the period 1970-2009 are the following:

1) capital stock is expressed in constant 2010 prices ("K");
2) GDP expressed in constant 2010 prices ("Q");
3) the population size ("POPs");
4) the rate of inflation ("TInfl");
5) the income from dependent employment expressed in current prices;
6) the share of income held from 1%, 5% and 10% of the richer population (POP);
7) the GINI index (IndGini);
8) the bank interest rates on short and medium-long term.

Other variables constructed from the data in the preceding are the following:

1) other income as the difference between GDP (or national income) and income from dependent employment, expressed in current prices;
2) the percentages of income from employment and other income on GDP, expressed in current prices;
3) the rate of profit, defined as the ratio of income from capital and the capital stock;
4) the rate of growth real GDP growth calculated as the difference between the nominal growth rate "g" and the inflation rate ("g real");
5) the growth rate of the population ("TPOP");
6) the real interest rate resulting from the average bank lending rates adjusted for inflation ("real r").

Figure 1. Comparison of the rate of real GDP growth with the rate of profit

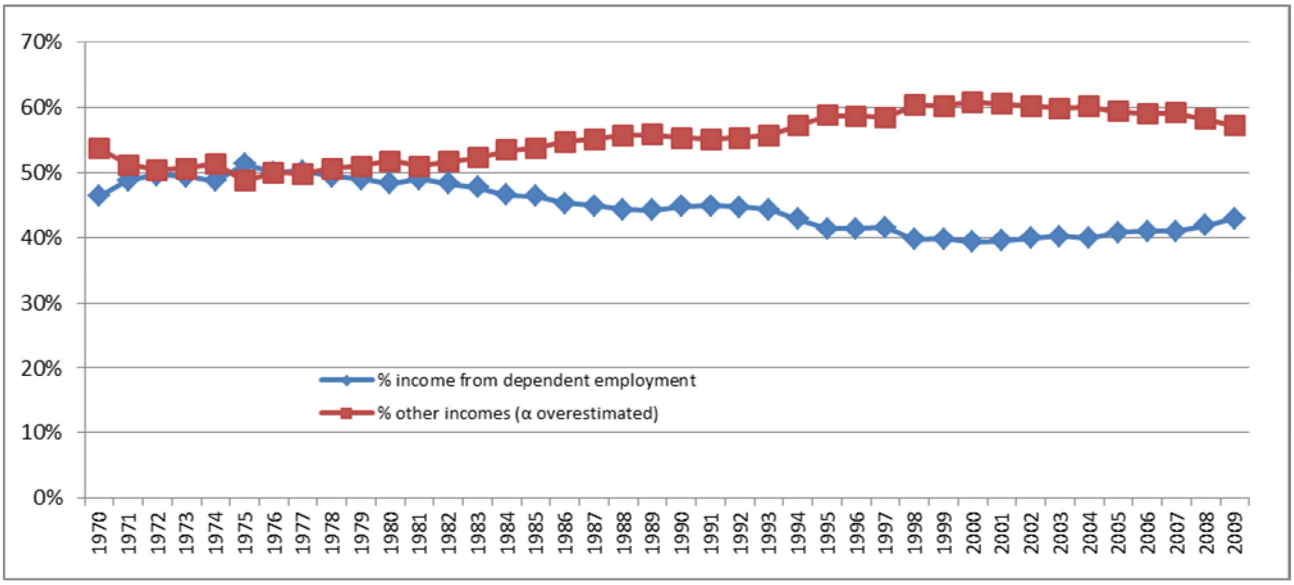


Source: our elaboration

The graph in Figure 1 compares the rate of real GDP growth with the rate of profit. Technically this rate can be obtained as a ratio of income from capital on GDP (or income) and capital of GDP, using two statistics that are usually collected separately. As the chart shows, this rate (which we called r) varies over the past 40 years between 15 and 20%. This level seems excessive, although it also incorporates the effect of inflation, and is probably overestimated, for two distinct reasons. Firstly, the share of national income going to capital also includes the incomes of self-employed workers. Secondly, the time series of capital does not include a number of components of wealth, such as, in particular, the financial assets. Given its likely overestimation , reflected in levels that appear above all other European countries, and considering that the rate of profit and the rate of return to capital can be expected to be equal only in the long run, as we explained in our analysis above, we used the average bank lending rates in the short and medium-long term after inflation to obtain a proxy of the rate of profit, adjusted to take into account of the component reflected in the rate of interest. As shown in Figure 1, the interest rate considered shows a cyclical pattern in recent years and a tendency to grow. It can be considered a proxy for the return on equity as an exogenous variable arising from the credit market (not directly related to the fundamental laws of capitalism). The graph in Figure 2 shows first a positive and then a negative difference between the rate of real GDP growth and the return on equity calculated as "real r", the growth rate of GDP first increasing and then decreasing, declining from approximately 10% in 1973 to -3% in 2009. The negative difference with the return on capital r, which can be interpreted as a factor of increasing divergence between the income of the capitalists and the workers, started after 1980.

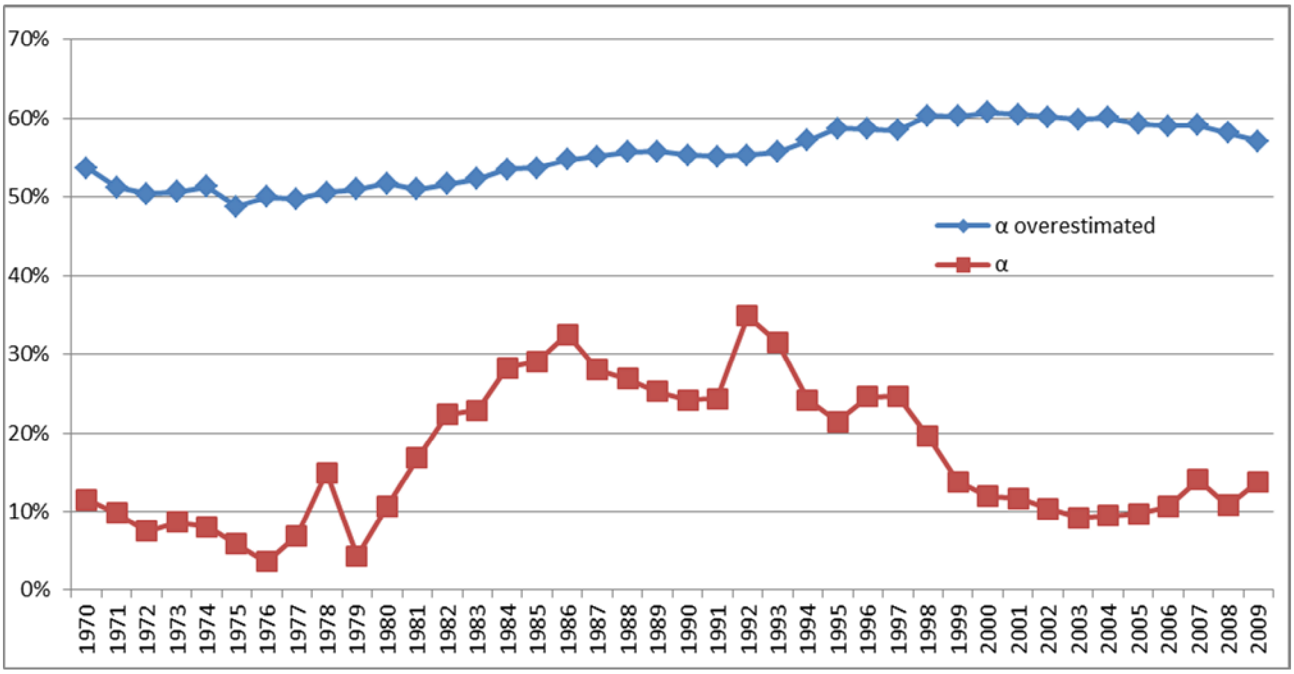
The graph in Figure 2 shows the composition of national income, that is, the percentage of income from dependent employment and other incomes. The "other incomes" are an inappropriate estimate of the capitalists' share (α) because is a residual calculated on the basis of the difference between total income and income from dependent employment and thus includes the incomes of professionals and other non-dependent workers, that cannot however be considered capitalists. In Figure 3 this proportion is compared with the amount that is obtained by considering the return on capital r calculated based on the real interest rate.

Figure 2. Composition of national income: percentage of income from dependent employment and other incomes.



Source: our elaboration

Figure 3. Comparison α overestimated with α obtained by considering the return on capital r calculated based on the real interest rate



Source: our elaborations on data from ISTAT and the Bank of Italy

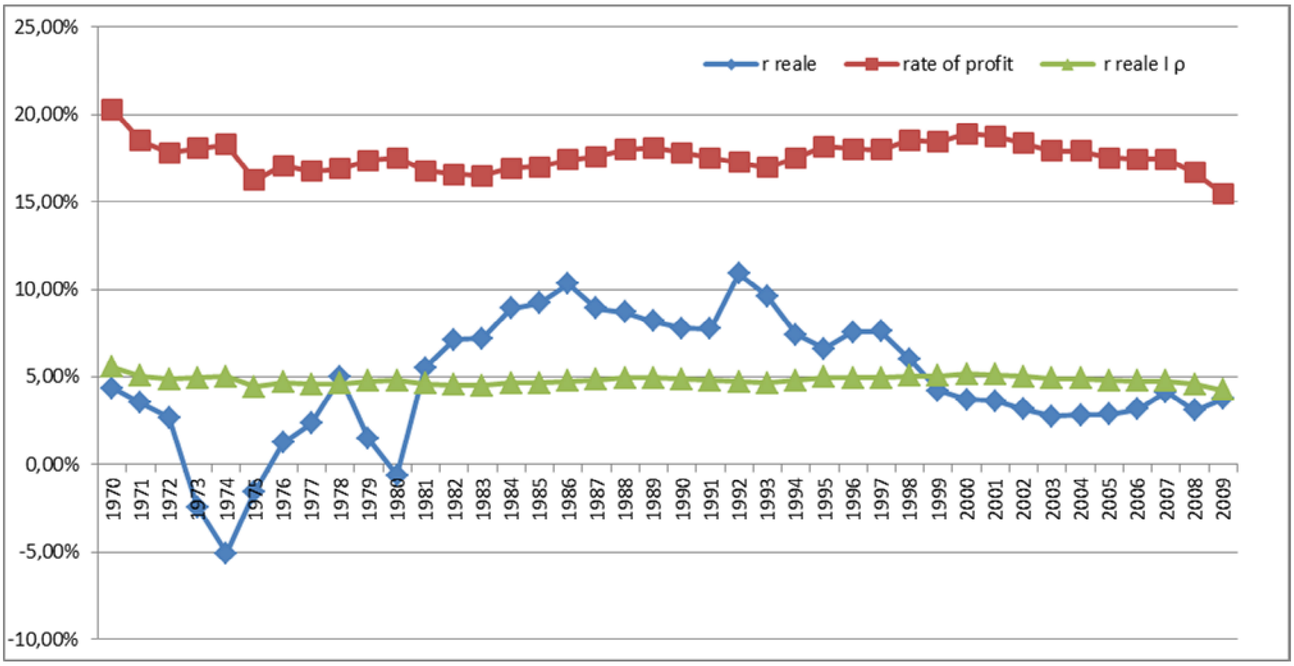
4.2 Estimates and discussion of the empirical results obtained

Let us first consider the problem of estimating the return on capital. As we have already stated, the estimate of the profit share from the capital income ratio generates an overestimation of the long term return on capital for two main reasons. On the one hand, in fact, the numerator of the estimate is the share of profits obtained from the statistics of national income. This in turn is obtained by subtracting from the same income the value of wages paid to employees, and thus includes the income of self-employed workers. On the other hand, the denominator of the estimate, the ratio between capital and income, does not include financial assets. The real interest rate, as a proxy for the return on capital, does not present the same problems. but shows a cyclical pattern that reflects the influence of factors such as money supply and inflation expectations. The real rate of interest, in particular, is a function of the return on equity, calculated using fundamentals such as the share of national income from the capitalists and the appropriate capital income ratio, and its conditioned mean $E[r|\rho]$, and can be estimated using the simple linear model:

(27) $r = a + b\rho + u$

where b represents the effect of the profit rate on the market rate and u the effect of a set of other unobservable variables, which is assumed to be zero. The estimate calculated on the basis of (27) is the projection of return on capital in the space of the real interest rate. Such a projection $\hat{r} = E[r|\rho]$, being limited by the performance of r, corrects, so to speak, the overestimation of ρ, and, at the same time, being conditioned by ρ, does not present r's cyclical trend (Figure 4).

Figure 4. Comparison between the profit rate ρ and the rate of interest r conditioned by ρ



Source: our elaborations on data from ISTAT and the Bank of Italy

5.The Estimation Problem

Consider the relationship between the dependent and the independent variables of our analysis in the stylized form:

(28) $y_t = \beta_0 + \beta_1 r_t + \beta_2 g_t + \gamma Z_t + u_t$

where y_t is either the income from capital as a share of national income or a measure of income inequality for the th year, r_t is a correspondent measure of the profit rate, g_t the growth rate of GDP, Z_t a set of exogenous variables, and u_t a random disturbance. It is important to underline the fact that equation (28) is not a structural relationship, but a reduced form portraying the result of historical processes, on the basis, inter alia, of underlying forces such as population growth and technological progress. If we assume that growth has been adjusted, either through optimization or through any consistent set of policies, to circumstances outside the control of the policy makers, including exogenous variables, states of nature etc.. the coefficients β_i, i=1,2 in (28) should be zero. In other words, all systematic differences in capital output ratios or in income distribution measures from one year to another should be accounted for by differences in the Z_t variables or in the random term u_t. A β_i different of zero, on the other hand, would imply the existence of systematic differences across years that are not accounted for by the controls Z_t in the equation: these differences could be due to different policy rules, different abilities in following the same rules or different levels of information or other omitted variables that are correlated with.

In order to test for the existence of a relationship between income from capital as a share of national income and other measures of income distribution with the two key variables: rate of profit and rate of growth, we use both OLS regression model and quantile regressions (Koenker and Bassett. 1978). While OLS focuses on modeling the conditional mean of the response variable without accounting for its distribution, the quantile regression model accounts for the full conditional distributional properties of the response variable (or is residual after accounting for the exogenous variables) thereby differing on the assumptions about the error terms of the regression model. In the case of equation (28), the OLS model is based on the assumption that the error term is normally distributed with zero mean and constant variance: $u_t \sim i.i.d. N(0.\sigma^2)$.

The consequence of the mean zero assumption of the error term implies that the model fits the conditional mean, namely $E[y - \gamma Z|x] = \beta_0 + \beta_i x_t$ which can be interpreted as the average value of the dependent variable. after accounting for the effect of the exogenous variables Z, corresponding to a fixed value of the covariate x (i.e. profit and growth). The linear regression model describes how the conditional distribution behaves by utilizing the mean of a distribution to represent its central tendency, a choice that appears appropriate under the assumption of homoscedasticity, namely of constant variance for all values of the covariate x.

The quantile-regression model (QRM) estimates the potential differential effect of one or more covariates (growth and profit) on various quantiles in the conditional distribution. A conditional quantile is a statistic corresponding to the probability level of a given distribution, according to a function (the quantile function) defined as $q(p) = \{y: \Pr(Y \leq y) = p\}$. By considering the different quantiles, the QRM estimates how the effect of a covariate varies with the distribution of the response variable and accommodates heteroscedasticity. The QRM corresponding to the LRM in Equation (28) can be expressed as:

$$(29) \qquad y_t = \beta_0^{(q)} + \beta_1^{(q)} r_t + \beta_2^{(q)} g_t + \gamma^{(q)} Z_t + u_t^{(q)}$$

The parameter vector, $[\beta_0^{(q)}\beta_1^{(q)}\beta_2^{(q)}\gamma^{(q)}]$ is obtained by minimizing the sum of absolute deviations from an arbitrarily chosen quantile of the dependent variable (K/Q ratio or income inequality) across years. In the case of Equation (29) this sum can be expressed

as:

$$(30) \qquad \text{Minimize: } \sum_i \left| y_t^q - [\beta_0^{(q)} + \beta_1^{(q)} r_t + \sum_j \gamma_j^q Z_{jt} \right|$$

where y_t^q = K/Q ratio or income inequality measure at quantile q, (i =1, ...n).

The solution to Equation (30) is found by rewriting the expression as a linear programming problem over the entire sample (see Chamberlain, 1994) and solving for the values of the parameters. Both the squared-error and absolute-error loss functions are symmetric, as the sign of the prediction error is not relevant. While OLS can be inefficient if the errors are highly non-normal, quantile regression is more robust to non-normal errors and outliers. QR also provides a richer characterization of the data, allowing to consider the impact of a covariate on the entire distribution of y, not merely its conditional mean.

5.1 The estimation results

The tables below present the results of our econometric analysis using both the OLS and the Quantile Regression (QR) methods, with alternative specifications on both the main covariates (r-g, r and g and g alone) and on the shifters (the inflation rate, the population growth rate and a linear trend). In general, the results confirm only partially Piketty's thesis, and seem to corroborate alternative interpretations on the workings of the growth, the profit and the rate of return to capital. In particular, as predicted by our equation (10), the share of capital appears to be linked by a very strong positive relationship with the growth rate. Furthermore, the effects of the rate of return always dominate on the growth rate effect, suggesting a powerful long term influence of the profit rate on both reducing the productivity of capital and increasing income inequality. The effect of the growth rate on both variables, on the other hand, is significant and negative, as suggested by the model presented in this paper, corroborating the hypothesis that both functional and personal income distribution adjust in opposite ways to maintain equilibrium growth in the face of exogenous shocks to the growth of employment, technical progress or another autonomous change of the external scenario. Finally, the quantile estimates suggest that the impact estimates do not depend on the distribution and are robust across the quantiles considered.

6. Conclusions

In this paper we have considered the problem of the determinants of income distribution in the light of the recent hypotheses advanced by Piketty on the evolution of the capitalistic system. We have first reinterpreted Piketty's analysis in the context of a modified Cambridge model, where functional income distribution can adjust to ensure equality between a warranted rate and a natural rate of growth. We have further shown that this model yields some of the effects depicted by Piketty's analysis through the rate of return to capital and the exogenous growth rate, if not only the functional, but also the personal distribution of income reacts to equilibrate the economy in response to divergent growth in the goods and labor markets.

We have also tested alternative versions of the above models by using the longest time series on national accounts and capital stocks available for Italy. The result appear to indicate that the rate of return to capital and the rate of growth of the economy, and, as Piketty claims, their difference, have indeed a major impact on the capital share and on several measures of inequality. The parameter estimates appear robust with respect to the distribution of the variables in question and the growth rate remains a significant determinant of the dependent variables even without the rate of return, as in the case of one of the models considered. However, the effect of growth on the capital share and personal income distribution appear to be contrary to Piketty's predictions and to corroborate an alternative formulation based on a post-Keynesian framework. In such a framework, the main adjustment factors in response to a misalignment between equilibrium and full employment growth would not be the capital labor ratio, but a complex adjustment involving both the functional and the personal income distribution. This adjustment, in turn, suggests that productive capital and wealth should be considered as different variables with divergent roles in ensuring equilibrium in the economy: capital would in fact respond to growth by increasing accumulation and, as a consequence, further enhancing production and employment. Wealth, on the contrary, would tend to reduce its concentration with growth (in response to a tide that lifts or lowers all boats). With declining growth, Piketty's predictions would thus be upheld for the personal, but not for the functional income distribution.

The role of the state is thus crucial, not only to support full employment and technical progress, but also to avoid that income distribution deteriorates. For this, appropriate fiscal stimuli and discriminating taxation will be in order. In particular, our model suggests a dual tax policy differently related to the functional and personal income distribution. Moreover, under declining exogenous growth, it also appears that fiscal policy should try to attenuate the fall of the income share accruing to the owners of productive capital (pure capitalists and workers). In other words, our conclusion is that capital and wealth, unlike what is implied by Piketty's conjecture, behave differently in relationship to growth and thus should be treated differently by government fiscal policies.

Table 1a. OLS and Quantile Estimates: the "best" equation estimated for each dependent variable

Dependent Variables	**Capital Share**		**Gini Index**	
Estimation method	OLS	25% Quantile regression	OLS	75% Quantile regression
Constant	0.479 (0.007)***	0.467 (0.008)***	0.07 (0.06)	0.09 (0.04)**
r			6.22 (1.25)***	6.02 (0.93)***
g	0.244 (0.084)***	0.306 (0.101)***	-0.20 (0.11)**	-0.15 (0.08)**
Population growth rate	-2.147 (0.626)***	-4.177 (0.749)***	3.41 (0.69)***	3.24 (0.51)***
Trend	0.003 (0.0002)***	0.004 (0.0002)***	-0.0006 (0.0002)**	-0.0004 (0.0002)**
R^2	0.91		0.54	
Adjusted R^2	0.90		0.48	
Pseudo R^2		0.74		0.33

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 1b. OLS and Quantile Estimates: the "best" equation estimated for each dependent variable

Dependent Variables	Income Share of the Top 1%		Income Share of the Top 5%		Income Share of the Top 10%	
Estimation method	OLS	25% Quantile regression	OLS	50% Quantile regression	OLS	75% Quantile regression
Constant	-0.02 (0.02)	-0.06 (0.01)***	-0.04 (0.04)	-0.12 (0.05)**	0.01 (0.05)	-0.04 (0.05)
r	2.19 (0.40)***	3.05 (0.30)***	5.20 (0.82)***	6.84 (1.12)***	6.32 (1.12)***	7.53 (0.97)***
g	-0.11 (0.03)***	-0.14 (0.02)***	-0.31 (0.06)***	-0.35 (0.08)***	-0.38 (0.08)***	-0.44 (0.07)***
Population growth rate	1.69 (0.20)***	1.31 (0.15)***	3.54 (0.42)***	4.39 (0.57)***	4.60 (0.57)***	7.02 (0.49)***
Inflation rate	-0.10 (0.01)***	-0.06 (0.00)***	-0.16 (0.03)***	-0.15 (0.04)***	-0.16 (0.04)***	-0.20 (0.03)***
R^2	0.91		0.91		0.88	
Adjusted R^2	0.90		0.90		0.86	
Pseudo R^2		0.77		0.76		0.74

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 2. OLS Estimates of the Capital Share Determinants

	Specification 1	Specification 2
Independent Variables		
Constant	0.479 (0.007)***	0.473 (0.007)***
g	0.244 (0.084)***	0.250 (0.095)**
Tpop	-2.147 (0.626)***	
Trend	0.003 (0.0002)***	0.003 (0.0002)***
R^2	0.91	0.88
Adjusted R^2	0.90	0.87

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 3. Quantile Estimates of the Capital Share Determinants

	Specification 1			Specification 2		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Independent Variables						
Constant	0.467 (0.008)***	0.466 (0.010)***	0.482 (0.012)***	0.473 (0.014)***	0.470 (0.011)***	0.472 (0.011)***
g	0.306 (0.101)***	0.263 (0.126)**	0.298 (0.147)**	0.187 (0.178)	0.220 (0.140)	0.302 (0.147)**
Population growth rate	-4.177 (0.749)***	-2.044 (0.935)**	-1.446 (1.090)			
Trend	0.004 (0.0002)***	0.004 (0.0003)***	0.004 (0.0004)***	0.003 (0.0004)***	0.004 (0.0003)***	0.004 (0.0004)***
Pseudo R^2	0.74	0.73	0.69	0.65	0.69	0.66

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 4. Gini index and income share of the top 1%: OLS Estimates

Dependent Variable	Gini Index	Share of Top 1%pop				
Independent Variables						
		Specification 1	Specification 2	Specification 3	Specification 4	Specification 5
Constant	0.074 (0.057)	-0.019 (0.019)	-0.109 (0.025)***	0.025 (0.033)	0.073 (0.002)***	0.081 (0.003)***
r	6.221 (1.251)***	2.190 (0.405) ***	3.986 (0.521)***	1.365 (0.688)**		
g	-0.196 (0.107)**	-0.109 (0.030)***	-0.247 (0.038)***	-0.121 (0.053)**		-0.164 (0.061)**
r-g					0.187 (0.060)**	
Population growth rate	3.409 (0.691)***	1.688 (0.205)***	1.754 (0.333)***		1.046 (0.512)**	1.045 (0.530)**
Inflation rate		-0.098 (0.013)***		-0.103 (0.023)***		
Trend	-0.0006 (0.0002)**					
R^2	0.54	0.91	0.75	0.71	0.33	0.29
Adjusted R^2	0.48	0.90	0.73	0.68	0.30	0.25

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 5. Determinants of Gini Index: Quantile Estimates

Estimation Method	25% quantile regression	50% quantile regression	75% quantile regression
Independent Variable			
Constant	0.027 (0.091)	0.109 (0.078)	0.089 (0.042)**
r	7.074 (2.001)***	5.616 (1.724)***	6.025 (0.931)***
g	-0.225 (0.171)	-0.201 (0.147)	-0.146 (0.079)**
Population growth rate	2.953 (1.105)**	3.068 0.952)***	3.243 (0.514)***
Trend	-0.0007 (0.0004)	-0.0007 (0.0003)**	-0.0004 (0.0002)**
Pseudo R^2	0.39	0.32	0.33

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 6a. Determinants of the Income Share of the Top 1%: Quantile Estimates

	Specification 1			Specification 2		
Estimation Method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent Variables						
Constant	-0.063 (0.014)***	-0.047 (0.024)**	-0.066 (0.026)**	-0.142 (0.024)***	-0.136 (0.034)***	-0.114 (0.037)***
r	3.050 (0.298)***	2.757 (0.500)***	3.172 (0.533)***	4.599 (0.506)***	4.513 (0.706)***	4.112 (0.780)***
g	-0.142 (0.022)***	-0.143 (0.037)***	-0.154 (0.040)***	-0.159 (0.037)***	-0.209 (0.052)***	-0.213 (0.057)***
Population Growth Rate	1.310 (0.151)***	2.087 (0.254)***	2.918 (0.271)***	1.257 (0.323)***	1.468 (0.451)***	2.441 (0.499)***
Rate of Inflation	-0.065 (0.001)***	-0.085 (0.017)***	-0.085 (0.017)***			
Pseudo R^2	0.77	0.74	0.75	0.58	0.60	0.58

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 6b. Determinants of the Income Share of the Top 1%: Quantile Estimates

	Specification 3			Specification 4		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent Variables						
Costant	-0.067 (0.018)***	-0.027 (0.049)	0.070 (0.072)	0.064 (0.004)***	0.074 (0.003)***	0.078 (0.003)***
r	3.158 (0.368)***	2.357 (1.007)**	0.542 (1.484)			
g	-0.164 (0.028)***	-0.156 (0.077)**	-0.051 (0.114)			
r – g				0.170 (0.104)	0.201 (0.085)**	0.248 (0.084)***
Population growth rate				2.212 (0.887)**	1.112 (0.720)	0.716 (0.715)
Inflation rate	-0.054 (0.013)***	-0.054 (0.034)	-0.117 (0.051)**			
Pseudo R^2	0.58	0.50	0.46	0.10	0.25	0.31

Table 6c. Determinants of the Income Share of the Top 1%: Quantile Estimates

	Specification 5		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent variables			
Costant	0.072 (0.005)***	0.083 (0.004)***	0.091 (0.004)***
g	-0.159 (0.103)	-0.198 (0.094)**	-0.259 (0.082)***
Population growth rate	2.223 (0.897)**	1.161 (0.822)	0.664 (0.718)
Pseudo R^2	0.08	0.22	0.28

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 7. Income share of the top 5% and 10%: OLS Estimates

Dependent Variable	**Share of Top 5%pop**				**Share of Top 10%pop**			
Indipendent Variables								
	Specific. 1	Specific. 2	Specific. 3	Specific. 4	Specific. 1	Specific. 2	Specific. 3	Specific. 4
Costant	-0.036 (0.040)	-0.046 (0.367)	0.215 (0.005)***	0.205 (0.005)***	0.009 (0.055)	0.283 (0.005)***	0.315 (0.007)***	0.304 (0.006)***
r	5.204 (0.823)***	4.594 (0.830)***			6.325 (1.124)***			
g	-0.309 (0.061)***	-0.209 (0.068)***		-0.367 (0.120)***	-0.383 (0.084)***			-0.418 (0.138)***
r – g			0.200 (0.099)**			0.473 (0.136)***	0.260 (0.128)**	
Population growth rate	3.545 (0.418)***	2.570 (0.430)***		2.195 (1.047)**	4.598 (0.571)***	3.059 (1.159)**		3.050 (1.203)**
Inflation rate	-0.164 (0.027)***		-0.242 (0.042)***		-0.164 (0.037)***		-0.255 (0.054)***	
Trend		0.001 (0.0001)***						
R^2	0.91	0.92	0.65	0.34	0.88	0.41	0.57	0.37
Adjusted R^2	0.90	0.91	0.63	0.30	0.86	0.37	0.54	0.33

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 8a. Determinants of the Income Share of the Top 5%: Quantile Estimates

	Specification 1			Specification 2		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent variables						
Costant	-0.154 (0.054)***	-0.116 (0.054)**	-0.061 (0.038)	0.212 (0.006)***	0.215 (0.007)***	0.228 (0.008)***
r	7.574 (1.103)***	6.838 (1.118)***	5.780 (0.782)***			
g	-0.449 (0.082)***	-0.351 (0.083)***	-0.318 (0.058)***			
r – g				0.265 (0.118)**	0.304 (0.144)**	0.154 (0.157)
Population growth rate	2.432 (0.560)***	4.392 (0.568)***	5.033 (0.397)***			
Inflation rate	-0.102 (0.037)**	-0.152 (0.037)***	-0.194 (0.026)***	-0.317 (0.050)***	-0.302 (0.061)***	-0.246 (0.066)***
Pseudo R^2	0.75	0.76	0.77	0.43	0.43	0.43

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 8b. Determinants of the Income Share of the Top 5%: Quantile Estimates

	Specification 3			Specification 4		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent variables						
Costant	-0.085 (0.035)**	-0.051 (0.051)	-0.075 (0.025)***	0.182 (0.009)***	0.208 (0.009)***	0.222 (0.007)***
r	5.124 (0.796)***	4.617 (1.166)***	5.304 (0.563)***			
g	-0.116 (0.065)*	-0.195 (0.095)**	-0.289 (0.046)***	-0.303 (0.195)	-0.372 (0.204)*	-0.431 (0.161)**
Population growth rate	1.498 (0.412)***	2.972 (0.604)***	3.736 (0.292)***	4.824 (1.699)***	2.258 (1.772)	1.401 (1.402)
Trend	0.001 (0.0002)***	0.001 (0.0002)***	0.001 (0.0001)***			
Pseudo R^2	0.76	0.76	0.78	0.14	0.23	0.25

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 8c. Determinants of the Income Share of the Top 10%: Quantile Estimates

	Specification 1			Specification 2		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Indipendent variables						
Costant	-0.098 (0.070)	-0.102 (0.066)	-0.045 (0.047)	0.258 (0.008)***	0.285 (0.009)***	0.299 (0.007)***
r	8.486 (1.447)***	8.591 (1.351)***	7.526 (0.969)***			
g	-0.533 (0.108)***	-0.437 (0.101)***	-0.444 (0.072)***			
r – g				0.546 (0.222)**	0.406 (0.244)*	0.509 (0.187)***
Population growth rate	2.978 (0.735)***	5.799 (0.686)***	7.018 (0.492)***	5.259 (1.894)***	3.393 (2.089)	1.686 (1.593)
Inflation rate	-0.118 (0.048)**	-0.147 (0.045)***	-0.200 (0.032)***			
Pseudo R^2	0.71	0.72	0.74	0.21	0.29	0.26

***: 1% significance level; **: 5% significance level; *:10% significance level.

Table 8d. Determinants of the Income Share of the Top 10%: Quantile Estimates

	Specification 3			Specification 4		
Estimation method	25% quantile regression	50% quantile regression	75% quantile regression	25% quantile regression	50% quantile regression	75% quantile regression
Independent variables						
Costant	0.311 (0.008)***	-0.317 (0.010)***	-0.335 (0.010)***	0.274 (0.009)***	0.305 (0.010)***	0.322 (0.009)***
g				-0.286 (0.210)	-0.391 (0.220)*	-0.416 (0.187)**
r – g	0.338 (0.154)**	0.331 (0.191)*	0.068 (0.196)			
Population growth rate				5.998 (1.832)***	2.969 (1.913)	1.719 (1.632)
Inflation rate	-0.365 (0.065)***	-0.352 (0.081)***	-0.303 (0.083)***			
Pseudo R^2	0.40	0.39	0.34	0.19	0.26	0.25

***: 1% significance level; **: 5% significance level; *:10% significance level.

References

Chamberlain, G. (1994), “Quantile regression, censoring and the structure of wages", *Advances in Econometrics*, ed. by C. Sims. Elsevier: New York

Domar, E. (1946), Capital Expansion, Rate of Growth, and Employment, *Econometrica* 14, 137-250.

Guiso, L., Jappelli T. and Terlizzese D. (1996), "Income Risk, Borrowing Constraints, and Portfolio Choice," *American Economic Review*, American Economic Association, vol. 86(1), 158-72, March.

Harrod, R.F. (1939), “An Essay in Dynamic Theory”, *Economic Journal 49*: 14-33.

Kaldor, N. (1963), “Capital Accumulation and Economic Growth”, Lutz, F.A., Hague, D.C. (eds.), *Proceedings of a Conference held by the International Economics Association*, London: Macmillan.

Kalecki, M. (1943), “Political Aspects of Full Employment”, *Political Quarterly, 14*: 201-223

Kalecki, M. (1971), *Selected Essays on the Dynamics of the Capital Economy*, Cambridge UK: Cambridge University Press

Kessler D. and Wolff E.N. (1991), “A Comparative Analysis of Household Wealth Patterns in France and the United States”, *Review of Income and Wealth, 37, No. 3*: 249-66, September

Keynes, J.M. (1936), *The General Theory of Employment, Interest, and Money*, London: Macmillan

Koenker, R. and Bassett G., (1978), “Regression Quantiles", *Econometrica*, *46*: 33-50.

Pasinetti, L.L. (1962), “Income Distribution and rate of Profit in Relation to the Rate of Economic Growth”, *Reviews of Economic Studies, 29*: 267-279

Piketty, T. (2014), *Capital in the Twenty-First Century*, Cambridge MA: Belknap Press.

Ramsey, F.(1928): “A Mathematical Theory of Saving,” *Economic Journal, 38(152)*: 543–559.

Solow, R.M. (1956), “A Contribution to the Theory of Economic Growth”, *Quarterly Journal of Economics, 70*: 65-94.

Taylor, L. (2014), “The Triumph of the Rentier? Thomas Piketty vs. Luigi Pasinetti and John Maynard Keynes”, Institute for New Economic Thinking, 1-19.

Targetti Lenti, R. (2015), “Is Piketty’s approach right? Which consequences for the Inequality Growth nexus?”, Second Conference of SITES/IDEAS, Florence, 23 September 2015.