**Can the link between functional and personal income distribution enhance the analysis of inequality?**

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**Abstract**

Aim of the paper is to present a framework for linking the functional and the personal income distribution. In the first part the Piketty’s book “Capital in the XXI Century” is briefly reviewed. Piketty’s framework is discussed arguing that it can explain only partially level and changes within the personal income distribution. Piketty links in a very innovative way the returns from capital *r* to the rate of growth of national income *g* comparing them in a macroeconomic framework. He claims that when returns on capital rise more quickly than the overall economy and taxes on capital remain low, a vicious circle of ever-growing dynastic wealth and growing concentration of wealth takes place. However, the rise in the inequality of personal income distribution cannot be explained only by the rise of capital incomes. An analysis of the generation of personal incomes, and consequently of inequality, requires a suitable framework that links incomes at the macroeconomic level (national accounts) and incomes at the level of the individual/household. It is possible to build this framework starting from the individual endowments and their links to the productive structure: that is from what it can be called the “generating function of personal income”. This function transforms personal endowments in personal earnings, given the productive structure, the technologies, and the market rules that determine the functional distribution. The personal income distribution and its inequality are linked to the functional one, through the shares of capital and labor owned by each individual.

The framework here introduced seems to be a suitable tool for taking in account that the personal income distribution is inextricably tied up with different sources of inequality in the distribution of national income. Sources such as what comes from the institutional and productive structures (matrix **Y**), but also what comes from the distribution of endowments and of individual/ household entitlements (matrix **S**). This approach, we argue, can allow assessing and evaluating the effects of “ambitious new policies”, aimed to reducing poverty and inequality ex-ante, as suggested by Atkinson in his last book.

**1. Introduction**

Inequality in income distribution has long been one of the major themes of economic and socio-political debate, but interest in this topic within the economic field has waned over time. GDP per capita has been widely considered to be a satisfactory indicator of economic prosperity. Having been rather neglected during the period of sustained economic growth in Western Europe and North America that followed the Second World War, the first two decades of the XXI century saw a resurgence in interest toward this issue. A very substantial body of research on inequality has been accumulated, building on the potential of improved data and focused on clarifying concepts and measures, capturing trends, and understanding the causal processes at work back and forth to the economy. The interest toward inequality in income distribution increased with the deterioration of social and economic conditions following globalization, financial crisis and unemployment. Inequality has now become the focus of remarkably wide-ranging attention, from International Institutions, Government Reports to, finally, also academic journals across a variety of disciplines. As Tony Atkinson observed in a “pioneering” article (Atkinson, 1997), the personal income distribution has been brought “from the cold” only at the end of the 90’.

The question is ‘why should economists “care’ about inequality’? Equity is a fundamental value in democracies. It is connected to the functioning of the economic system (Atkinson, 1997). Economic inequalities can be conceived of as the outcome of the underlying economic process which produce some other economic effects. Individual differences provide behavioural incentives to work, save, or take an entrepreneurial risk. Inequalities tend to be self-enforcing and self-sustaining. Inequality in one respect or for one group may hang together with equality in another respect or for other groups. Linkages and effects amongst and between inequalities are not necessarily obvious and their revealing requires analytical effort.

More recently, considerable attention has been paid to the ways in which higher inequality could act as an obstacle to growth. Social protection and the Welfare State more broadly (e.g. via education and health care) can potentially provide an environment that stimulate rather than undermines economic growth. Even more important it is the understanding that policies might improve both equity and efficiency simultaneously and avoid the trade-off between them. Special attention has been paid to the role of Institutions. Differences in institutions and policies are likely to play an important role in explaining the different levels and trends of wage and capital income inequality across countries. Inequality in the income distribution into industrialized countries is very high and increasing with the rise of per-capita income. A forty-year trend of increasing inequality, common to many advanced economies, deserves the search of forces which are deeply rooted “within modern industrial capitalism” (Solow, 2014, p.2). Growing inequality bring to discuss some issues as how different sources of inequality can be analyzed and what set of concrete proposals aimed at reducing it can be put forward. We can find some answers and proposals in two recent books: Piketty’s "Capital in the Twenty-First Century” (2014a) and Atkinson’s “Inequality. What can be done?” (2015).

Piketty’s work is an impressive empirical research on inequality and on its persistence over time, with particular reference to the "sustainability" of capitalist systems in which inequality is increasing. An empirical analysis of inequality in wealth’s and income’s distribution, in the long run, was never been made before Piketty’s book (Piketty, 2014a, 2014b). Therefore, it has already allowed, and will allow in the future, to promote a very rich and innovative debate. “Post-Piketty, the public-intellectual debate over inequality, economic policy, and equitable growth ought to focus differently” argue in the Introduction the editors of “After Piketty: the agenda for economics and inequality” (Boushey et. al, 2017, p.1) a very recent book collecting essays from economists and sociologist. In the "Capital in the Twenty-First Century” and in the many reviews, comments and critics that followed its publication are packed so many topics, insights, comments and observations that affect almost any sphere of economics, so that no single survey can summarize them. In this essay, we will focus mainly on the factors that can explain the trends of the concentration of wealth and of personal income distribution. The functional distribution of income between capital and labor, the increase of capital share in national income and the wealth’s concentration are of course very important factors. The relation between them which pushes toward greater inequality in income and wealth, is well identified in Piketty’s macro setting. “Capital in the XXI Century” discusses trends in inequality of income and wealth in many countries, and in different periods, taking in account of the relation between capital and growth. However, the personal income generating process, and its links with inequality, are not really analyzed.

In his last book, Atkinson (2015) brings his theoretical and practical experience to bear on the multifaced features of income inequality. He presents a comprehensive set of policies that could bring about a genuine shift in the distribution of income in developed countries. Atkinson claims that fresh ideas are needed in order to reduce inequality. It is necessary to go beyond imposing new taxes on the wealthy. His quite ambitious set of policies asks for an analytical innovative framework aimed to identify the micro and the macro variables which are sources of personal income distribution and therefore of inequality. It should be introduced a framework in order to “make a link between incomes at the macroeconomic level (national accounts) and incomes at the level of the household” (Atkinson, 2009, p.1). As Atkinson claims, the relationships between “factor shares …and inequality in the personal distribution of income … is the principal problem of political economy.” (Atkinson, 2009, p. 1). This framework, as we will show, can be built starting from the individual endowments and their links to the productive structure, that is from what we can call the “generating function of personal income”.

The outline of the paper is the following. Section 2 introduces thePiketty’s analytical framework. Section 3 discuss the “fundamental contradiction of capitalism”, that is how the inequality *r* > *g* in the long run brings to a higher concentration of wealth*.* In this section, the authors argue that Piketty’s approach is only partially suitable to explain growing inequality in personal income distribution. Section 4 introduces a general framework that can link the functional and the personal income distribution. The framework here introduced seems to be a suitable tool for taking in account that personal income distribution is inextricably tied up with different sources of inequality in the distribution of factors’ income such as those related to the institutional and productive structures and those that comes from the distribution of endowments and of individual/ household entitlements. Remarks on the relevance of the proposed framework for the assessment of reducing inequality’ policies concludes the paper (Section 5).

**2. The Piketty’s analytical framework.**

*“Capital in the Twenty-First Century*” provides a general theory of the functioning of a capitalist economy. Issues on inequality are only one aspect of that general theory. The setting can be called "classic" in the wake of Smith, Ricardo and Marx. However Piketty is not interested in explaining the role of capital accumulation *on* economic growth, but instead the inverse relation, that is the role of economic growth *on* the returns to capital, on the concentration of wealth and the inequality of income in capitalist economies. The forces that shape income’s concentration are economic but also political and institutional as wars, taxation, and inflation (Milanovic, 2014, p. 529). In a society where “patrimonial capitalism” prevails, wealth concentration mainly contributes to the inequality in the distribution of personal income. When the percentage of people who do not need to work in order to earn their living (the rentiers) will go up the distribution of personal income will become even more unequal.

Piketty uses very simple economic models to explain what is going on. He reverses the relationship between income distribution and growth as it has been interpreted in the traditional Keynesian models. In such models the rate of the economic growth is obtained as the ratio between the saving rate and the capital-output ratio. Piketty, instead, investigates how the ratio between the saving rate and the rate of growth of the economy determines the capital-output ratio, and consequently the share of capital’s income in the national product. The definition of capital follows the SNA guidelines. It includes all forms of assets (housing, land, machinery, financial assets in the form of cash, bonds and shares, intellectual property) that generate a return/rent as the result of the functioning of a “pure and perfect” market for capital. Durable goods are not included.

The analytical framework consists of two models: i) the first is a quite standard Harrod-Domar-Solow macro model aimed at determining the capital-income ratio *β* and the capital’ share on national income *α.*; ii) the second model is aimed at linking the wealth’ concentration to the rate of growth of the average rate of return to capital *r* in comparison to the rate of growth of the economy *g*. The first model leads to the **“**first and the second laws of capitalism**”.** According to the first law, *α* is linked to *β* and to *r (α = r* x *β).* The capital-output ratio *β* measures the overall importance of wealth in a given society, as well as the capital intensity of production (Piketty, Saez, 2014, p.840). Assuming, as Piketty does, that in perfectly competitive markets *r* is equal to the marginal productivity of capital, it decreases when *β* increases. In a more complex economy, where many diverse uses of capital exist, the rate of return on capital *r* may be higher or lower than the marginal productivity of capital. It can be determined by some other forces: firstly by the technology and secondly by the abundance of the capital stock (Piketty, 2014a, p. 154). Thirdly, the owner of capital which is in a monopolistic position can impose a rate of return greater than the marginal productivity of the capital itself.

The central question becomes how much the rate of return on capital *r* decreases when the capital-income ratio *β* increases (Piketty, 2014a, p.155). This depends on the elasticity of substitution (*σ*) between capital K and labor L in a CES production function. The standard assumption is that the production function is a Cobb Douglas where *σ* is equal to 1: as the stock of capital rises, the rate of return on capital *r* decreases exactly in the same proportion, so that *α* does not change (Piketty, 2014a, p. 154). If the rate of return on capital *r* falls more than proportionately when the capital income ratio *β* increases, then the share of capital’s income in national income decreases. On the opposite, if the rate of return *r* falls less than proportionately when *β* increases then the capital share of income increases with *β*. Piketty introduces the hypothesis that the elasticity of substitution (*σ*) between capital K and labor L is greater than one (*σ>1*) so that a rise of capital income ratio *β* also leads to a rise of the share of capital in national income. Intuitively, it makes sense to assume that *σ* tends to rise over the development process, as there are more diverse uses and “forms” for capital and more possibilities to substitute capital for labor (Piketty, Saez, 2014, p. 841).

The “second fundamental law of capitalism” allows to determine the value of *β* in the long run. The hypothesis is that capital-income ratio converges toward *β=s/g*, where *s* is the long-run annual saving rate (saving being invested in domestic or foreign assets) and *g* is the long-run annual total growth rate of the economy (as sum of the population and the productivity growth rate (Piketty, Saez, 2014, p. 840). The higher the savings rate and the lower the growth rate, the higher the capital-income ratio *β* will be (Piketty, 2014a, p. 44). In a stagnant economy, where the growth of the economy is relatively slow because of both demographic or technical factors, the rate of saving exceeds the rate of growth, (*s>g*) so that *β* will be high and increasing. If both *α* and *β* are increasing, also the concentration of wealth will be high and increasing. At least it is what we observe in historical series. Piketty claims that capitalists save a sufficiently large share of their returns to ensure that their capital will grow at least as fast as the economy. This process tends to give lasting, disproportionate importance to wealth created in the past, and therefore to inheritance (Piketty, 2014a, p. 267). Inherited wealth will dominate wealth amassed from a lifetime’s labor by a wide margin, and the concentration of capital will attain extremely high levels (Piketty, 2014a, p. 25). These levels are incompatible with the meritocratic values and the principles of social justice prevailing in modern democratic societies.

Several daily and weekly newspapers have hosted reviews of "Capital in the Twenty-First Century”, almost always very positive (Krugman, 2014; Stiglitz, 2014a; Solow, 2014). Only few review have been critical. At the beginning the reliability of the data’ sources used and of the estimates presented have been challenged (Giles, 2014). Criticism on the sources, however, do not appear to have significantly weakened the volume’s content. The author himself answered by pointing out that the results obtained, showing increasing inequality in many periods and in many countries based on empirical evidence, can only be the result of an imperfect inference, as it always happens in social sciences. Piketty has revolutionized the field of researches on income distribution by the use of fiscal sources and by his focus on top income shares. In collaboration with Facundo Alvaredo, Anthony Atkinson and Emmanuel Saez (2014) he uses very detailed fiscal data to trace the evolution of income and wealth distribution in different countries. This choice is in line with the previous researches of Simon Kuznets (1953) who first used tax data. The use of fiscal data, however, can be questioned as the sole (or even the best) approach to the analysis of income distribution (Mechling et al., 2017). Historically, income tax returns have been filed by a small percentage of the population even in today’s rich countries, so the long-term series can be of dubious quality. The same is true in developing countries now. We might know the top of an income distribution (the richest tax-filers) but we don’t any information about the bulk of the population. Whether the highest tax-filers are really the richest people is also questionable. Not only because of the obvious incentive to underreport income or because in the past some particularly rich classes were exempt from taxation. Taxes are paid by fiscal units, not by individuals: the richest fiscal units may change with the tax rules (e.g., whether it is more advantageous to file jointly or separately). The income that is reported to tax authorities is market and not disposable income, that is income not including transfers and taxes. The concentration of market income among fiscal units may, or may not, tell us much about the inequality of disposable income among individuals, which is ultimately the concept we are interested in. Piketty mentions some of these caveats but essentially ignores them. Many authors have raised a variety of issues concerning the sources and construction of the data. This topic is out of the focus of our paper. It can be useful, however remember the claims of Auerbach and Hassett (2015) that “in translating data from other sources on US wealth concentration, Piketty changes the timing of observations in a manner that overstates the strength of the recent upward trend and obscures a downtrend present in his source data at the end of the sample period. Other data sources - largely from administrative databases - suggest dramatically different trends in inequality (Bricker et al., 2016; Reynolds, 2006; Armour et al., 2013, 2014; Burkhauser et al., 2012; Fisher et al., 2013).

More recently, also the theoretical framework and the methodological approach adopted by Piketty were challenged. French economists, especially, were critics of Piketty’s approach (Aghion, 2014). Although reviewing these topics is out of our scope here, it may be useful to summarize some of the most important critical remarks. i) the definition of “capital as wealth” has been criticized as too ambiguous and not compatible with an approach based on a CES production function (Raval, 2017); ii) the definition of "capital" and “rent” and the choice to include houses in total capital has been questioned (Bonnet et. al, 2014, Rognlie, 2015); iii) a radical critic of the Piketty’s “second fundamental law of capitalism” has been advanced by Krusell and Smith (2014). They argue that this law, “which embeds a theory of saving, is rather implausible; iv) some doubts have been advanced on the hypothesis that the elasticity of substitution between capital and labor is likely to remain higher than one (Rognlie, 2016). v) Acemoglu and Robinson (2015) argue that Piketty didn’t took into account the role of institutions in shaping the inequality.

Piketty answered to the numerous and different remarks writing some new papers and arguing that the arguments of the book have been “simplified in the telling and retelling” so that the original message was misunderstood. The factors that generate inequality, in income and wealth, Piketty argues, are many: institutional, socio-economics and demographic (Piketty, 2015b). The factors which explain the dynamic of wealth (accumulation of capital) are different from those which explain the dynamics of labor income (demand and supply of skills and education, technology). It is very difficult, therefore, to reach a consensus on a general and “shared theory” of the generation of wealth and income concentration. This issue deserves a deeper discussion starting from the “fundamental contradiction of capitalism”: the inequality *r* > *g*. This inequality can be considered the most important relation between *r* and *g* that explains the rising concentration of wealth and therefore of income.

**3. The “fundamental contradiction of capitalism”. The inequality *r* > *g* in the long run*.***

Piketty links in an innovative way the returns from capital to the rate of growth of national income. Trends of capital’s rent *r* and of income growth rate *g* are compared in a macroeconomic framework. From this relation Piketty derives the value of the concentration of wealth, that of capital incomes and, finally, from the inequality in the distribution of capital income, the inequality in the personal income distribution. Piketty shows how the gap *r* − *g* is directly linked to the inverted Pareto coefficient of the wealth distribution. The analytical model (rather mathematical in nature), that explains the relationship between the rate of return of capital, the rate of growth of the economy and the concentration of wealth, is developed in two papers subsequent to the *Capital in the Twenty-First Century* (Piketty, 2015a, Piketty and Zucman, 2015). Piketty claims that when *r>g* capital grows faster than the economy the concentration of capital will attain extremely high levels (Piketty, 2014a, p. 25). Piketty argues, also, that the effect “of *r-g* on inequality follows from its dynamic cumulative effects in wealth accumulation models with random shocks, and the quantitative magnitude of this impact seems to be sufficiently large to account for very important variations in wealth inequality” (Piketty, 2015b, p. 75-76). Over a wide range of models, the long-run magnitude and concentration of wealth and inheritance are a decreasing function of *g* and an increasing function of *r*. Under fairly general conditions, if shocks take a multiplicative form, the top tail of the distribution of wealth converges toward a Pareto distribution. The inverted Pareto coefficient (measuring the thickness of the upper tail and hence the inequality of the distribution) increases with the gap between *r* and *g*. A decrease in *g* is inevitable once countries have reached a very high level of income. It is the “dead hand” of the past generations (high *β* ratio) and the high returns on capital that destroy the fabric of today’s advanced capitalist societies (Piketty, 2014a, p. 942). The way by which wealth is accumulated and distributed contains forces pushing toward an extremely high level of inequality. Capital accumulation generates changes in the functional distribution of income in favour of capital. Because incomes from capital are more concentrated than incomes from labor, also the personal income distribution will become more unequal. A vicious circle of ever-growing dynastic wealth starts, which cannot be reduced by an additional level of competition. This inequality is the fundamental contradiction of the patrimonial capitalism (Piketty, 2014a, p. 298).

The relationship between the inequality *r* > *g* and a rising concentration of wealth has been criticized under different respects. Firstly it has been considered weak from the theoretical point of view. Debraj Ray (2014, p. 9) argues that the inequality *r* > *g* is mainly a condition of economic efficiency. An economy where r <g is inefficient in the sense that it has been saved too much. The r>g relationship does not tell us anything more. It does not tell us anything about increasing inequalities in the wealth distribution. Only a detailed study of inheritance can enlighten us as to whether inheritances are key factors in explaining rising inequalities. Mankiw (2015, p.43) argues that r>s is an equilibrium condition in neoclassical models. Their existence means that “we live in a world in which any dynamic Pareto improvements has been unexploited… There is, moreover, good reason to doubt that *r* > *g* leads to the “endless inegalitarian spiral” that Piketty describes... Piketty reasons that resources of the wealthy would grow relative to the labor income if *r* > *g*. We can now see, however, that this condition is not sufficient once consumption, procreation, and taxation are accounted for. Instead, to obtain the worrisome “endless inegalitarian spiral,” we would need the return on capital *r* to exceed the economy’s growth *g* by at least 7 percentage points per year” (Mankiw, 2015, p.44).

In the Piketty model capital income grows as a share of national income because the rate of return does not fall sufficiently fast with capital deepening. This argument is based on the empirical evidence collected by Piketty but it is running against one of the fundamentals of economic theory: decreasing returns to an abundant factor of production (Milanovic 2014). When the capital/output ratio increases, the marginal return to capital *r* should go down. Stiglitz (2014) argues that Institutions and policies (banking and finance) can explain the “Piketty puzzle” of a rising wealth/income ratio together with a rise in *r* and stable wages. Also from the empirical side the Piketty’s argument can be considered weak. Rognlie (2014) argues that when converted from gross to net terms, standard empirical estimates of the elasticity of substitution between capital and labor are well below those assumed by Piketty. Rising capital/income ratio, which depends partly on rising market prices, is more likely to be associated with a substantial decrease in capital’s net share of income, not with an increase. In this case r − g is likely to fall and not to increase as well.

Also the Piketty’s time series, based on after-tax rates of return, faces two shortcomings. “First, the tax rates used to calculate the after-tax returns on capital in Piketty and Zucman (2014) are average tax rates. But given the book’s focus on the share of wealth held by the top 1 percent and even the top 0.1 percent, the relevant tax policy parameter seems to be the top marginal tax rate rather than the average tax rate. Second, Piketty calculates the return on capital based on national accounts data and does not adjust for risk” (Auerback, Hasset, 2015, p.39). Relying on an alternative time-series on the after-tax rates of return in the United States, that takes into account marginal tax rates and it is adjusted for risk, Auerback, Hasset (2015, p.39) find that the post-tax rate of return remains consistently lower than GNP growth. From this perspective, the apocalyptic *r* > *g* “exploding wealth inequality” scenario does not look especially likely.

Piketty answered to these critics claiming that he is well aware that *r* > *g* cannot be the only or even the primary tool for explaining changes in wealth and therefore in income inequality. Institutional changes and political shocks, which can be considered endogenous to the inequality and to the development process itself, are also very important (Piketty, 2015a, p. 48). In the real world, many shocks to the wealth trajectories of families can contribute to make the wealth distribution highly unequal. These shocks are related to financial or estates rate of return, demographic factors, differences in saving behaviour, differences in propensity to invest, differences in taste parameters, in labor market features, in the institutional and political setting. Differences in earnings to be saved and cumulated are also important shocks. Wealthier people can obtain higher average returns than less wealthy people. Unequal returns on capital, then, are a divergence force for that significantly amplifies and aggravates the effects of the inequality depending on *r* > *g*. (Piketty, 2015a, p. 50). He claims also: “I certainly do not believe that *r* > *g* is a useful tool for the discussion of rising inequality of labor income: other mechanisms and policies are much more relevant here, e.g., supply and demand of skills and education” (Piketty, 2015a, p.48). He goes on “the rise in labor income inequality in recent decades explains why total income inequality is now substantially higher in the United States than in Europe” (Piketty, 2015a, p.49). Piketty argues that the two dimensions of inequality, of labor income and of capital ownership, do interact in important ways: for example, rising inequality in labor earnings during a certain period of time might tend to fuel rising wealth concentration in following decades or generations. “In certain societies, the top shares of income and wealth might be highly correlated, while in other societies they may represent entirely different social hierarchies (as in traditional patrimonial societies)” (Piketty, 2015b, p.73).

One important issue, however, is not still explained in the Piketty’ approach: how to derive the inequality in personal income distribution from capital and labor shares in national income, and then how to highlight the different factors behind the level of inequality. As Pier Luigi Porta (2014) argues, Piketty’s analysis focuses too much on the symptoms rather than going direct to the heart of the inequality generation process. The passage from a macro approach (the r>g inequality) to a micro one (inequality in personal income distribution) is very complex and in the Piketty’s book it is not really explained. Also in the literature, however, the functional and the personal income distributions have always been analyzed separately and, furthermore, since the 1960s, the relevance of these issues is more and more downplayed. As Lindert (2014, p.) argues “the shares of labor versus capital in current income… have never proved to be a good predictor of inequality”. The personal income distribution has been quite always analyzed emphasizing “that there is no direct link with factor shares” (Atkinson, 2009, p.4). A very strong link, instead, exists and must be enlightened with suitable frameworks.

**4. From functional to personal income distribution: what kind of linkage?**

Atkinson (2009) argues that a new approach to functional and personal income distribution is needed for three reasons: i) to make a link between incomes at the macroeconomic level (national accounts) and household incomes; ii) to help understand inequality in the personal distribution of income; iii) to address the concern of social justice with the fairness of different sources of income. “In making the link between national income and the income of the household sector, the breakdown by sources is, indeed, necessary since the different sources raise different issues… The link between factor shares and the personal distribution is more complex than in the days of classical economists for two important reasons: people have multiple sources of income … and there is considerable inequality within categories of income.” (Atkinson, 2009, p. 4).

An analysis of the process which links functional to personal income distribution requires a suitable framework. The effects of a rise of the capital income share (π) on the personal income distribution depends not only from its amount, as Piketty argues, but also from the inequality within capital and labor income distributions and from the correlation between the two distributions. In today’s world, where people have both earnings from labor and from capital, all effects can be enlightened, following Atkinson (2009, p 10), with a simple decomposition of the squared coefficient of variation *V*2. The overall inequality of total income, measured by *V*2, can be decomposed as a function of the share of capital income π, of the squared coefficient of variation of labor income , of the squared coefficient of variation of capital income and of the correlation ρ between wage income and capital income distributions:

 (1)

The equation (1) shows that “an upward trend in the share of capital income… does not necessarily lead to a rise in overall income inequality… for the right side of (1) to increase with the share of capital income” it is necessary that:

π > [1 − λρ]/[1 + λ2 − 2λρ] (2)

where λ is defined “as the ratio of the coefficient of variation of capital income to that of wages (i.e. λ = Vk /Vw ).”

The condition (2) implies that the effect on inequality of a rise in the capital share depends both on the degree of correlation ρ and on the ratio between the inequality of the capital income Vk and the inequality of the labor income Vw. In particular, if the two distributions are uncorrelated, “a rise in the capital share increases inequality where it exceeds 1/(1 + λ2)… (It is assumed throughout that λ is greater than 1) Where the correlation is positive, the critical value is reduced still further, and if ρ is greater than 1/λ, an increase in the capital share always increases inequality” (Atkinson, 2009, p 11).

The decomposition proposed by Atkinson became more relevant when it is considered in a more general framework which could explain how personal incomes are generated by the use of both capital and labor in the productive sector. This means to link the personal income distribution and its inequality to the functional one, trough the shares of capital and labor owned by each individual. As a matter of fact, the factors that can be considered as sources of individual incomes, in the short run, are not only the amount of the endowments (physical and human capital) but also the "ability" to transform these endowments into personal income. In the long run, the accumulation of capital/wealth (earned or inherited) plays, of course, a very important role in generating earnings, income and inequality. But it must be considered only one of the factors. The structure of the factors ownership of individuals grouped into family units, of different composition and size, determines the distribution of market incomes.

The mechanisms that regulate the distribution of market income among the various units must be brought back to the variables that contribute to the “generation” of the value added of the economic system into different sectors of production, business units and workers. The ways in which the individual endowments translate into earnings depends on their prices as a result of structural and cyclical market equilibria. This process, following Dagum (1977) can be represented by a "generating function of income", that is, by a function *f* which ensures the correspondence between the market income *ymi* of each unit *i* and the endowments owned, given their prices. In a first very simplified specification it can be assumed that endowments are human capital *cu* and physical capital *ck* . This function, for each unit *i*, can be expressed as:

*ymi* = *f (cui, cki )* (3)

Two groups of variables, micro and macro, determinate the generating function of the market income. From one side, the value ​​of the endowments can be considered the result of the factors that determine the earning capacity of a subject such as personal abilities (innate or acquired through education), age, ownership of capital assets accumulated or inherited. All these factors are considered as important variables for explaining the earning capacity of the subjects, and therefore the inequality in personal income distribution by the traditional theories which stress the influence of microeconomic variables. Occupational choice, and the consequent social position, in turn depends not only on the level of education, but also by the family background and the paternal prestige. In a system where incomes are earned in the market, the capabilities are enhanced by the social and economic organization. Not only the unequal distribution of abilities tend to produce an unequal distribution of incomes, but also factors such as the "fate" and the luck are important variables as well. The luck, however, has a very important role in the accumulation process of wealth and heritages, as Piketty has shown.

From the other side the ways through which resources are exchanged in the market and translated into income depends also on macroeconomic variables. In particular, the prices of the endowments synthesize the structural economic characteristics of the different markets. The capability of earning a given level of market income *ym* depends on the position of each unity in a specific socio-economic setting, that is on the relations between the characteristics of each subject and the productive sectors in which he operates: not only on market conditions, but also on the structure of property, the localization as well as on the legal rules and the social, cultural and religious features of a country. In a market economy these conditions can be expressed by a vector of prices and the final result will be a flow of earned incomes.

If the focus of the analysis is on the disposable income *ydi*, that is the income post-taxes and transfers, it is necessary to consider as a supplementary endowment the capability to obtain transfers from the government or from other subjects *tri*.

*ydi* = *f (cui, cki , tri)* (4)

The distribution of the disposable income *ydi*, is obtained from the distribution of market income taking into account of the impact of the redistributive policies. This impact reflects the structure of the redistributive mechanisms that operate through the tax system (more or less progressive) and through the social security. Each economic unit (individual or household) according to his position within the economic system and to the interactions with the other units (enterprises, government) will contribute to the inequality in the distribution of both market and disposable income. The inequality in the market income will be higher when the ownership of capital/wealth is more concentrated, when the dispersion of wages and salaries is wider. Further the inequality will be higher when the exclusion from the market and the marginalization, that affect systematically some components of the labor force, specific industrial sectors or regions, is higher.

Traditionally, the analysis of the personal income distribution considers households and not individuals as the reference units. This choice is justified by some considerations both from the methodological than by the empirical point of view: 1) some of the endowments are owned at the household level, 2) available data come generally from sample surveys conducted at the household level. For any household *h*, the level of income earned in the production activities (*ymh*), in every period, can be expressed as:

*ymh* = *f (cuh, ckh )* (5)

The function *f* is the “household income generation function” which transforms personal endowments, owned at the household level *cuh, ckh* in household earnings *ymh*, given the productive structure, the technologies, and the market rules that determine the functional distribution of the value added. Atkinson (2015, p. 103) argues that “household income, and its distribution, derives not only on macroeconomic factors” but also on other factors that have been called “entitlement rules” by Andrea Brandolini. These rules can be defined as the “mechanisms regulating the appropriation of the output of the economy, or…as the “filter” between the production and its distribution among people” (Brandolini, 1992, p.5)

The households can be classified into different socio-economic groups in order to be meaningful and homogenous from the point of view of the process of generation and distribution of income. The choice of the level of disaggregation and of the type of socio-economic groups depends above all on the goals of the researcher. Households’ classification has to be chosen in accordance with the overall analytical or policy focus and to a degree that can be supported by the data (SNA, 1993; chapter XX). Many different criteria can be selected including: geographical location (e.g. urban-rural), assets (e.g. wealth, size of land holding) and the socio-economic characteristics of a representative individual (e.g. household head or principal earner).

A suitable classification of the productive factors which make up the households’ endowments, should be chosen in order to identify the different factor markets. This classification should allow catching up the effects of policies aimed to increase the level of competitiveness of the system, to promote the compliance for the rules of the labour market and to favour technological changes that “increases the employability of workers” (Atkinson, 2015, pp. 118-119). The labor factor can be cross-classified by location (e.g. urban-rural, or geographical region), skill or qualifications obtained, employment status (e.g. employee, own account worker, employer) and by gender. This factor generates different type of labor income depending on employment status: dependent or independent. Mixed income (a category suggested in the 1993 SNA) is also frequently chosen as a category to represent the income of household enterprises (where it is difficult to distinguish the returns from labor from the returns of other factors) and it is also cross-classified in a similar way to labor. Generally no distinction is made between different types of capital and natural resources.

In a first, very simplified framework, taking in account only of the relations between households and the productive sectors, the set of all household market incomes can be represented as a block matrix **D**, where, following a functional criteria, the incomes are splitted only in three categories. Obviously the number of the productive factors considered could be more than the three here used. The first column shows the blocks of the income from dependent employment of each group of households, the second column shows the blocks of the income from independent employment and the third column shows the blocks of the income from capital. In the matrix **D** some elements can be equal to zero when the household of the row does not have all types of income considered in the functional distribution. The households have been grouped according to their level of income in decile/percentile groups.

Table 1 – Block matrix **D**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FACTORS | | Income from | | |
| Households  Groups Households | | Dependent  labor | Independent  labor | Capital |
| 1 | 1  2  ….  n1 | yd11  y d12  ……  y d1n1 | yi11  y i12  ……  y i1n1 | k11  k12  ……  k1n1 |
| 2 | 1  2  ….  n2 | yd21  y d22  ……  y d2n2 | yi21  y i22  ……  y i2n2 | k21  k22  ……  k2n2 |
| …. | ….. | ….. | …… | …… |
| *H* | 1  2  ….  n*H* | yd*H*1  y d*H*2  ……  y d*H*n*H* | yi*H*1  y iH2  ……  y i*H*n*H* | k*H*1  k*H*2  ……  k*H*n*H* |

In order to determine the income received by each of the *H* socio-economic group from the factors of production, we must multiply each block of the matrix **D** by a unit row vector **e**׳***nh***, (Bottiroli Civardi, Targetti Lenti, 1980, pp. 712-714 ) obtaining a new matrix **T** with *H* rows (corresponding to the houshold groups) and *F* columns (three in this case).

Table 2 – Matrix **T**

|  |  |  |  |
| --- | --- | --- | --- |
| Production Factors  Household groups | Income from Dependent labor  d | Income from Independent labor  i | Income from Capital  k |
| 1 | Td1 | Ti1 | Tk1 |
| 2 | Td2 | Ti2 | Tk2 |
| … |  |  |  |
| *H* | Td*H* | Ti*H* | Tk*H* |

**T**is the matrix of the market households’ income distribution and can be considered as the product of two matrices: the matrix **Y** of the composition of the factorial income and the matrix **S** of the structure of the ownership of the factors by the different groups of households:

**T** = **S.Y** (6)

In the general case, if we consider the factorial income classified in *F* components, we can define the matrices **Y** and **S** as:

Table 3 – Matrix **Y**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Y1** | **0** | **......** | **......** | **......** | **0** |
| **Y=** | **0** | **Y2** | **......** | **......** | **......** | **0** |
|  | **0** | **0** | **......** | **Y*f*** | **......** | **0** |
|  | **0** | **0** | **......** | **......** | **......** | **Y*F*** |

Table 4 – Matrix **S**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ….. |  | ….. |  |
|  |  |  | ….. |  | ….. |  |
|  | …. | …. | ….. | …. | ….. | ….. |
| **S**= |  |  | ….. |  | ….. |  |
|  | …. | …. | ….. | …. | ….. | ….. |
|  |  |  | ….. |  | ….. |  |

The matrix **Y** is a block diagonal matrix whose elements are the total amount of value added earned by different factors of production (dependent workers, independent workers, physical capital and so on). The values of **Y** are determined by the macroeconomic variables which generate the factorial income distribution. Each element  of matrix **S**, instead, represents the share of *h-th*  group of households to the *f-th* type of income (wages, salaries, income from autonomous work,…) according to the different ownership of human and physical capital. These values can be considered as the result of all that variables that influence the earning capability of people as native or acquired personal abilities, level of education, age, ownership of physical capital. In other words, they depend on all the variables that in the “traditional” theories of personal income distribution are considered as casual factors (Lydall,1979).

To assume that matrix **T**is the result of the product of the two matrixes **S** and **Y,** allows us to separate two components in the process of the market distribution of income to the households. This breakdown allows us to identify the different effects on personal income distribution of the changes in the market and employment structure and in public policies. First of all the income distribution is influenced by a change in the factorial distribution: this happens, for instance, when in the sectors of production the technological processes change. The income distribution can change, however, changing the distribution of human capital and of wealth in terms of the factors properties. These are macroeconomic variables out of the control of single individuals and/or household.

The framework here presented can be considered the theoretical approach for building a Social Accounting Matrix (SAM). A SAM is basically a matrix combining in an accounting framework the flows in value of an economic system and showing, in addition, for all transactions, who pays what to whom. The elementary flows, which interrelate the economic units aggregated at different level, are the starting point. The SAM captures and shows the entire circular flow of income from its production to its distribution, its redistribution and its expenditure. Most of the SAM, in particular, has been oriented towards an analysis of linkages between the structural features of an economy and the distribution of incomes and expenditures among household groups. Matrix T, here introduced, is the “core” of the Institution Household account

The SAM can be considered as an extension of the traditional input-output framework. This format adds some matrices, not included in the Leontief schema, which allow taking in account of the relationships between factorial distribution of income, income distribution to Institutions and final demand. The introduction of accounts referred to Institutions (Households, Private Companies, Government, Rest of the World) allows capturing the link between factors of production and the Institutions, which own the different factors of production. The secondary distribution of income is also introduced as the result of transfers between different Institutions, mainly between private Institutions and the Government. The disposable income of Institutions is the starting point for sustaining the final demand. In particular the Household, grouped in different socio-economic groups, sustain the demand for consumption. The SAM can be considered not only as a database and as an accounting tool, but also in a wider sense, as a macroeconomic model that can be used both for structural analysis and for fiscal and expenditure policies simulations. It can be used also as the starting point for building Computable General Equilibrium Models (CGE). literature on the SAM and CGE has been growing in last years at theoretical and empirical levels. Some empirical applications has been done by the authors (Bottiroli Civardi, Targetti Lenti, 1980, 1988, 1990, 1992, 2008; Civardi et al. 2010).

An innovative research agenda has been launched as a step towards the creation of Distributional National Accounts (DINA), which aim is to decompose key National Accounts Aggregates (in particular household incomes) by percentiles of the population. This step will allow to link deciles of personal income distribution to different “items” of value added (Bourguignon, 2015). Piketty, Saez and Zucman (2016, p.3) proposed some guidelines attempting to construct a prototype distributional national accounts. Such prototype could be “improved upon as more data become available, new knowledge emerges on who pays taxes and benefits from government spending, and refined estimation techniques are developed just as today's national accounts are regularly improved” The authors argue that methodologically, their contribution is “to construct micro files of pre-tax and post-tax income consistent with macro aggregates”. See also the results of a recent OECD (2015) workshop.

**5. Concluding remarks.**

Traditional redistributive policies which transform market income in disposable income act, first of all, through the tax system by adopting progressive taxation not only on income but also on different types of wealth. According to Atkinson (2015), the sources of inequality in the industrialized countries are today so many and multifaced that traditional fiscal and redistributive policies will not go to the root of the problem. Taxation must be considered only one tool, among many others, to increase social mobility. “A well designed tax system can do more than just raise money” (Stiglitz, 2014c), but a decrease of inequality through the increase in social mobility asks for the introduction of more radical policies (ex-ante) than the redistributive (ex-post) traditional ones (Atkinson, 2015).

The set of fiscal policies, suggested by Piketty’s, for curbing income inequality, is the result of his model of “patrimonial capitalism”. The increase of the tax burden must not be considered, as generally happens, mainly a measure of equalization, but rather as a tool to finance a significant expansion of the social security and the redistributive transfer of income and subsides. It is necessary to reform the tax system by adopting progressive taxation not only on income but also on the different types of wealth: it would be especially necessary to introduce a progressive tax on estates and inheritances and to standardize the taxation of capital worldwide. A progressive wealth tax on a global scale, based on the automatic exchange of bank information, is suggested by Piketty not only as "useful utopia", but as a proposal to think about and discuss.

Piketty’s approach has a limited efficacy because it is effective only on the ex post inequality’ level. Innovative and structural policies, instead, must be associated to the traditional one. “Reducing inequality is not just a matter of taxes and spending” (Atkinson, 2015b, p. 2-4). Social security and taxation are policies aimed to redistributing income and wealth between people. They are very important to reduce inequalities in the distribution of disposable incomes *ex-post*, but certainly they cannot reduce inequality in the distribution of market income, namely on the *ex-ante* income generating process. This kind of inequality can decrease with policies aimed to change in the composition of the ownership of endowments by different group of households (matrix **S**). The “sharing of capital” could be one of these policies. Social mobility and better opportunities for poor people can be obtained by improving the quality of schools and easing the access to all. These policies have a positive impact on the endowment of human capital of different household groups.

Atkinson recommends ambitious new policies at least in five areas: technology, employment, social security, the sharing of capital, and taxation (Atkinson, 2015, p 15). In our opinion, the effects of some of these policies on the personal income distribution could be better assessed and evaluated within an analytical framework which links the individual/household’ market income to the functional distribution. The framework here introduced seems to be a suitable tool for taking in account that the personal income distribution is inextricably tied up with different sources of inequality in the distribution of national income such as what comes from the institutional and productive structures (matrix **Y**), but also what comes from the distribution of endowments and of individual/ household entitlements (matrix **S**). This approach can be very useful in the design of policies aimed at assuring more equality not only in outcomes but also in opportunities, not only in industrialized countries as UE or U.S., but also in developing ones. Our approach can be a starting point for collecting data in a way more suitable to capture and to enlighten the links between household endowments and value added.

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