Impact of Innovation Activities on Employment and Inequality at Micro- and Macro Level

Entry title

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Definition

Economic inequality primarily refers to differences across individuals, social groups and/or countries in terms of income distribution. Early studies in the wake of the First Industrial Revolution focussed mainly on the functional distribution of income and the extent to which each production factor was relatively more or less rewarded. On the other hand, the current debate focuses primarily on inequality across individuals and/or countries, on the basis of the Kuznets' approach that postulates an inverted U-shape relation between economic growth and income inequality. However, a growing secular trend of inequality between countries that started in the early 19th century was reversed in the last two decades while, as far as inequality within countries is concerned, highly differentiated paths took place in the wake of the Fourth Industrial Revolution. Namely, developed countries experienced occupational polarization effects that are due, among other factors, to technological change and automation processes, whereas inequality slightly decreased in developing countries. These latter ones, in particular, went through a combination of complex and highly differentiated dynamics with the emergence of a new global middle class that is the result of the good performance of the median deciles in a few economies of the developing world.

1. Introduction

The relationship between income distribution, inequality and technological change represents a classic debate in the early literature on economics and on economic policy with contributions dating back to Smith's division of labor (1776), Malthus' (1798) and Ricardo's (1815, 1817) studies on rents along with Ricardo's concerns about "technological unemployment" in the wake of the first industrial revolution. These early speculations on inequality, including that of Marx (1969), were mainly

focussed on the functional distribution of income across different factors of production at an aggregate level. David Ricardo in particular was probably clearer about distribution, as his analysis was explicitly focused on the distributional laws. He highlighted an inverse relationship between profits and wages and the final outcome of this relationship, in terms of how large the share of the pie for each social group would be, depends on the balance of power between workers and capitalists.

However, while for the classical economists the functional distribution of income among individuals was the main starting point of their analysis, the so-called neoclassical revolution made inequality in practice to disappear. As each economic agent earns her marginal productivity, no one earns neither more nor less of what she is entitled to from the participation to the production process (with the corollary that no participation implies zero income). Thus, there is no apparent reason to "perceive" income differentials as unjust, apart from the well-known market failures argument, determining rents that are appropriated by, for instance, monopolists.

But there is more. Granted that within countries the distribution of income is given by the opportunity cost of each factor (i.e. her marginal productivity), also the inequality between countries is due to disappear in the long run. This is because poor countries can benefit from several elements (such as cheap imitation of advanced technologies through technological spillovers, low salaries, low capital costs) that would generate higher profit opportunities in the backward countries, thus attracting capitals from abroad. These movements would rebalance the inequalities between countries by promoting growth rates differentials favourable to backward countries. All in all, these elements would conjure to promote a process of catching-up that should make countries to converge to the same income levels (see, for instance, Barro & Sala-i-Martin, 1995). This should imply that the distribution before tax should be the same all over the world. As this is obviously not true, the role of the different national and regional institutions becomes thus crucial in order to explain why and how different countries experience different levels of inequality.

On top of this, a certain amount of inequality is seen as beneficial to the economic systems, as it is an incentive for poor people to try and catch-up with the rich people: inequality would thus act in order to spur people to increase their effort and to run the risk of trying to increase their income level. In this way, the dimension of the pie would increase so that everyone will have the possibility to cut-out a bigger slice. Inequality thus acts to spur more economic growth, and in turn the wave (of economic growth) would lift all the boats. Furthermore, the rich part of the population, with a higher saving rate, would finance more investments.

This view of inequality within countries was then reinforced and made mainstream by the seminal work by Kuznets (1955), that shifted the focus on individual wealth and income distribution. Kuznets' basic assumption was that inequality stems from the structural changes brought about by the transition

patterns between sectors characterized by different productivity levels as national economies go through consequent development stages. As a result, the postulated association between increasing levels of inequality and consequent stages of economic growth became a central theme in the economic debate in more recent years.

For all these reasons, the dynamics of income distribution both within and between countries was thus sort of expunged from the interest of the economists, because the within component was explained by differences in productivity and was due to "inevitably" follow the patterns of industrialization (and thus of technical change) that a country would follow in its path toward development. In turn, the between countries inequality was a problem "only" for the backward countries, to which the rich countries could benevolently look, give advice, and help to "structurally adjust" their economic systems to imitate their successful effort. The issue was thus moved to the sub-field of development economics, with little interest to economists outside that field.

This seems to have been the trend, at least until the XXI century: wide differences in the between country inequality were coupled to a more or less stable (and in some cases, decreasing) within country inequalities. As inequality is a typical relational phenomenon, this trend would seem to be "sustainable" as people would see their relative position within their societal cluster of reference to move upward.

However, the last 30 years have seen the within country inequality to rise steeply in many developed countries, to reach its highest levels since the 1980s. In these countries inequality reached such a peak, that this issue has been put on top of the policy agenda, on the one side, because persistent inequality could trigger social resentment, fuel populist and protectionist sentiments and bring about political instability, crime and violence (Wilkinson and Pickett, 2010). On the other side, inequality, far from being a stimulus, has been empirically showed to be a hindrance to economic growth. Moreover, it is inequality at the bottom of the distribution that has a stronger negative effect on growth (Cingano, 2014).

For these reasons, inequality is seen as producing only countereffects on the economy. In fact, apart from what Milanovic (2010) terms as "good" inequality (i.e. that level of inequality that is needed in a system to incentivize people to increase their effort and/or run the risk of an enterprise to improve their socio-economic position) it seems now acknowledged in the literature that inequality has detrimental effects as i) it is indirectly related to health; ii) it is directly related to violence and crime; iii) it is indirectly related to happiness and anxiety; iv) it is inversely related to economic growth; v) it is directly related to wealth accumulation, which in turn generates further inequality; vi) it is indirectly related to social mobility, as the social elevator works insofar as inequality does not drags it (especially because of point v).

In the following, we will thus analyse the two views of inequality (between and within countries) by making separate analyses of the literature for developed countries and developing countries. In this way, we will show how the different institutional settings operate in radically different way in determining different patterns of inequality.

2.1 Inequality between countries

As we have seen in the previous paragraphs, global inequality in income distribution can be decomposed into inequality between countries and inequality within countries. Along this decomposition one can classify the causes that affect the dynamics of the distribution of income in the world population. On the one hand, one can point out those factors that can affect inequality at a macroeconomic level through the creation of a differential among countries in the generation of national income. On the other hand, one can identify those microeconomic factors that operate within countries. In the first grouping, one can find factors such as productivity, trade policies, the operation of international financial and commodities markets and all those events possibly generating political turmoil. These factors can raise the economic gap between countries souring the international disparities in the production of goods and services and in the creation of value added. In the second grouping, one can point out factors affecting the operation of national labor markets such as skill-biased technical change, skill shortages and educational mismatch and changes in the institutional framework leading to deregulation of labor markets, to the resizing (downsizing) of the welfare system and to the decline in the degree of representativeness of unions. Of course, for each grouping one can identify the action of specific organisations and institutions. Inequality among countries can depend on the policies and prescriptions advised (and sometimes imposed) by supranational organisations (such as the International Monetary Fund, the World Bank, the World Trade Organisation and the European Union) as well as the institutions and the organisations acting at a national level. Inequality within countries is more dependent on institutions and organisations attributable to a national context such as the laws promulgated by the national governments.

Bourguignon (2016) and Milanovic (2010, 2016) analyse in depth this decomposition of global inequality in the last thirty years. They portray a series of stylised facts, which have become conventional wisdom in the debate of the dynamics of inequality. First of all, using the Theil index of inequality, Bourguignon (2016) highlights a steady decline in total global inequality in the lapse of time between 1990 and 2010. Truly, Milanovic (2016) maintains that if one adopts a Gini measure of inequality among countries, unweighted by population, this variable shows a growing secular trend which is reversed only in these last twenty years. However, if one measures inequality using a population-weighted Gini indicator an unambiguous secular declining trend emerges. Anyway, in both circumstances, Milanovic's statistical analysis proves that in the first ten years of the XXI

century global inequality has proceeded along a smoothly declining path. Ravaillon (2018) argues that this evidence can result possibly from the highly positive performances in that lapse of time of two large countries such as China and India. However, while in the 1990s GDP per capita of 12 developing countries was growing more than twice as the average of OECD countries, ten years later the amount of emerging economies whose rate of growth was twice as high as the average rate of growth of OECD countries was 83 (Keely, 2015). Second, the two economists show that, if one considers both developed and developing economies, inequality within countries has increased marginally on aggregate. However, it is worth noticing that this variable exhibits a high variance among countries and macro-areas. Conclusively, not only one can say that the trend of global inequality stems from the diverging dynamics of inequality among countries and inequality within countries, but also that the decrease of inequality among countries outweighs the slow dynamics of inequality within countries.

2.2 Inequality within countries

2.2.1 Inequality in developing countries

Once outlined the picture of global inequality and of its components, it can be useful to discuss the differences between developed and developing economies in the dynamics of inequality within countries. Of course, one has to take into account that both the sets of developing and developed countries contain a remarkable variety of different countries, located in different geographical areas and characterised by extremely different cultural, political, institutional and socio-economic settings. Therefore, one should expect a significant degree of heterogeneity within each of these two sets in terms of economic performance and mechanisms of regulation of income distribution. However, a few regularities emerge that differentiate the two groupings of countries. First of all, inequality in developing countries is on average appreciably higher than in developed ones. Particularly, in Africa, Mena countries, Latin America and Asia the average of the Gini index has always been significantly higher than in Western countries in the lapse between 1980 and 2014. In fact, while in developing countries the average of this indicator has always been higher than 0.38, in Western countries the average Gini index has always been below 0.35. The only exceptions are Eastern European and Central Asian countries, which have had in this interval of time a dynamic of the Gini index very close to that of Western countries (Simson, 2018). Secondly, the rise in inequality within countries has turned up differently in developed and developing countries. As a matter of fact, in developed countries increase in inequality has been the result of both the erosion of the economic position of the lower middle class and the vigorous rise of the highest decile in income distribution and, within this, of the richest 1% (Milanovic, 2016). Differently, in developing countries, especially in Asian economies, the low and the median deciles have been awarded by substantial increases in their real incomes. However, this evidence does not apply to South American countries where, after two

decades of increase in inequality in the 1980s and in the 1990s, also due to the structural adjustment programs prescribed by the International Monetary Fund, inequality has significantly decreased between 2002 and 2012 (Simson, 2018). Seemingly, in this decade a decrease in the level of inequality can be observed in some Sub-Saharan African countries, though the data availability and the economic literature about them are still very limited and do not cover all the countries in this area. The combination of these complex and highly differentiated dynamics in inequality within countries has produced the so-called "elephant chart" (Lakner and Milanovic, 2016), which shows the global real income change by deciles in the lapse 1988-2008. The graph shows the emergence of a new middle class (Keeley, 2015), which is the result of the good performance of the median deciles in a few economies of the developing world.

As to the causes of the joint dynamics of the two dimensions of inequality, while Milanovic (2016) seems to acknowledge a remarkable weight on globalisation of markets of goods and services, Ravaillon (2018), without denying the role of globalisation, indicates an array of possible additional factors that might have influenced the transformation of the frame of inequality in this period such as the fall of former Soviet Union, technical change favouring highly skilled workers (skilled-biased technical change), the stagnation of Japan and the institutional change occurred in several western countries that has favoured the deregulation of labor markets, the downsizing of welfare systems and has flattened the progressivity of the income taxation curve.

2.2.2 Inequality and poverty in developing countries

In developing countries inequality in income distribution is strictly related to the dynamics of poverty. Obviously, in developing countries the lowest deciles in income distribution identify so low levels of income that they may be below the poverty line. Of course, this problem is minimised in developed countries wherein only a minimum portion of the population laying in the lowest decile is below the poverty line of 1 US$ per day. Ferreira and Ravaillon (2011) outline three different stylised facts about inequality in developing countries and the relationship between the intermingled dynamics of inequality and poverty. First of all, they show that there does not seem to be a strong correlation between the growth rate of economy and the change in inequality. Secondly, the empirical evidence shows a statistically significant correlation between the growth rate of the economy and the changes in absolute poverty. This second stylised fact derives directly from the first one. Intuitively, if there is no correlation between inequality and the growth rate that means that any increase in the rate of growth of the economy gives rise to an increase of mean income and this effect translates into a decrease in absolute poverty. However, the magnitude of this decrease depends strictly on the initial level of inequality. As a matter of fact, according to the third stylised fact outlined by Ferreira and Ravaillon (2011), the elasticity of absolute poverty with respect to changes in the growth rate depends

negatively on the level of inequality; the higher the level of inequality the lower the decrease in absolute poverty due to a unit increase in the growth rate of the economy. Hence, the higher is the level of inequality the weaker is the effect of growth in reducing poverty (Ferreira and Ravaillon, 2011). As a consequence, the higher is the initial level of inequality the higher is the flow of the increase in the level of income gained by the highest deciles and, complementarily, the lower the fraction of the increase in the level of income flowing to the lowest deciles; growth in income concentrates in the upper deciles of income distribution, impairing the effect of growth on the lowering of poverty. Finally, Ravaillon (2014a, 2014b) reviews the theoretical arguments that uphold the hypothesis of a negative link between initial inequality and the rate of growth of an economy. In this way in developing economies a triangle of both causal and feedback relationships among inequality, rate of growth and poverty comes out.

2.2.3 Inequality in developed countries

A wide strand of the labor economics literature (Murphy and Welch, 1992; Katz and Murphy, 1992; Juhn and Murphy, 1993; Machin and van Reenen, 1998; Katz and Autor, 1999 offers a comprehensive literature review) has been devoted to assessing the increasing income inequality levels within national economies in OECD countries between 1960s and 1990s, highlighting at least three important stylized facts: i) increasing polarization of the income distribution and namely between income shares associated with the highest and the lowest percentiles; ii) increasing wage gaps between workers based on individual characteristics (i.e. age, education and working experience); iii) increasing inequality levels within homogenous occupational groups as identified by either individual, occupational and sectoral characteristics (i.e. gender, age, education, working experience, occupational title and industry).

Starting from this perspective, a further stream of the economic literature flourished across the 1980s and 1990s debating the role played by technological change in shaping over time the demand for skills in the labor markets. In particular, the Skill-Biased Technical Change hypothesis (SBTC) was kickstarted by the seminal work of Krueger (1993) questioning the then prevailing assumption that technical change is factor neutral in favour of a more nuanced view according to which complementarities between technologies and human capital bring about factor-biased patterns of economic growth. Focussing mainly on the pivotal role played by the introduction of personal computers, these contributions produced multiple empirical evidences supporting the association between adoption of computers in firms with an increasing employment share of skilled workers (Bartel and Lichtenberg, 1987) and the relative wage shares (Katz and Murphy, 1992; Acemoglu, 1998; Goldin and Katz, 1998; Autor et al., 1998). The basic assumption behind the SBTC hypothesis is that firms increasingly demand skilled labor to deal with newer technologies due to the fact that

technical change in the productive system is constantly evolving towards ever higher levels. In this framework, the demand for skilled workers increases, outpacing its relative supply and thus raising either their relative employment and wage share, whereas the demand for unskilled ones will shrink thus bringing downward pressure on both their employment and wage shares.

Broadly speaking, this factor-biased pattern can be explained by pointing out the complementarity between new technologies and skills that are deemed to be peculiar of individuals endowed with higher levels of human capital (e.g. tertiary and college education). At the same time, new technologies are a substitute, rather than a complement, for skills typically associated with lower levels of human capital (e.g. primary or no education at all). An alternative explanation for diverging labor compensations focusses on the tasks that are performed on the job rather than on the individual skill endowments thus basing the biased pattern of economic growth on job characteristics or, more precisely, the routine content of tasks associated with the different jobs (Autor et al., 2003; Acemoglu and Autor, 2011). The Routine Based Technical Change hypothesis postulates that technology is a substitute for workers employed in professions characterized by routine tasks and complementary to those employed in non-routine ones. This perspective is particularly useful when trying to disentangle the employment impacts of newly introduced automation processes in the wake of the so-called Fourth Industrial Revolution and has consequently become a central issue in the related academic debate. In particular, Autor et al. (2003) proposes a model capable to explain a large fraction of the differential evolution of the labor demand across different occupations as spurred by declining prices of new technologies (i.e. computers).

On the other hand, the role of automation in shaping patterns of occupational polarization has been disputed on the basis of either the major role played by alternative determinants and the vast gradient of differential labor market outcomes as reference is made to international comparison between countries. This is especially true among European countries, where very different patterns of employment changes took place in the last two decades according to the different institutional settings of labor markets (Eurofound, 2014). While polarization effects did take place in Continental Europe, the evolution over time of the composition of the labor force in Northern and Southern European countries was more compatible with occupational upgrading processes. In particular, wage-setting institutions seem to play a major role in shaping the relationship between innovation and inequality, thus determining the extent of polarization among occupations and contributing to explain also the role played by the expansion of utilization of non-standard contracts and migrations in generating inequality among professions (Oesch and Rodrìguez Menes, 2011; Fernandez-Macìas and Hurley, 2017).

A further alternative explanation considers professions as a whole and not as aggregates of tasks. In this way the profession becomes the object of substitution. Following this approach, recent studies encompassing either empirical analysis and computer simulations raised concerns about a possible surge of "technological unemployment", highlighting how large shares of the labor forces in western countries are facing a "high risk" of automation (Frey and Osborne, 2017; Brynjolfsson and McAfee, 2014). However, when the analysis focusses on job characteristics, be they restricted to tasks or not, the impact of technical change is non-linear across individual skills. In fact, highly skilled/paid and low skilled/paid professions alike tend to increase their relative employment shares whereas medium-skilled professions' employment and wage shares tend to decrease thus entailing a polarization in the labor market rather than a mere divergence between skilled and unskilled workers (Autor and Dorn, 2009; Goos et al., 2014).

Another important issue to analyse when discussing the relationship between innovation and inequality in industrialized countries is related to the nature and types of different innovative activities and their possible differential effects on overall employment dynamics and earnings structures. In fact, when reference is made to all types of innovative activities considered altogether, the available empirical evidence seems inconclusive about the sign and magnitude of the impact (Vivarelli, 2014), suggesting that different dynamics and channels might be involved. Following Joseph Schumpeter, we can distinguish between product and process innovation. According to these definitions, *product innovation* is "the introduction of a new good" or a "new quality of good" (Schumpeter, 1934), be it a radically new good or an improvement or imitation of an already established one. Mostly, this type of innovation is associated with innovative activities such as investments in design and R&D, aiming at opening new markets in a framework of "technological competitiveness" and thus entailing job creation (Pianta, 2017).

On the other hand, *process innovation* is "the introduction of a new method of production" (Schumpeter, 1934), taking place either by investment in improved capital goods (embodied technological change) and/or organizational innovations, usually leading to higher efficiency levels associated with savings in terms of production factors (i.e. capital and/or labor). Process innovation thus usually delivers potential for productivity improvements, job destruction, product upgrading and/or price reductions. As a result, an increased demand in the market of goods may as well expand their relative production thus entailing job creation as well via market compensations (Pianta, 2005). However, process innovation usually consists "in a strategy of cost (or price) competitiveness" where "labour saving new processes and organisations are introduced, leading to job losses" (Pianta, 2017, p. 3). In this perspective, empirical evidences support the idea that innovative activities have a differentiated impact on employment across industries thus explaining a large share of the variability

in employment dynamics by making reference to the extent to which a given sector is oriented toward product or process innovation. In industries where the former prevails, technological change mostly generates job creation whereas the opposite is true otherwise (Pianta, 2004). However, the sign of the variation depends also on demand side factors in the market for goods and services as high demand growth rates are associated with improvements in employment outcomes whereas stagnating demand can exacerbate inequalities among firms and workers alike. In this latter scenario, high unemployment rates, selection among firms and positive economic growth rates can coexist thus contributing to explaining increased inequalities and "jobless growth" periods such as those experienced by European countries in the 1990s and in the recovery from the crisis of 2008 (Pianta et al., 1996; Fagerberg et al., 1999).

3. Policies to tackle inequality

Of course, the policies aimed at tackling inequality in developed and developing countries are expected to be rather different. The exposure of developing countries, or at least some of them, to political and economic instability and to the volatility of international markets of commodities do not always foster the creation of the institutional framework needed for the implementation of policies to deal with inequality. Anyway, it is worth addressing a very general framework of analysis that can be applied, with the due specifications, to different economic and institutional contexts. Ravaillon (2018) maintains that policies to tackle inequality can fall into two groups. Those that intervene on market incomes (wages, profits, rents) and those that change the distribution of disposable income. The first group includes all the policies that affect the operation and the performance of the labor markets and of productive factors. It encompasses all the educational policies and the programmes of intervention on human capital development through training of employees, of unemployed and of discouraged people in working age, who do not participate to the labor market. These interventions alter the balance between labor demand and supply and can contribute to the relative compression of wage differentials and of the skill/educational wage premium. Particularly, Brazil has benefited from these educational policies, which have contributed substantially to the diminishing of inequality, at least for the first decade of the 2000s. As for the fiscal policies, the welfare policies and the fine-tuning of a progressive system of direct taxation can provide both the incentives for participation to the labor market and the financial insurance when confronted with income fluctuations. To prove how fiscal and taxation policies can affect substantially income distribution, Keeley (2015) argues that the 1% of top earners at global level have augmented their share of total earning in the majority of OECD countries in the lapse of time between 1981 and 2012, also as a result of a contraction on the tax rates

of top income. Whereas in 1981 the OECD average tax rate of top incomes was 66%, in 2013 this rate was collapsed at 43%, as a consequence of a smooth decrease in this period of time.

As said previously, the unstable political framework of a few developing countries can hamper the implementation of the policies to deal with inequality. As fiscal and redistributive policies depend on the central government and their effects need time to turn up, political unsteadiness hinders the effectiveness of such policies. On the contrary, developed countries enjoy the benefits of more stable political and institutional frameworks which can favour the thorough implementation and the smooth accomplishments of the pursued effects. Furthermore, the dependence of the economic performance of such countries on the external trade and on the volatile prices of raw materials in international markets can undermine the steadiness of the national economic performance impairing the government's budget balance and increasing the difficulties in tackling inequality.

4. Conclusion

The debate on the relationships between income inequality and techno-economic innovation is quite old and articulated, as it refers back to the classical economists. Although the neoclassical theory made it sort of disappear from the economic debate, the topic showed its resiliency by resurfacing in the last two decades to become one of the main elements of the actual debate.

Inequality can show-up in the two different dimensions of between and within countries. The former refers mainly to the debate on convergence, based on the Solow model. As countries experience differences between them in income levels, these levels are however expected to decrease as backward countries benefitting from different sorts of spillovers, can eventually catch-up with the forward countries. Although, the economic literature has shown absolute convergence to be rather rare, in favour of local convergence towards different steady states (the so-called “club convergence”), still the empirical analysis has shown decreasing levels of between countries inequality in the last decades (especially because of the roles of China and India).

More problematic is the analysis (both theoretical and empirical) of within countries inequality, for which the main frame is still the Kuznetz idea that this kind of inequality is linked to different developmental stages experienced by different countries. The mainly US-focused analysis has developed a skill-biased approach to inequality and technical change, which however, in the other areas of the World appears to be more “institutionally based”.

Policies can be devised to comply with the targets of the Sustainable Development Goal #10, which can address either directly inequality or indirectly the market mechanisms leading to inequality. However, especially in these cases the differences between developed and developing countries are

rather crucial, as stability of the political framework (which is typically a problem of developing countries) works to either enhance or hamper the implementation of the policies to deal with inequality.

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