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Inequality and Growth: Goal Conflict or Necessary Prerequisite?[1]

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In this paper I discuss recent theories on the relationship between growth and inequality, and ask whether the two move together or not. Output growth can be due to increases in either physical capital, human capital, the labour supply or the level of technology, and I argue that each of these represents a mechanism that relates our two variables of interest. The literature indicates that there are two difficulties in answering the question. The first concerns causation, since inequality affects growth, growth impacts distribution, and third factors have an effect on both. The second is the fact that, depending on the source of growth, inequality and growth may be positively or negatively related. This means that we have to be much more precise in the way in which we ask the question. On the one hand, we need to identify the particular source of growth before we can assess how it relates to inequality. On the other, different dimensions of inequality have different impacts. Both the theory and the empirical evidence indicate that inequality at the top of the distribution does not have the same effect as inequality at the bottom.

1. Introduction

The relationship between growth and income inequality has occupied the attention of the profession for some 50 years, since the appearance of Kuznets (1955) pioneering work, and it is both important and controversial. It is important because policy makers need to understand the way in which increases in output will be

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shared among heterogeneous agents within an economy, and the constraints that this sharing may put on future growth. Its controversy derives from the fact that it has been difficult to reconcile the different theories, especially since the empirical evidence has been largely inconclusive.[2]

A first aspect of the debate concerns causation. Does the growth process have an impact on inequality? Or does the distribution of income and wealth among agents determine aggregate growth? Moreover, an economy's growth rate and its income distribution are both endogenous outcomes of the economic system. They are therefore subject to common influences, both with respect to structural changes as well as macroeconomic policies. Structural changes that affect the rewards to different factors will almost certainly affect agents differentially, thereby influencing the distribution of income. Likewise, policies aimed at achieving distributional objectives are likely to impact the aggregate economy's productive performance. Being between endogenous variables, the income inequality-growth relationship – whether positive or negative – will reflect the underlying common forces to which they are both reacting as well as the direct impacts that one may have on the other.

A second cause of controversy is that each of the theories proposed explores a single mechanism applicable only to particular types of countries. Theories about rural-urban migration, such as the Kuznets hypothesis, cannot describe the relationship between inequality and growth in mature industrialised economies; models based on credit market imperfections are applicable only to those economies where such imperfections are substantial; and the concept of skilled-biased technical change adds little to our understanding of the relationship between the two variables in countries with stagnant technologies.

In this paper I review recent developments in the theory of growth and distribution. My focus will be on those theories that can help us understand the relationship between these two variables in modern, industrialised economies. In these countries, the growth process is the result of a combination of technological change, capital accumulation – either physical or human –, and changes in the supply of labour. I will argue that each of these represents a possible mechanism creating a link between inequality and growth. Causation need not be the same in all cases. It could run from growth to inequality, from inequality to growth, or there may be other factors, such as policies and technologies, that simultaneously determine both. I make no a priori distinction between these, as all of them can be present in one form or another.

Two crucial questions arise for the policy maker. The first one is whether inequality is a pre-requisite for growth. The early approaches to the relationship between distribution and growth argued that inequality was a necessary condition

[2] See Aghion, Caroli, and García-Peñalosa (1999), Bertola (2000) and Bertola, Foellmi, and Zweimüller (2006) for overviews of the theoretical literature.

for growth, as it led to both a higher rate of saving and investment and to stronger incentives for agents to exert high effort. As we will see, there are also reasons why a more dispersed distribution of income reduces the rate of growth, and an answer to the importance of the two effects can only be provided by the empirical evidence.

A second question is whether the growth process brings about an increase in inequality, implying a conflict between productive efficiency and distributive considerations. In order to answer, it becomes essential to consider the precise source of growth. When growth is caused by human capital accumulation, it will tend to make the distribution of income less dispersed. However, technology-driven growth could have the opposite effect, implying a positive correlation between inequality and growth.

Moreover, certain structural parameters of the economy or policies will have an impact on both distribution and output growth. An example of this is labour taxation. Higher taxes on labour will imply shorter working hours, which in turn will have two effects. On the one hand, shorter hours imply lower utilization of capital, reducing the incentives to invest and hence growth. On the other, diminishing returns imply that shorter hours increase the hourly wage rate and lower the return to capital, thus reducing inequality. That is, inequality and growth will be positively related even if there is no causal effect of one on the other.

The paper is organised as follows. The next section decomposes a country's growth rate into four components: technological change, human and physical capital accumulation, and changes in the labour supply. I then examine the mechanisms relating inequality and growth considering these components one by one. Section 3 looks at technology and human capital, in order to assess the impact of inequality on growth and that of growth on inequality. Section 4 considers the inequality-growth relationship when growth is driven by physical capital accumulation, and identifies a number of factors that will influence both. I then address the question in terms of the effects of changes in the labour supply. The last section concludes.

2. A Framework of Analysis

2.1 The Determinants of Output Growth

In order to examine what are the determinants of the rate of growth of an economy, let us consider an aggregate production function of the form

$$Y = F(K, L, A)$$

where K denotes the aggregate physical capital stock, L a measure of the aggregate labour supply, and the function F(.) exhibits constant returns to scale to capital and labour. We can interpret A as the level of labour augmenting productivity or total factor productivity (TFP). It captures the level of technology but also the "quality" of the labour input or human capital.

It is then possible to write the rate of output growth as

$$g = s_k \frac{\dot{K}}{K} + s_L \left(\frac{\dot{A}}{A} + \frac{\dot{L}}{L} \right)$$

where s_K and s_L are, respectively, the capital share and the labour share in aggregate output, and $s_K + s_L = 1$ because of our assumption of constant returns to scale. That is, the rate of growth depends on the growth rates of physical capital, labour productivity, and the labour supply, as well as on the (possibly endogenous) factor shares.

This traditional approach to growth accounting can be extended in two directions. First, note that the aggregate labour supply is equal to the product of the number of employed individuals (P), the fraction of those that are employed (e), and the number of hours each employed individual works, (H). That is, L=P□e□H, implying that we can write the rate of output growth as

$$g = s_k \frac{\dot{K}}{K} + s_L \left(\frac{\dot{A}}{A} + \frac{\dot{P}}{P} + \frac{\dot{e}}{e} + \frac{\dot{H}}{H} \right).$$

Growth then depends also on changes in participation, the employment rate, and hours worked.

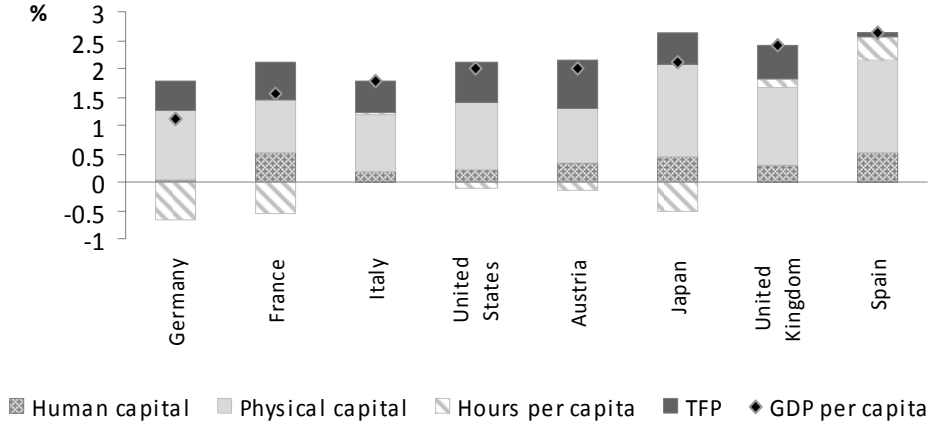
A second extension is to allow for worker heterogeneity in terms of their education or skills. The literature tends to define those with only high-school education as "unskilled workers" and those with college education as "skilled workers", and I will follow this convention, although there are clearly sources of skills other than formal education. A possible way of introducing this heterogeneity is to write the labour supply in terms of efficiency units of labour. That is, $L = xL_s + L_u$, where Ls and Lu denote, respectively, the supplies of skilled and unskilled workers and the former are x times more productive than the latter. Since skilled labour is more productive, growth accelerates as a greater fraction of the population becomes skilled. A common way to account for this is to suppose that A is a combination of pure technological change and the average number of years of education in the labour force.

The contribution of these factors to per capita output growth varies across countries and over time. Chart 1 reports a growth accounting exercise where per

capita GDP growth is decomposed into four elements: human capital, physical capital, hours per capita, and TFP. There are wide variations across countries. For example, human capital was a major contributor in France but negligible in Germany. Changes in hours of work (per capita) were a factor that reduced growth in France, Germany and Japan, while they increased it in Spain.3 The role of TFP also varies widely; it was negligible for Spain but accounted for 0.7 and 0.8 points in the USA and Austria, respectively.

Table 1 reports growth rates for the three EU Member States, Ireland, Portugal and Spain, that experienced fast growth in the last two decades of the 20th century. The rate of growth of per capita GDP is decomposed as the sum of the rates of growth of total factor productivity (TFP), the capital-labour ratio, employment, and participation. The table indicates very different patterns across countries but also over time for a given country. The increase in capital per worker played an important role in both Portugal and Spain, while in Ireland its contribution was modest in the earlier period and negative in the latter one. In contrast, TFP growth was the single most important factor driving growth in Ireland. The increase in the rate of labour force participation has contributed substantially to GDP growth, and in some instances, notably in Spain, it systematically accounted for a greater fraction of increases in output than TFP growth.

Chart 1: Growth Accounting – Selected Countries, 1982–2003



Source: Bassanini, Nunziata and Venn (2008).

Notes: The data for Germany cover only the period 1991–2003.

[3] Note that hours per capita is the product of hours per worker, the employment rate and the participation rate.

Table 1: Growth Accounting – Ireland, Portugal and Spain

	Ireland		Portugal		Spain	
	1984–93	1994–98	1984–93	1994–98	1984–93	1994–98
TFP	2.2	3.1	0.9	0.6	0.4	0.0
Capital per worker	1.0	-0.3	1.8	1.6	1.8	1.4
Employment rate	0.3	0.6	0.1	-0.3	-0.6	0.2
Participation rate	0.4	2.2	0.7	0.9	0.9	0.7
Per capita GDP	3.9	5.6	3.5	2.8	2.5	2.3

Source: Lebre de Freitas (2000).

2.2 Individual Incomes and Inequality

Let us now consider individual incomes. The market income of individual i of skill level j is given by $Y_{ij} = rK_i + w_j H_i$, where K_i is the individual's stock of capital or wealth, r the rate of return, w_j the hourly wage rate for workers of type j, and H_i the individual's hours of work. Any measure of inequality will be a function of the distribution of relative incomes, hence we need to define agent i's income relative to mean income, namely $y_{ij} \equiv Y_{ij} /(Y / N)$. Relative income can be expressed as

$$y_{ij} = s_K k_i + s_L \omega_j h_i \frac{1}{p}$$

where ki and hi denote, respectively the agent's physical capital and hours relative to the mean, N is the population, ω_j the wage of type j workers relative to the average wage, and p≡P/N is the participation rate.

An inequality index for market incomes, I, can then be defined as a function of individuals' relative incomes, that is, $I = \Phi(y_{ij})$. Inequality then depends on factor shares, the distribution of physical capital, the relative skilled and unskilled wages, hours of work, and the participation rate. To this list, we should add taxes and transfers set by the government which, for a given distribution of market

Box 1 : The Gini Coefficient in a Model Economy

Consider an economy with four types of agents characterised as follows:

- A fraction $1-p$ of the labour force are not employed, and receive a government transfer T;
- A fraction l of the labour force are unskilled workers earning a wage w_u;
- A fraction s of the labour force are skilled workers. Of those $s-\kappa$ own no capital and have an income equal to the skilled wage w_s;
- There are κ skilled worker-capitalists, each of whom earns profits π as well as the wage w_s.

We can define the labour share as $s_L \equiv \left(w_s s + w_u l\right)/y$. Our assumptions also imply that the profits received by each worker-capitalist are $\pi = (1-s_L)y/\kappa$.

The degree of income inequality can be measured by the Gini concentration index computed across the four groups of population. With four subgroups, the definition of the Gini concentration index is

$$Gini = \frac{1}{2y}\sum_{i=1}^{4}\sum_{j=1}^{4}\left|y_i - y_j\right|\cdot n_i \cdot n_j$$

where y_i is the income in group i relative to average income, and n_i denotes the relative weight of group i in the population.

Given our assumptions and denoting by w the average wage, the Gini coefficient of market or gross income is given by

$$Gini_g = (1-\kappa)(1-s_L) + s_L\left(1-p+\frac{ls}{p}\frac{w_s-w_u}{w}\right).$$

Assuming, for simplicity, a constant proportional tax rate τ on all incomes, and recalling that the transfer was equal to *T*, we can write the Gini coefficient of disposable income as

$$Gini_d = (1-\tau)(1-\kappa)(1-s_L) + (1-p)s_L\left(1-\tau-\frac{T}{w}\right) + (1-\tau)s_L\frac{ls}{p}\frac{w_s-w_u}{w}$$

The Gini coefficient is thus a function of population proportions, the labour share s_L, the wage differential $(w_s - w_u)/w$, the participation rate, *p*, and government transfers and taxes. A greater wage differential between the skilled and the unskilled and lower participation raise the Gini coefficient. The effect of the wage share is ambiguous. This is a standard effect when there is inequality within groups (workers) and between groups (capital-owners versus non capital-owners). On the one hand, a higher wage share reduces the income differential between those who own capital and those who do not, as captured by the first term in the above equation; on the other, for any given wage differential, a higher wage share increases the weight that the wage distribution has in total market income and raises inequality. If, however, labour income is more equally distributed than capital income, the first effect dominates and a higher labour share is associated with a lower Gini coefficient. Lastly, both a higher tax rate and a higher transfer rate reduce inequality in disposable incomes.

incomes, will determine inequality in disposable income. A common index of inequality is the Gini coefficient, and an example of how some of these factors affect it is given in box 1. What is important for our purposes is that the variables determining the distribution of income are the same ones that we have seen affect the rate of growth. Each of these elements hence represents a channel that potential links, in a causal or non-causal way, inequality and growth, and the rest of the paper considers them in turns.

Let me illustrate the importance of the various the sources of inequality with some recent data for the USA, the UK and Germany. Chart 1 depicts the contribution to gross household income inequality of four sources of income: wage income, capital income, self-employment income, and a broad category (other) which includes all other incomes such as government transfers, pensions, alimony, etc. The contribution of, say, wage income is a combination of inequality in wages and the weight that wage income has in total household income. By definition the sum of the contributions of the four factors is equal to one.

Chart 2: Inequality Decomposition – Selected Countries, 2000

Source: Breen, García-Peñalosa, and Orgiazzi (2008).

Notes: Data from the Luxembourg Income Study. The inequality measure used is the squared coefficient of variation. The data for the UK is for 1999.

We can see that although in all three countries wage income accounts for the largest share of inequality, its contribution varies substantially. Wage income inequality accounts for over 80% of overall inequality in the USA but its contribution in the UK and Germany is substantially lower. In the UK, self-employment income plays a particularly important role accounting for 30% of income dispersion, while in Germany the contribution of capital income inequality was 15%, substantially higher than in the two Anglo-Saxon economies.

So far we have considered, in line with traditional analyses of income inequality, two sources of heterogeneity across agents: differences in their endowment of physical capital or wealth and in their human capital. In what follows, I will examine these two sources of heterogeneity separately. To be more precise, let us consider again the relative income of agent *i*, which is given by $y_{ij} = s_K k_i + s_L \omega_j h_i / p$. We can identify three elements in this expression. The first one is the relative wage, ω_j, which measures the way in which different types of labour are rewarded and captures the effect of the distribution of labour earnings on income inequality. In the next section of the paper I will focus on differences in human capital endowments, examining the arguments that link growth to the returns to education, and ignoring differences across agents other than their level of education.

The second element in the above expression are factor shares, s_K and s_L, which capture how capital and –some aggregate measure of– labour are rewarded. In order to focus on this aspect, section 4 will ignore differences across workers and consider as the only source of heterogeneity differences in initial wealth endowments. Lastly, h_i and p capture elements of the labour supply – hours per worker and participation –. I will argue that hours of work are closely related to the rewards to capital and labour, and hence consider again differences in wealth endowments as the source of inequality. Our discussion of the causes and effects of labour market participation needs, however, other sources of heterogeneity that may determine who decides to go to work and who does not. I will then focus on two groups of individuals that have historically had different degrees of labour market attachment, men and women, and the implications that changes in female labour market participation have for inequality and growth.

3. Technology and the Quality of Labour

Human capital has played a key role in the new growth theories.[4] On the one hand, these theories have emphasized that just as economies accumulate physical capital,

[4] See Lucas (1988), Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992).

it is possible to accumulate human capital to generate higher per capita output. On the other, building on the seminal work of Nelson and Phelps (1966), one of the most important lessons that these theories have taught us is that we cannot separate the process of human capital accumulation from that of technological change. Nelson and Phelps argued that a major role for education is to increase the individual's capacity to innovate and to adapt to new technologies. This complementarity between education and innovation activities has two important implications. First, technological change requires educated workers. Indeed, the new growth theories have emphasized the importance of having an educated labour force in order to have R&D-driven growth. Second, under the Nelson and Phelps approach to human capital, workers with different levels of education are *not* perfect substitutes. In particular, skilled or high-educated workers are able to implement and/or use new technologies, while unskilled workers are not. As a result, their relative rewards depend not only on the relative supplies of high- and low-education workers, but also on the speed and on the type of technological change. This has given rise to an extensive literature that explores the concept of *biased technical change* and its implications for wage inequality.

At the same time, the education expansion that took place in industrialised countries in the second half of the twentieth century has been seen as an important force in reducing income inequality over the period, as the increase in the relative supply of skilled workers resulted in a reduction of their wage relative to that of the unskilled. This would seem to indicate that growth, when driven by human capital, will be accompanied by a reduction in inequality. The relationship between human capital, growth and distribution is, however, more complex than this simple argument would indicate. On the one hand, inequality can affect both innovation and human capital accumulation, and through these the rate of growth. On the other, technological change itself can affect wage inequality in ways that complement or offset the impact of changes in the skilled labour force. In this section, I discuss these two arguments, and then turn to some of their policy implications.

3.1 The Impact of Inequality on Growth

The traditional view that inequality should be growth-enhancing is based on three arguments. First comes Kaldor's hypothesis, formalized by Stiglitz (1969), that the marginal propensity to save of the rich is higher than that of the poor. If the growth rate of GDP is directly related to the proportion of national income that is saved, more unequal economies are bound to grow faster than economies characterized by a more equitable distribution of income. A second reason why inequality may enhance growth has to do with investment indivisibilities: investment projects, in particular the setting up of new industries or the implementation of innovations, often involve large sunk costs. In the absence of a broad and well-functioning

market for shares, wealth obviously needs to be sufficiently concentrated in order for an individual (or a family) to be able to cover such large sunk costs and thereby initiate a new industrial activity. Hence a sufficiently concentrated distribution of wealth is a pre-requisite for growth. Lastly, the idea that there is necessarily a trade-off between productive efficiency and equality is based on incentive considerations, first formalized by Mirrlees (1971). Namely, when individual output depends on the unobservable effort borne by agents, rewarding them with a constant wage independent from output performance will obviously discourage them from investing any effort.

The idea that income inequality is necessary to foster effort remains central in the growth literature, as I will discuss in the next subsection. However, the recent literature has refuted the first two arguments on the grounds that, even though they might be important at the early stages of development, in modern industrialised economies capital markets are sufficiently developed for investments in physical capital not to be constrained by personal wealth or domestic savings. Nevertheless, the idea that credit constraints are important has been explored in relation to investments in human capital and, as we will see, has yielded very different conclusions.

3.1.1 Inequality, Incentives and Innovation

One of the cornerstones of the new growth literature is the Schumpeterian idea that innovation is endogenous and responds to market conditions and economic incentives. Moreover, innovation is, to a large extent, performed by entrepreneurs and hence the determinants of entrepreneurship will affect growth. Entrepreneurship is characterized by large risks, and there exists plenty of evidence supporting this fact. For example, in the United States, 61.5% of businesses exit within five years, and the founder of a private company faces a risk of about 10% of losing all his/her investment in the first ten years. At the same time, the cross-sectional standard deviation of self-employment earnings is substantially higher than that of wages from paid employment.[5] In order to induce individuals to become entrepreneurs and innovators rather than employees, large returns are required to compensate for these risks. The immediate implication is that the higher the income of a successful entrepreneur is relative to wages in employment, the larger the fraction of the population that choose entrepreneurship, and hence the faster the rate of innovation is. That is, greater income inequality will result in faster technological change and growth.

Surprisingly, the fact that greater inequality induces more entrepreneurship does not imply that redistribution hampers growth. On the contrary, a certain degree of income redistribution can *increase* entrepreneurship and the rate of growth. The

[5] See, respectively, Moskowitz and Vissing-Jorgensen (2002) and Hamilton (2000).

reason is that redistribution provides insurance to all agents undertaking risky activities as it guarantees a minimum income in the case of failure. This effect reduces income uncertainty and hence induces more entrepreneurship.[6]

3.1.2 Inequality and Human Capital Investments

Investments in education –or human capital– have two important features. The first one is that young agents' education investments are strongly affected by parental income. A possible cause of this correlation between parental income and education are credit market imperfections. Human capital is embodied in the individual, making it difficult to use education as collateral against which to borrow. This aspect implies that, even in rich economies, borrowing in order to invest in education is difficult and costly, and as a result the distribution of income can affect the level of education in the economy. Public education can, to some extent alleviate this effect, but the correlation between income and tertiary education is strong even in countries where education is free. The reason for this is the fact that family wealth provides insurance against the risk of failing at university. The absence of such insurance discourages the offsprings of poor household from undertaking risky education investments, while individuals from wealthier families choose to make such investments.[7]

The second feature is that investments in education are characterized by strong diminishing returns, implying that it is more efficient to invest a little in many individuals than a lot in few. To illustrate the way in which distribution affects education think of a situation in which it is simply not possible to borrow in order to study so that any investment in education has to be financed by family wealth. High wealth concentration implies that only those at the top of the distribution will invest. Although these investments can be large, strong diminishing returns imply that, at the margin, they are not very productive. Alternatively, suppose that wealth is evenly distributed. All agents in the economy are now able to study, making small but highly productive investments, which result in a higher average level of human capital. In other words, a more equal distribution of wealth leads to a higher average stock of human capital.

How does this affect growth? There are three ways in which education will affect the rate of growth. The first is simply through factor accumulation: more efficiency units of labour result in a higher level of output. The second is due to the fact that R&D needs to be performed by highly educated individuals. The more educated the labour force is, the more workers will be available to undertake

[6] See García-Peñalosa and Wen (2008).

[7] Galor and Zeira (1993) examine the effect of inequality on education when there are credit constraints, while Checchi and García-Peñalosa (2004) and García-Peñalosa and Wälde (2000) condier the role of uncertainty.

research and development, and hence the faster the rate of innovation will be. Lastly, as argued by Nelson and Phelps, educated individuals are better at adopting new technologies. A more educated labour force will then result in faster or more widespread adoption of new technologies, leading to faster growth.

The mechanism I have just described implies that a more unequal distribution of wealth will result in lower levels of human capital, less innovation and adoption, and slower growth. This contrasts with the argument presented in the previous subsection that greater income inequality creates incentives for entrepreneurship and hence leads to innovation and faster growth. Note, however, that the two mechanisms are compatible and can be simultaneously in operation. The risk associated with entrepreneurship implies that the rewards to successful entrepreneurs need to be higher than the wages similar individuals can obtain, and hence it is inequality *at the top* of the income distribution that creates the right incentives. In contrast, the second approach is based on the idea that the returns to investments in education are highest at low levels of human capital, and hence growth requires low inequality *at the bottom* of the distribution. This means that greater inequality will increase the rate of growth if it is due to an increase in dispersion at the upper end of the distribution, and reduce it whenever it is caused by more dispersion at the bottom.

3.2 The Impact of Technological Change on Labour Market Inequalities

Wage income is the main source of personal and household income, and hence its distribution has major implications for inequality. A large literature has hence examined the evolution of the distribution of labour earnings,[8] and documented that in the last two decades of the 20th century a number of industrialised countries experienced a substantial widening in the earnings distribution.[9] The most spectacular rise has undoubtedly taken place in the UK and the USA. Between 1980 and 2000, the ratio of the 90th to the 10th percentile of the earnings distribution rose by 14% in the UK and by 21 in the USA.[10] Although not all economies experienced this rise in earnings inequality – notably France and Germany – most developed economies have seen the secular trend of stable or falling earnings inequality reversed in the 1980s and 1990s. Moreover, the evidence clearly indicates that an important component of the increase in earnings

[8] I will use the terms wage distribution and earnings distribution interchangeably, even if this is not entirely accurate.

[9] See the overview provided by Gottschalk and Smeeding (1997), and Atkinson (2007) for recent trends.

[10] Author's calculations from OECD "Trends in earnings dispersion" database. See also Checchi and García-Peñalosa (2008b).

inequality has been an increase in the so-called relative wage, that is the ratio of the hourly wage of those with tertiary education (also termed skilled workers) to that received by those with only secondary education (called unskilled).

In order to understand the determinants of the relative wage we need to think of different types of labour as not being perfect substitutes, implying that the supply of skilled and unskilled workers will affect their rewards. Moreover, if the two types of labour are imperfect substitutes, technical change may not affect the productivity of skilled and unskilled workers in the same way.[11] This can be easily captured by an aggregate production function in which we allow for skill-specific technologies, with A_s representing the technology used by the skilled and A_u that used by the unskilled. That is, output can be expressed as $Y = F(K, A_s L_s, A_u L_u)$; see box 2. The evolution of the relative wage then depends on two forces: changes in relative labour supplies and changes in the relative skill-specific productivities.

Box 2: A Production Function with Biased Technical Change

To capture the idea of biased-technical change more precisely consider an aggregate production function of the form

$$Y = K^{\alpha}\left(\beta(A_s L_s)^{\gamma} + (1-\beta)(A_u L_u)^{\gamma}\right)^{1-\alpha}.$$

The elasticity of substitution between the two types of labour is given by $1/(1-\gamma)$, and they use skill-specific technologies, with A_s representing the technology used by the skilled and A_u that used by the unskilled.

Taking logs, the relative wage can be expressed as

$$\ln\frac{w_s}{w_u} \cong \gamma \ln\frac{A_s}{A_u} - (1-\gamma)\ln\frac{L_s}{L_u}.$$

The standard effect of relative labour supplies is captured by the negative impact of L_s / L_u on the relative wage. Skill-biased technical change, in turn, is represented by an increase in the ratio A_s / A_u. Under the (empirically validated) assumption that $\gamma > 0$ -i.e. if skilled and unskilled labour are substitutes-, a higher ratio A_s / A_u will result in a higher relative wage.

[11] An excellent review of this literature is provided by Hornstein, Krusell and Violante (2005).

There will be two effects of growth on the relative wage. When growth is driven by an increase in the relative supply of skilled labour (i.e. higher ratio L_s / L_u) it will be associated with a reduction in the relative wage. This is the traditional effect of education on inequality, which drove the reduction in wage dispersion observed in the 1960s and 1970s. In contrast, when growth is due to technical change, its effect will depend on whether A_s or A_u grows faster. If technological improvements lead to a faster increase in A_s, we will say that there is skill-biased technical change, and this will result in an increase in the relative wage. That is, skill-biased technical change will be accompanied by an increase in earnings inequality.

One of the questions raised by this literature is why is it that after several decades of fast technological progress, technical change *became* skill-biased, probably some time around the late 1970s or early 1980s. A number of authors have examined whether technical change has become skill-biased in response to some external factor. Two explanations have been put forward, both of them based on the idea that researchers can target their innovations and make them complementary with either unskilled or skilled workers. The first argument maintains that it was the education expansion itself that changed the nature of technical change.[12] To understand this, we need to think of the research process as a fixed cost, implying that the research firm needs to sell a sufficiently large number of units of the new intermediate good (or technology) in order to cover the R&D costs. When skill labour was scarce, it was more profitable to create innovations that complemented the unskilled, but as the education expansion that started in the 1960s increased the number of workers with tertiary education, it became profitable to invent machinery to be used by skilled workers and as a result technical change became skill-biased.

An alternative, or rather complementary, hypothesis is that the expansion in trade that started in the 1980s was the trigger that changed the nature of innovations.[13] When new industrialising countries started imitating goods produced by the high-income economies, established firms in the latter countries experienced a sharp increase in competition due to the lower wages paid in the former. This competition was, however, largely restricted to those goods that were produced by unskilled workers since the new industrialising countries lacked skilled labour. The way to escape competition was hence to invent new products that had to be produced by the skilled workers abundant in high income countries and which the new industrialising economies would not be able to imitate. Again, technical change became skilled biased.

[12] This idea was first explored by Acemoglu (1998).
[13] See Thoenig and Verdier (2003).

3.3 Indirect Effects of Biased Technical Change

The concept of biased technical change has proven to be a powerful tool relating technological progress to wage dynamics. The problem is that because technological progress is hard to measure directly, the only way to identify the effect of biased technical change is by not being able to attribute changes in the relative wage to other causes. These other causes have been argued to be changes in the internal organization of firms and in labour market institutions. But what is the source of changes in firms' organization and in institutions? Perhaps the most enduring contribution of this literature will be the idea that both organizational change and the evolution of labour market institutions are partly the result of biased technical change.

A number of recent contributions have argued that technological change, and in particular IT-technologies, have changed the internal organization of firms. The overall conclusion of this literature is that technologically-induced organizational change tends to increase inequality both within a firm and across workers in different firms, and is seen as largely responsible for the increase in labour earnings of top managers, and hence in earnings inequality. Technological progress has also been argued to be a source of changes in labour market institutions. What these theories argue is that the collapse of centralised wage bargaining in the late 20th century was the result of the increase in the productivity gap across workers brought about by technological progress that created an increased complementarity between capital goods (equipment) and skilled workers. Empirical evidence, in turn, indicates that changes in labour market institutions can account for part of the recent increase in wage dispersion, and have been shown to have a substantial impact on overall income inequality.[14]

3.4 Human Capital, Inequality and the Welfare State

The determinants of the degree of income inequality in a country include social and political forces as well as economic ones. In particular, government transfers can be an important source of household income. For example, in 1993, social security benefits accounted for 14% of household income in the UK.[15] Similarly, taxes play an important redistributive role, suggesting that even if growth matters in shaping

[14] Saint-Paul (2001) and Garicano and Rossi-Hansberg (2006) examine the effect of technology on organizational change, and support for the complementarity between technology, organizational change and human capital is provided by Caroli Van Reenen (2001) and Bresnahan at al. (2002). The effect on labour market institutions is analysed by Acemoglu, Aghion and Violante (2001), while empirical evidence on the importance of labour market institutions for income inequality can be found in Checchi and García-Peñalosa (2008a, 2008b).

[15] See Atkinson (1997).

the distribution of income, policy choices also play a crucial role. In rich industrialised economies, taxes and transfers reduce the Gini coefficient by about a third. Moreover, differences across countries in taxes and transfers account for a large fraction of overall income inequality. In 2000/2001, the Gini coefficient for market incomes was the same in Germany, Australia and the USA, 48%. The Gini of disposable income (i.e. after transfers and direct taxes) was, respectively, 28, 32, and 37, placing Germany amongst the most equal and making the USA one of the most unequal of the high-income economies.[16]

This raises the question of what determines the degree of redistribution, or, more generally, the size of the welfare state in an economy. It is likely that redistribution is determined simultaneously with inequality itself. This is precisely the argument put forward by Bénabou (2005), who maintains that inequality, human capital accumulation, and the welfare state are jointly determined.

Suppose that growth is driven by the accumulation of human capital, and that individuals are endowed with different levels of human capital (or education) and of random ability. There are three key elements in the model. First, an individual's disposable income depends on her human capital, her ability, and the degree of redistribution, denoted τ. Second, some individuals are credit constrained and hence invest in the education of their offsprings less than they would in the absence of credit constraints. Third, individuals vote over the extent of redistribution, and do so before they know their children's ability.

Two relationships appear. On the one hand, the desired degree of redistribution is a decreasing function of the degree of human capital inequality in the economy, that is,

$$\tau = \Gamma(\text{inequality}) \text{ with } \Gamma' < 0 .$$

The intuition for this is that redistribution provides social insurance against the uncertainty concerning ability. The more unequally distributed human capital is, the more unequal the distribution of expected income is and hence the more *expensive* insurance becomes for those with high human capital. As a result there will be less support for redistributive policies.

On the other hand, we have a relationship governing the process of human capital accumulation. Greater redistribution relaxes the credit constraint of the poor, allowing them to increase the educational attainment of their children which in turn results in a lower degree of long-run inequality. That is,

$$\tau = \Psi(\text{inequality}) \text{ with } \Psi' < 0 .$$

Since the two relationships are decreasing, they may intersect more than once and give rise to two stable equilibria for the same preferences and technology. One

[16] See Brandolini and Smeeding (2007).

equilibrium is characterized by low inequality and high redistribution, while the other exhibits high inequality and low redistribution.

This approach has a number of important implications. First, the equilibrium relationship between inequality and redistribution will be negative, since, paradoxically, more equal societies choose to redistribute more. Second, different sources of inequality have different impacts on the extent of redistribution. If inequality is mainly due to differences in human capital endowments, the support for redistributive policies will be weaker than when inequality is largely due to random ability shocks. Third, which of the two equilibria results in faster growth is ambiguous. It depends on the distortions created by redistribution – in terms of the reduction of the labour supply it entails, as we will discuss in section 5 below – and the positive effect of a greater investment in education by the poor.

Before we turn to the question of capital and labour supply in the next sections, consider a possible interpretation of Bénabou's analysis. In his original framework, the random term in the individual's income function is interpreted as innate ability, but it can be given alternative interpretations. For example, uncertainty could be related to the overall performance of the sector in which the worker chooses to work, which in turn depends on the degree of openness and competition faced by the sector. Under this interpretation, an increase in openness would accentuate the uncertainty faced by individuals with a given level of human capital and lead to greater support for redistribution. That is, trade openness can increase the size of the welfare state and lead to a lower degree of inequality. The effect on growth would be ambiguous, as more redistribution would tend to reduce the labour supply but openness may itself have other positive effects on output growth.

4. Physical Capital Accumulation

Let us turn now to how physical capital accumulation creates a link between inequality and growth. We will depart from our analysis in the previous section and suppose that all individuals are endowed with a single unit of homogeneous labour, so that they all receive the same wage income. Instead, let us consider that the only source of inequality are unequal initial endowments of capital or wealth.[17]

Suppose that output is produced by a large number of competitive firms according to a Cobb-Douglas aggregate production function of the form $Y = K^{\alpha}(AL)^{1-\alpha}$, where L is the aggregate labour supply. Suppose that the only source of growth is the accumulation of physical capital, implying that higher investment on the part of firms results in faster growth. The parameter α is the key element linking inequality and growth. On the one hand, α is the marginal

[17] The discussion in this subsection follows closely the analysis in Bertola (1993) and García-Peñalosa and Turnovsky (2006, 2007).

productivity of capital. The higher it is, the more productive capital is and the more firms will want to invest, leading to faster growth. On the other, α is the share of capital in aggregate income and will hence affect income inequality. To see this note that if the only difference across agents is their wealth, we can write the relative income of agent *i* as $y_i = \alpha k_i + (1-\alpha)$. The distribution of income is then determined by the distribution of wealth and factor shares. For any given distribution of wealth (i.e. of the k_i's), the higher the capital share, the greater the weight of capital is in relative incomes and the more dispersed the distribution of income will be. A higher capital share, i.e. a higher value of α, will result in both a faster rate of growth and a more dispersed distribution of income.

Growth and inequality will also be affected by policy parameters. Suppose, for example, that all income is taxed at a constant proportional rate τ and that the revenue is used to finance a lump-sum transfer, denoted *b*, so that the individual's relative disposable income is given by $y_i = (1-\tau)\left(\alpha k_i + (1-\alpha)\right) + b$. Using the government's budget constraint to substitute for *b*, we can write relative disposable income as $y_i = \alpha k_i + (1-\alpha) - \tau\alpha\left(k_i - 1\right)$. Individuals with above-average capital, that is, for whom k_i is greater than 1, will pay a net tax, while those with below-average capital, i.e. with k_i less than 1, will receive a transfer. The greater the tax rate, the more equal the post-tax distribution of income is. At the same time, a higher tax rate will reduce the net return to capital and thus its rate of accumulation, leading to slower growth.

To sum-up, the two mechanisms just described imply that factors that affect capital accumulation have an impact on inequality as well. When growth is driven by physical capital accumulation, differences in technology (α) result in a positive correlation between growth and pre-tax income inequality, while differences in income tax rates (τ) lead to a positive correlation between growth and post-tax income inequality. There is a third factor that affects the accumulation of physical capital, namely the labour supply. The next section turns to this aspect.

5. Labour Supply

5.1 Leisure and Hours of Work

As discussed in section 2 above, the aggregate labour supply is a combination of hours worked per employee and the fraction of the population that works, which in turn is the product of the rate of labour force participation and the employment

rate. I will leave aside considerations relating to employment (or unemployment),[18] and focus on the other two elements. In this subsection I discuss how the fact that individuals can choose, to some extent, how many hours to work affects both growth and inequality, while subsection 5.2. examines the causes and effects of changes in participation rates.

5.1.1 Factor Returns and Factor Shares

The last decades of the 20th century witnessed a substantial widening of the gap between working hours in the United States and Europe. While in 1970 Europeans spent about the same time at work as Americans, by 2000 working hours in the EU Member States had fallen to 77% of hours worked in the USA. As we can see in table 2, these changes in work hours implied that despite the large productivity gains experienced by European countries, GDP per capita did not catch up with that in the USA. This observation has sparked a debate about the causes and effects of differences in labour supply, and an extensive literature has focused on whether taxes or preferences have driven these differences, and on the impact of labour supply on growth.[19] However, little attention has been paid to the distributional implications of an endogenous labour supply.[20]

Table 2: GDP and Hours of Work

	GDP per capita		GDP per hour		Hours per capita	
	1970	2000	1970	2000	1970	2000
USA	100	100	100	100	100	100
EU-15	69	70	65	91	101	77
France	75	71	69	100	109	71
Spain	50	57	47	73	105	78

Sources: Blanchard (2003, 2004).

[18] The main reason for doing so is that there is no clear evidence of a relationship between unemployment and inequality. See, for example, Checchi and García-Peñalosa (2008a).

[19] The three competing approaches are proposed by Blanchard (2004), Prescott (2004) and Alesina et al. (2005).

[20] The analysis in this section and the next follows García-Peñalosa and Turnovsky (2007, 2008) and Turnovsky and García-Peñalosa (2008).

In order to analyse the role of hours of work, we need to introduce an elastic labour supply so that agents can choose how many hours to work. The elasticity of leisure in the utility function then becomes a crucial parameter determining both the rate of growth and the distribution of income. A greater preference for leisure will result in fewer work hours. This in turn implies a lower utilization of capital and hence a lower productivity of investment, reducing the rate of capital accumulation and hence of growth. Countries with different preferences for leisure will then have different rates of growth.

To examine the effect on inequality, let us go back to our basic relative income equation. Suppose, as in section 4, that the only difference across agents is their wealth endowment, so that the relative income of agent *i* can be expressed as $y_i = s_K k_i + s_L$. With a Cobb-Douglas production function and the resulting constant factor shares, the endogeneity of the labour supply would have no effect on distribution which would only depend on the constant labour share and the (given) distribution of wealth. In order for hours worked to have an impact on the distribution of income we need to allow for changes in the labour share. The labour share will be endogenous with a more flexible production functions that the Cobb-Douglas, such as a CES production function; see box 3.

Box 3: An Endogenous Labour Share

To understand the effect of hours worked on the share of labour, consider an aggregate production function of the form

$$Y = \left(\alpha K^{\rho} + (1-\alpha)(AL)^{\rho}\right)^{1/\rho},$$

where *L* is the effective labour supply, given by the product of hours and population, that is *L=hN*, and $\sigma = 1/(1-\rho)$ is the elasticity of substitution between capital and labour. The labour share is then given by

$$s_L \equiv \frac{wL}{Y} = \left(1 + \frac{1-\alpha}{\alpha}\left(\frac{K}{hN}\right)^{\rho}\right)^{-1},$$

and is a function of the capital labour ratio. Differentiating we have that the sign of $\partial s_L / \partial h$ is given by the sign of the parameter ρ. This means that when capital and labour are complements – that is, when $\rho < 0$ and the elasticity of substitution is less than 1 – a higher value of *h* results in a lower labour share. An elasticity of substitution less than 1 – i.e. $\rho > 0$ – implies that the labour share is increasing in *h*.

The labour share is by definition equal to the product of the wage times the labour supply divided by aggregate output, i.e. $s_L = wL/Y$. An increase in hours worked then has two effects. On the one hand it raises the effective labour supply which tends to increase the labour share. On the other, it results in a lower wage rate which tends to reduce it. Which of these two effects dominates depends on the elasticity of substitution between capital and labour. The bulk of the evidence indicates that capital and labour are complements, so that the elasticity of substitution is less than one, $\sigma < 1$.[21] Then an increase in hours worked would result in a lower labour share and consequently greater income inequality. That is, increases in hours worked will result, on the one hand, in a faster rate of growth and, on the other, in a lower labour share and a more dispersed distribution of income.

Evidence of a positive correlation between average hours worked in a country and the Gini coefficient of income is obtained by Alesina et al. (2005) for OECD economies. Chart 3 depicts weekly hours of work per capita and the Gini coefficient of disposable income in six countries, and the two variables exhibit a correlation of 0.68. Proper econometric work is needed to examine the robustness of this correlation, but the data seems to support the idea that hours and inequality tend to move together. Note, however, that there could be reasons for this correlation other than the one we have just explored. For example, if we go back to the incentive argument of section 3.1.1, a more dispersed distribution of income may provide stronger work incentives and hence increase the fraction of time devoted to work.

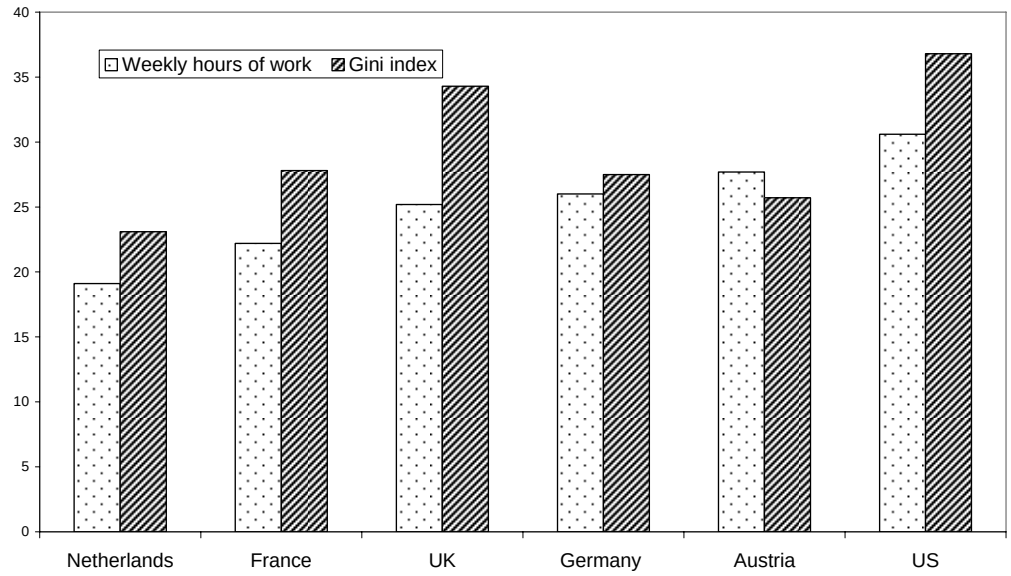
5.1.2 Taxation

As we have seen, one possible reason why labour supplies differ across countries is different preferences for leisure. If preferences are the cause of variations in labour supply, growth rates and inequality across countries, then there are no strong policy implications.[22] An alternative view, put forward by Prescott (2004), is that the gap in labour taxes between the USA and the EU has caused differences in time use. That is, they are the result of government policy.

[21] See Guvenen (2004).

[22] There may be a reason for intervention if preferences are endogenous and multiple equilibria possible; see Alesina, Glasser and Sacerdote (2005).

Chart 3: Inequality and Hours of Work – Selected Countries, 2000



Sources: Hours from Alesina at al. (2005). Gini coefficients on household disposable income for 1999 or 2000 from the Luxembourg Income Study (key figures).

Table 3 reports hours worked and GDP per capita in France and Germany relative to the USA, as well as the effective tax rate on labour income and the Gini coefficient of disposable income in the 1990s. The so-called *effective labour tax* – a combination of taxes on wages and consumption – remained roughly constant in the USA between the 1970s and the 1990s, at 40%. However, it increased substantially in many European countries. In France it rose from 49% to 59%, and in Germany from 52% to 59%. The timing of these increases coincided with the reduction on hours of work witnessed in the large European economies, and hence it seems a possible explanation.

Table 3: Hours of Work, Taxes and Income Inequality in the 1990s

	Hours worked per capita	GDP per capita	Effective labour tax	Gini coefficient
USA	100	100	0.40	0.35
France	68	74	0.59	0.29
Germany	75	74	0.59	0.27

Source: Hours, GDP and taxes for 1993–96 from Prescott (2004). Gini coefficients on household disposable income for 1994 from the Luxembourg Income Study (key figures).

It is straight forward to show that higher taxes on wages and consumption have a substitution effect that leads to a lower labour supply and slower growth, and this is supported by recent empirical evidence.[23] However, the change in taxes raises a puzzle as to its effects on inequality. If capital endowments are more unequally distributed than labour endowments, then the increase in labour taxes should also have increased post-tax income inequality. This prediction is at odds with the evidence which indicates an increase in inequality in the USA, stability in Germany, and a reduction in France over the period.[24] A possible explanation is that the reduction in hours caused an increase in the labour share, leading to lower pre-tax inequality. This effect could have been sufficiently strong to offset the direct distributive effect of higher taxes, so that a higher effective tax on labour was associated both with lower working hours and a more equal distribution of income.

5.2 Women in the Labour Market

One aspect that has received little attention in the recent growth literature is the role of labour market participation. Yet, changes in participation rates can have a substantial impact on per capita GDP growth, as reported in table 1. The table indicates that growth in participation has contributed substantially to GDP growth, in some instances more than TFP growth. Moreover, the increase in participation has been largely due to the massive entry of women in the labour market in these countries in the last two decades of the 20th century. Between 1984 and 1998, both Ireland and Spain experienced an increase in female participation rates of over 3% per year and Portugal of 1 % per year, while male participation rates declined

[23] See Cardia, Kozhaya, and Ruge-Murcia (2003).
[24] Brandolini and Smeeding (2007) document trends in inequality in these countries.

slightly over the period.[25] These numbers imply that the contribution of female labour market participation to output growth is of the same order of magnitude as that of TFP growth, and raises the question of what are the implications of women entering the labour market for the relationship between inequality and growth.[26]

There are two reasons why we would expect a relationship between female labour participation, inequality, and growth. The first concerns the policies that would promote female participation, and their relationship to wage inequality. The second aspect is the impact of increased participation on inequality across households.

Women's decision of whether or not to participate in the labour market is based on a comparison of the forgone home production if they work with the income obtained if employed. In all industrialised countries there is still a large gap between the hourly wages of men and those of women.[27] Wage gaps are particularly evident in two types of jobs. One is female-dominated jobs, such as nursing, which tend to command lower wages as compared to male-dominated jobs with similar employee characteristics. The second are part-time jobs which are characterized by substantially lower hourly wages than similar full-time jobs. Differences in wage rates are aggravated by the fact that the tax rate of the income of married women is higher than that for men or for single women. Encouraging female participation would then require policies that reduce the gender wage gap and that lower the tax rate for second earners.[28] Such policies would then lead to lower gender inequality which would increase participation and hence result in faster growth.

Lower inequality between the wage rates of men and women may nevertheless be associated with increases in inequality when measured for other groups. Reducing the gender wage gap is likely to be due to an increase in the wages of women at the top of the earnings distribution, and hence would increase the dispersion of female earnings. This is precisely what we observe in the USA, where the sharp reduction in the gender wage gap at the end of the 20th century was associated with increases in the dispersion of female hourly wages and female earnings.[29] In other words, faster growth will be associated with lower inequality across gender groups but greater inequality within groups.

Throughout the paper we have looked at inequality among individuals, yet the empirical literature and policy-makers are often concerned with the distribution of

[25] Author's calculations from "OECD Labour Force Statistics V4.4".

[26] A problem with the literature trying to quantify the impact of female labour participation on growth is that it is difficult to quantify the size of the "household good" produced by those women not working in the market and which they stop producing once they engage in market production.

[27] Blau and Kahn (2000) review the literature.

[28] OECD (2004).

[29] Evidence on this is provided by Gottschalk and Danziger (2005) and Burtless (2007).

income among households. Increased female participation and the increased dispersion of female earnings have had major implications for the distribution of household incomes. When married women did not work, the distribution of labour income across households was simply given by the distribution of earnings among men. However, once women enter the labour market, inequality across households also depends on the correlation between the income of a husband and that of his wife. Household income inequality increases or decreases depending on whether there is a positive or a negative correlation between the earnings of spouses. Existing evidence indicates that there is a strong positive correlation between the labour earning of husbands and wives, with high-earning men marrying high-earning women. As a result, increases in female participation rates result in a more unequal distribution of household income. In the USA this correlation increased in the last two decades of the 20th century and was part of the cause of the increase in income inequality across household over the period.[30]

6. Concluding Remarks

In this paper I have discussed recent developments in the theory of growth and distribution, focusing on those approaches that are most relevant for modern industrialised economies. My review has necessarily been selective and there are a number of aspects that have not been covered. There are two main approaches that I have not dealt with. The first one consists of theories that apply to developing countries. The adoption of industrial technologies, rural-urban migration, or the introduction of free elections, are aspects that would affect both inequality and growth. However, neither of these mechanisms seems relevant for the economies of the European Union. The second aspect that I have chosen not to discuss is the role of "globalization" in inducing changes in inequality. Globalization, or more precisely the increase in trade flows that occurred in the late 20th century, is a vast phenomenon that has had a variety of effects. In so far as it affects the supply of factors, its impact can be examined in terms of the supply-side framework used in this paper. However, openness also changes demand patterns, and this will create additional mechanisms through which inequality and growth can be correlated. Space constraints have obliged me not to discuss these demand-side arguments.

The supply-side approach to growth allows us to decompose a country's growth rate into the growth rates of technology, physical capital, human capital, and labour supply. I have argued that each of these represents a channel through which inequality and growth are related.

We can summarize the main arguments as follows:

[30] This is documented by Burtless (1999).

- Inequality has two effects on the growth rate, a positive incentive effect, in line with the traditional literature, and a negative opportunity-creation effect operating through the constraints on human capital investment that it imposes on poor individuals. Greater inequality is hence conducive to growth if it occurs at the top of the distribution, and detrimental if it occurs at the bottom.
- Growth affects inequality through the impact of education and technological change on relative wages. On the one hand, human capital accumulation reduces the relative wage of educated workers and results in lower earnings inequality. On the other, when technical change is skill-biased, faster technology-driven growth will result in greater earnings inequality. Either of these two offsetting forces could dominate, implying that growth can be accompanied by increases or reductions in inequality.
- A number of factors affect both growth and distribution. A high marginal productivity of capital, a low tax rate, or a weaker preference for leisure, encourage the accumulation of physical capital and hence foster growth. However, they also tend to reduce wages and the labour share, making the distribution of income more dispersed. This results in a positive correlation between inequality and growth.
- The increase in female labour force participation has been an important force driving growth in industrialized economies. The consequences for inequality are, however, complex. On the one hand, greater female participation and the consequent increase in female wages has reduced wage inequality between men and women. On the other, there has been an increase in earnings inequality amongst women, and this has contributed to the increase in household income inequality observed in some countries.

Given the conflicting theoretical predictions, we would like to turn to the empirical evidence in order to assess the relative importance of these various mechanisms. A number of articles have tried to estimate the effect of growth on inequality, while others have examined the impact of inequality on growth. This literature has suffered from two problems, largely linked to the limited availability of data on the distribution of income. First, because of the limited number of observations, all types of countries tend to be grouped together without any consideration of whether the same mechanism applies or not to the entire sample. Second, establishing the direction of causality is problematic, and most of the literature can at best identify cross-country correlations between these two variables.

The early empirical studies based on cross-country regressions, such as Perotti (1996), tended to indicate a negative correlation between inequality and growth. As more data on inequality became available, it was possible to use more sophisticated econometric approaches that looked at shorter periods, included fixed effects, and divided the data into different groups of countries, and the resulting studies have found a positive, or at least more ambiguous, relationship. Forbes (2000) finds that

when short growth spans are used, inequality and growth are positively correlated. Barro (2000) divides his sample into poor and rich countries, and his results indicate a negative correlation in the former and a positive one in the latter. Overall, the empirical literature has not bee able so far to obtain robust results on the correlation between distribution and growth.

The study by Voitchovsky (2005) stands out in this literature, both because it uses a small sample of rich and relatively homogeneous countries for which we could expect the same mechanisms to apply, and because of the careful econometric specification used to estimate the effect of inequality on growth. Moreover, Voitchovsky uses different distributional measures in order to allow for different effects of inequality at different points of the distribution of income. Her results strongly support the hypothesis that, for rich industrial economies, greater inequality at the top fosters growth while greater inequality at the bottom dampens it.

Where does this leave us in our understanding of the relationship between distribution and growth? I draw three conclusions from this literature. The first one is that, unlike the Kuznets hypothesis of the 1950s, we cannot expect the growth process to autonomously bring about a reduction of inequality. As a result, redistribution will remain a policy concern even in affluent societies. Second, there are different concepts of inequality which may move in opposite directions in response to a growth episode. For example, policies aimed at fostering growth through increased female participation will reduce wage inequality across genders but probably increase it across households. Lastly, despite the fact that we cannot single out one particular mechanism as the main factor relating growth and distribution, these theories can help us understand the likely consequences growth episodes. It becomes, however, essential to identify the specific source of growth in a particular country at a particular point in time in order to predict the effect on inequality and to design suitable redistributive policies.

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