

# Income distribution, economic growth and European integration

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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 physical capital, human capital, employment or the level of technology, and I argue that each of these represents a mechanism that relates our two variables of interest. The European integration process has represented a major policy change that has affected not only the opportunities for growth but also the constraints faced by national governments. We can then ask whether such integration has had an effect on inequality, and to what extent it has resulted in a conflict between productive efficiency and distributive considerations.

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## 1. INTRODUCTION

The relationship between growth and income inequality has occupied the attention of the profession for over a century, and is both important and controversial. It is important because policy makers need to understand the way in which increases in output will be 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.<sup>1</sup>

A first aspect of the debate concerns causation. Does the growth process have an impact on inequality? Does the distribution of income and wealth among agents determine aggregate growth? Or are both endogenous outcomes of the economic system, subject to common influences with respect to structural changes as well as macroeconomic policies? 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 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 models of the relationship between growth and distribution 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 labour input. 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 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. Early approaches argued this to be the case, as inequality leads 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 can *reduce* the

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<sup>1</sup> See Aghion, Caroli, and García-Peñalosa (1999), Bertola (2000) and Bertola, Foellmi, and Zweimüller (2006) for overviews of the theoretical literature, and Brandolini and Rossi (1998), Barro (2000), Forbes (2000), Banerjee and Duflo (2003) and Voitchovsky (2005) for empirical evidence.

rate of growth, and an answer to the importance of the two effects can only be provided by the empirical evidence. A second question concerns the effect of growth promoting policies on inequality, and in particular under which circumstances a conflict between the two objectives may emerge.

This issue presents new evidence on the relationship between inequality and growth, with particular focus on the effect of European integration. European integration has been a political process largely motivated by economic objectives, ranging from faster growth in the Union as a whole to regional convergence and increased social cohesion. The potential gains are due to increased trade, to the economies of scale that access to larger markets creates, and to reduction in uncertainty for both firms and individuals stemming from a common currency. But European integration has also imposed costs, most notably those associated to the budgetary austerity required from its members. We can then ask whether such integration has had an effect on inequality, and to what extent it has resulted in a conflict between productive efficiency and distributive considerations.

The paper is organised as follows. The next section introduces the framework of analysis, identifying the determinants of growth and of inequality. I then consider the relationship between these two variables by asking, first, how inequality affects growth and, next, which impact some of the sources of growth have on distribution. I turn next to the role of policy, while section 5 discusses income convergence across countries or regions. Section 6 concludes.

## **2. A FRAMEWORK OF ANALYSIS**

### **2.1. The determinants of output growth**

In order to examine the determinants of the rate of growth of an economy, let us consider an aggregate production function of the form  $Y = F(K, N, A)$ , where  $K$  denotes the aggregate physical capital stock,  $N$  is a measure of the labour input, and the function  $F(\cdot)$  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).

There are two sources of heterogeneity that I want to introduce into this traditional production function, both concerning the labour input. The first 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 clearly there are sources of skills other than formal education. Define  $L_s$  and  $L_u$  as the number of skilled and unskilled individuals, respectively, so

that the population is given by  $L = L_s + L_u$ . The second source of heterogeneity we need to consider is the fact that some individuals have a job and some do not, either because they are unemployed or because they are not active. Suppose that the same fraction  $e$  of each type of individual is employed,<sup>2</sup> so that the number of skilled employees is  $N_s \equiv e \cdot L_s$  and that of unskilled employees is  $N_u \equiv e \cdot L_u$ .

Let us assume a particular form for the production function that includes these various sources of heterogeneity, namely

$$Y = K^\alpha \left( A \left( (h e L_s)^\gamma + (e L_u)^\gamma \right)^{1/\gamma} \right)^{1-\alpha},$$

where  $h > 1$  captures how much more productive the skilled are than the unskilled. This functional form implies that the elasticity of substitution between capital and the labour aggregate is one, while that between the two types of labour is  $1/(1-\gamma)$  and implies that, as long as  $\gamma$  is different from 1, the two types of labour are imperfect substitutes. We can now define a number of variables in per capita terms, so that  $y \equiv Y/L$  and  $k \equiv K/L$  denote per capita output and capital, and  $l_s \equiv L_s/L$  and  $l_u \equiv L_u/L$  are the shares of skilled and unskilled individuals in the population. The rate of growth of per capita output is then given by

$$g = s_K \frac{\dot{k}}{k} + s_L \left( \frac{\dot{A}}{A} + \frac{\dot{e}}{e} + s_s \frac{\dot{h}}{h} + \left( 1 - \frac{s_u}{l_u} \right) \frac{\dot{l}_s}{l_s} \right),$$

where  $s_K$  and  $s_L$  are, respectively, the capital share and the labour share in aggregate output, and  $s_s$  and  $s_u$  are, respectively, the shares of skilled and unskilled labour in the total wage bill (with  $s_K + s_L = 1$  and  $s_s + s_u = 1$ ). This expression tells us that a country's rate of growth depends on four factors. First, it is determined by the rate of growth of factor supplies, as both faster physical capital accumulation and increases in the fraction of skilled individuals in the economy result in faster growth.<sup>3</sup> Second, it depends on changes in the employment rate, as captured by the term  $\dot{e}/e$ . Third, it is affected by labour productivity growth, whether it is total factor productivity,  $\dot{A}/A$ , or the productivity of the skilled relative to that of the unskilled, i.e.  $\dot{h}/h$ . Lastly, the relative importance of each of these factors for growth is given by the (possibly endogenous) factor shares.

<sup>2</sup> It is, of course, possible to consider different employment rates for the skilled and the unskilled.

<sup>3</sup> To see this note that  $s_u/l_u < 1$ .

## 2.2. Individual incomes and inequality

Let us now turn to the determinants of personal income inequality. In order to illustrate the various mechanisms in operation, consider a simple model economy with four types of agents characterised as follows.<sup>4</sup> First, a fraction  $1 - e$  of the population is not employed, and receives a government transfer  $T$ . We can think of this group as both those who cannot find a job and receive the unemployment benefit, and those who are retired and get a pension. Of the fraction  $e$  of employed population,  $n_u$  are unskilled workers earning a wage  $w_u$  and  $n_s$  are skilled workers, so that  $e = n_u + n_s$ . Skilled workers may also own capital. We suppose that  $n_s - \kappa$  of them own no capital and have an income equal to the skilled wage  $w_s$ , while  $\kappa$  also own capital and earn profits  $\pi$  as well as the wage  $w_s$ . The unskilled wage is assumed to be greater than the government transfer and lower than the skilled wage, i.e.  $w_s > w_u > T$ .

Under our assumptions, the labour share is simply  $s_L \equiv (w_s n_s + w_u n_u) / y$ , the average wage  $w \equiv (w_s n_s + w_u n_u) / e$ , and the profits received by each owner of capital  $\pi = (1 - s_L) y / \kappa$ . As a result, mean market income is defined as  $y = \kappa \cdot \pi + n_s \cdot w_s + n_u \cdot w_u$ . Assuming a proportional tax rate  $\tau$  on all incomes, mean disposable income is then given by  $y_d = (1 - \tau)(\kappa \cdot \pi + n_s \cdot w_s + n_u \cdot w_u + (1 - e)T)$ .

The degree of income inequality can be measured by the Gini concentration index computed across the four groups of population. Under our assumptions, we can write the Gini coefficient of disposable income as

$$Gini_d = (1 - \tau) \left[ (1 - \kappa)(1 - s_L) + s_L(1 - e) \left( 1 - \frac{T}{w} \right) + s_L \frac{n_s n_u}{e} \frac{w_s - w_u}{w} \right].$$

The Gini coefficient is thus a function of population proportions, the labour share  $s_L$ , the wage differential  $(w_s - w_u) / w$ , the employment rate,  $e$ , and government transfers and taxes. A greater wage differential between the skilled and the unskilled and lower employment raise the Gini coefficient. The effect of the labour share is ambiguous. On the one hand, a higher labour share reduces the income differential between those who own capital and those who do not, as captured by the first term in the equation above; on the other hand, for any given wage differential, a higher labour 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

<sup>4</sup> This section draws on Checchi and García-Peñalosa (2008, 2010).

capital income, the first effect dominates and a higher labour share is associated with a lower Gini coefficient.

The last element that affects inequality is public policy, as both a higher tax rate and a higher transfer rate reduce inequality in disposable incomes. So far I have made no assumptions about how taxes are used and transfers are financed. Consider the following scenario: suppose that the only public expenditure consists of the transfers and that their cost is greater than current tax revenue. Transfers must then be partly financed through a government deficit. The government's budget constraint then implies that the transfer is  $T = (d + \tau)y / (1 - e)(1 - \tau)$ , where  $d$  is the deficit as a proportion of average income. The Gini coefficient can now be written as

$$Gini_d = (1 - \tau) \left[ (1 - \kappa)(1 - s_L) + (1 - e)s_L + s_L \frac{n_s n_u}{e} \frac{w_s - w_u}{w} \right] - e(\tau + d).$$

This expression highlights that inequality depends also on the size of the public deficit, and hence constraints on the government's capacity to be indebted can affect the distribution of disposable income.

We can now see that some of the variables determining the distribution of income also affect the rate of growth. Factor shares, the employment level, and the productivity gap between the skilled and the unskilled, all appeared in the growth equation derived in the previous section. Policy plays an important role too. Both the tax rate and the size of the government deficit have a direct impact on inequality, while they can affect growth through their effect on capital accumulation. Each of these elements then represents a channel that potentially links, in a causal or non-causal way, inequality and growth.

### 3. OUTPUT GROWTH AND THE PERSONAL DISTRIBUTION OF INCOME

#### 3.1. The impact of inequality on growth

The traditional view that inequality should be growth-enhancing is based on three arguments. The first is the classical hypothesis, formalized by Stiglitz (1969), that the marginal propensity to save out of profits is higher than that out of wages (Kaldor, 1955; Pasinetti, 1962). As a result, the saving propensity of richer individuals (i.e. those with more capital income) is greater than that of poorer individuals, and since more savings result in more investment in physical capital, more unequal economies are bound to grow faster than economies with 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 well-functioning capital markets, wealth needs to be sufficiently concentrated in order for an individual 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, formalized by Mirrlees (1971). Namely, when individual output depends on the unobservable effort borne by agents, rewarding these with a constant wage independent from output performance will discourage them from investing any effort. Income dispersion, on the contrary, will provide incentives to exert effort.

All these approaches imply that more unequal societies will grow faster. Note, however, that in these early models these effects were only present during the transition to the steady state, since the long-run rate of growth was determined exclusively by the rate of exogenous technological change and hence was unaffected by savings, investment or effort. The 'new growth literature' has opened new avenues through which inequality may affect growth, both because long-run growth is seen as endogenous but also because a new range of variables are now seen as crucial determinants of output growth. The idea that income inequality is necessary to foster effort remains central in the new growth literature, as I will discuss in the next subsection. However, the recent literature has refuted the first two arguments presented above 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 from those found in the early literature.

### **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. Entrepreneurship is characterized by large risks, hence large returns are required to compensate for these risks and induce individuals to engage in innovation rather than become employees; see Moskowitz and Vissing-Jorgensen (2002) and Hamilton (2000). The immediate implication is that the higher the income of a successful entrepreneur is relative to wages, the larger the fraction of the population that

chooses 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 income 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, as shown by García-Peñalosa and Wen (2008). The reason for this is that redistribution provides insurance to agents undertaking risky activities, which reduces income uncertainty thus inducing more entrepreneurship.

### 3.1.2. Credit market imperfections and human capital

In modern, industrial economies the effect of credit market imperfections is likely to operate mainly through their impact on human capital accumulation.<sup>5</sup> Human capital has two particular features. First, it is embodied in the individual, making it difficult to use education as collateral against which to borrow and hence investing in education is only possible if the agent has sufficient parental wealth. As a result the distribution of wealth can affect the level of education in the economy, as shown by Galor and Zeira (1993). Public education can, to some extent alleviate this effect. However, the correlation between parental income and tertiary education is strong even in countries where education is free. The reason is that agents face the risk of failing at university, a risk against which there is no formal insurance. Family wealth provides insurance against this risk, implying that the offspring of the rich invest while those of the poor do not undertake risky, but socially productive, education investments (Checchi and García-Peñalosa, 2004).

A second feature of education investments is that they exhibit strong diminishing returns,<sup>6</sup> implying that it is more efficient to invest a little in many individuals than a lot in few. To illustrate this, consider 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.

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<sup>5</sup> Credit market imperfections can also generate incentive effects, as in Aghion and Bolton (1997), where limited liability creates moral hazard and affects the effort exerted by low-wealth individuals on their own investment projects.

<sup>6</sup> See Willis (1987) for a review of the empirical evidence.

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, as argued by Lucas (1988). Second, R&D needs to be performed by highly educated individuals. The more educated the labour force is, the more workers are available to undertake research and development, and hence the faster the rate of innovation is; see Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992). Lastly, as argued by Nelson and Phelps (1966), 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.

### 3.1.3. Empirical evidence on the impact of inequality on growth

We have just seen that credit market imperfections imply that a more unequal distribution of *wealth* will result in lower levels of human capital, less innovation, and slower growth. This contrasts with the argument presented earlier 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.

In the first paper in this special issue, Amparo Castelló-Climent re-examines what is the impact of inequality on a country's growth rate. The early literature on the topic developed models in which wealth inequality had an effect on growth but, due to limited data availability, tested these predictions by regressing growth rates on *income* inequality. The first empirical studies based on cross-country regressions, such as Perotti (1996), obtained 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 more ambiguous, relationship. Forbes (2000) finds that when short growth spans are used, inequality and growth are positively correlated. Barro (2000) estimates a negative correlation in poor countries and a positive one in rich countries, while Brandolini and Rossi (1998) find a negative correlation between income inequality and (productivity) growth in continental European countries but a positive one in English-speaking nations.

In her paper, Castelló-Climent considers the effect of both income inequality and asset inequality, using for the latter a measure of inequality in educational attainment. She finds, in line with the arguments just discussed, that the impact of inequality on growth is different depending on whether we consider the distribution of human capital or of income. Human capital inequality is associated with slower growth, while income inequality exhibits a positive

correlation with growth in high-income economies, i.e. precisely in those economies where credit constraints are weak and incentive effects are likely to dominate.

### 3.2. The impact of technological change on inequality

#### 3.2.1. Biased technical change

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,<sup>7</sup> and documented that in the last two decades of the 20<sup>th</sup> century a number of industrialised countries experienced a substantial widening in the earnings distribution. Moreover, the evidence clearly indicates that an important component of the increase in earnings inequality has been an increase in the so-called “relative wage”, that is the ratio of the hourly wage of those with tertiary education to that received by those with only secondary education (Gottschalk and Smeeding, 1997); Atkinson, 2008).

In order to understand the determinants of the relative wage we can use the production function from section 2, where the two types of labour are imperfect substitutes, implying that the supply of skilled and unskilled workers will affect their rewards. Furthermore, technical change may not affect the productivity of skilled and unskilled workers in the same way.<sup>8</sup> To capture this idea, let us modify the production function and suppose that aggregate output is given by<sup>9</sup>

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

so that the two types of labour use skill-specific technologies.  $A_s$  represents the technology used by the skilled and  $A_u$  that used by the unskilled. The relative wage can then be expressed as  $\ln w_s / w_u \cong \gamma \ln A_s / A_u - (1-\gamma) \ln L_s / L_u$ , and is affected by changes in relative labour supplies and in the skill-specific productivities.

In this context, the source of growth matters. 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

<sup>7</sup> I use the terms wage distribution and earnings distribution interchangeably, even if this is not entirely accurate since earnings are the product of hours of work and the hourly wage rate.

<sup>8</sup> An excellent review of this literature is provided by Hornstein, Krusell and Violante (2005).

<sup>9</sup> We ignore here the effect of employment and set  $e=1$ .

improvements lead to a faster increase in  $A_s$ , we will say that there is *skill-biased technical change*. Under the (empirically validated) assumption that  $\gamma > 0$ , i.e. that the elasticity of substitution between the two types of labour is greater than 1, skill-biased technical change 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 question that the literature has tried to answer is whether technical change has *become* skilled-biased. Thoenig and Verdier (2003) suggest that firms may change and influence the rate of diffusion of knowledge embodied in their products: they may render their products immune to imitation by reinforcing the skill intensiveness of their production process. If international integration increases the possibility of imitation, then it will give firms incentives to undertake technological change that will be biased towards more educated workers, making their products harder to copy by foreign competitors. In the context of our analysis, their theory predicts that European integration has made technological change skill-biased and hence resulted in an increase in the relative wage of educated workers.

### 3.2.2. 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, such as Saint-Paul (2001) and Garicano and Rossi-Hansberg (2006), 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. Empirical support for the complementarity between technology, organizational change and human capital is provided by Caroli Van Reenen (2001) and Bresnahan, Brynjolfsson and Hitt (2002) for France and the United States.

Acemoglu, Aghion and Violante (2001) argue that technological progress is also a source of changes in labour market institutions. They maintain 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 and skilled workers. A substantial empirical literature shows that changes in labour market institutions account for part of the recent increase in wage dispersion in many countries, a result confirmed for the overall income inequality by Checchi and García-Peñalosa (2008, 2010).

### 3.3. Physical capital accumulation

The idea that physical capital accumulation creates a link between inequality and growth is explored, amongst others, by Bertola (1993) and García-Peñalosa and Turnovsky (2006). Suppose that labour is homogeneous and fully employed ( $e = 1$ ), so that the production function reduces to a standard Cobb-Douglas function  $Y = K^\alpha (AL)^{1-\alpha}$ . If the only source of growth is the accumulation of physical capital, higher investment on the part of firms results in faster growth.

The parameter  $\alpha$  is the key element linking inequality and growth. On the one hand,  $\alpha$  is the marginal 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,  $\alpha$  is the share of capital in aggregate income and will hence affect income inequality, as shown by the expression for the Gini coefficient discussed earlier. For any given distribution of wealth, 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  $\alpha$ , will result in both a faster rate of growth and a more dispersed distribution of income, implying a positive non-causal correlation between inequality and growth.

## 4. THE ROLE OF PUBLIC POLICY

### 4.1. 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 and taxes play an important redistributive role, suggesting that even if growth matters in shaping the distribution of income, policy choices are also crucial. In rich industrialised economies, taxes and transfers reduce the Gini coefficient by about a third. Moreover, differences across countries in the extent of redistribution account for a large fraction of overall differences in income inequality. In 2000/2001, the Gini coefficient for market incomes was similar in Germany, Australia and the

US: around 48 per cent. The Gini of disposable income was, respectively, 28, 32, and 37, placing Germany amongst the most equal and the US amongst the most unequal of the high-income economies; see Brandolini and Smeeding (2008).

What determines the degree of redistribution, or, more generally, the size of the welfare state? Bénabou (2005) studies a model where 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. These endowments, together with the degree of redistribution  $\tau$ , determine an individual's disposable income. There are two key elements in his analysis. First, some individuals are credit constrained and hence invest in the education of their offspring less than they would in the absence of credit constraints. Second, individuals vote over the extent of redistribution, and do so before knowing their children's ability. As is common in this literature, the tax schedule depends only on individual income and not on her education or ability.

In this context, there are two negative relationships between the degree of human capital inequality and the degree of redistribution that individuals vote for. The first follows from the fact that individuals want some redistribution as it provides insurance against random ability, but the amount of redistribution they prefer depends on the dispersion of ability relative to that of human capital. When human capital is equally distributed, all differences in income are due to random ability. As a result, individuals vote for a highly redistributive policy to insure against ability shocks. When human capital is unequally distributed, insurance becomes costly for individuals with high human capital, because both those with high human capital and low ability and those with high ability and low human capital receive a transfer. As a result, there is less support for redistributive policies.

The second relationship governs 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. 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 equilibrium is characterized by low inequality and high redistribution, while the other exhibits high inequality and low redistribution.

This approach has a number of 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 weak. When inequality is largely due to random ability shocks, there will be a greater demand for redistribution. Third, which of the two equilibria results in faster growth is ambiguous. It depends on the distortions created by redistribution - in terms of employment or effort- and the positive effect of a greater investment in education by the poor.

Bénabou's framework can be used to examine the consequences of European integration for welfare policy. The key element in his analysis is the trade-off between the deterministic component of income –education, which agents can choose- and the random component –which affects equally all individuals. In Bénabou's original setup, the random term is innate ability, but it can be given an alternative interpretation. Suppose that the random term represents aggregate demand in the sector in which the individual works, which in turn depends on price volatility. Suppose also that monetary union entails a reduction in price uncertainty and hence in the dispersion of the random term of individual income. As we have seen, if uncertainty is smaller, support for redistributive policies will be weaker, and in equilibrium there will be a smaller degree of redistribution and a more unequal distribution of human capital and income. That is, economic integration would result in lower uncertainty, which in turn results in lower redistribution and hence higher inequality.

The analysis by Giuseppe Bertola in this issue addresses precisely this issue. He examines the effect of European integration on inequality by asking whether the European Monetary Union (EMU) has affected the distribution of household incomes within national states. His evidence indicates that EMU was associated with a small increase in post-tax household income inequality, most likely due to the constraints on public spending imposed by the various European treaties. As we saw in section 2, constraints on the government's capacity to incur a deficit will result in a larger Gini coefficient for disposable income.

Bertola's conclusions come as a surprise given the strong emphasis that the European integration process has put on social cohesion and regional convergence. If average incomes in regions across Europe and, in particular, within European countries have been converging, presumably this would have reduced the degree of national household income inequality. One possibility is that policy changes have been strong enough to offset any underlying regional converge in productivity. This raises two questions. The first is whether such convergence has occurred, an issue that we will examine in section 5. Second, we would like to know to what extent European integration has shifted preferences towards redistribution, in line with the mechanism described above, and resulted in a lower degree of redistribution in member states.

## 4.2. Labour market institutions and unemployment

A second policy dimension concerns the strength of labour market institutions (LMIs). Strong LMIs are argued to depress employment and dampen growth; see, for example, Blanchard (2004). Their effect on income inequality has, however, received less attention. If we go back to our simple model of section 2, there are several ways in which institutions affect distribution. First, higher government transfers such as the unemployment benefit increase the revenue of those out of employment and thus tend to reduce inequality. However, they also increase the number of unemployed and hence the fraction of low-income households, raising the Gini coefficient. Second, strong LMIs tend to increase the labour share. If labour income is more equally distributed than capital income, a higher labour share results in a lower Gini coefficient. Lastly, stronger unions or high minimum wages compress the wage gap between high and low skilled individuals, which in turn reduces inequality.

Overall, strong LMIs tend to reduce growth but also inequality. However, their effect can depend on the precise institution that we are considering. For example, suppose that there is an increase in labour taxes and that the revenue is used to finance some general government expenditure, such as defence. Because high labour taxes dampen employment, there is an increase in the number of low income households that results in higher inequality. Now suppose instead that the extra tax revenue is used to finance more generous unemployment compensation. There are now more unemployed, but they are less poor, hence the overall effect could be a reduction in inequality. This indicates that the composition of public policy is important in assessing how a given level of taxation and expenditure affects inequality.

The article by Antonio Afonso, Ludger Schuknecht and Vito Tanzi in this issue asks this question, using cross-country data to examine how public spending affects the personal distribution of income. Public spending has both a direct effect on inequality –through taxes and transfers- and an indirect one, operating, for example, through the opportunity to accumulate human capital. Their results indicate that the *efficiency* of public policy –and hence the reduction in inequality for a given level of expenditure- varies substantially across countries. This implies that reducing income disparities is not simply a question of increasing expenditure, but is also strongly affected by the way in which tax revenues are spent.

## 5. GROWTH, CONVERGENCE AND ECONOMIC GEOGRAPHY

In the previous sections we have focused on income inequality across persons or households within a country, which captures how a given national income is distributed among domestic

residents. Another strand in the literature has instead investigated income differences across nations, treating each country as a single observation, as if all individual incomes were equal within countries. This literature has examined the forces that make national average incomes converge or diverge, such as technological catch up or the presence of increasing returns in production. There are also intermediate approaches. Increased data availability has given rise to a number of studies considering differences in average incomes across regions in a country or a group of countries, such as the European Union.

A vast literature has examined in which ways the growth process affects the convergence of national or regional incomes, and two different approaches have emerged. The first one emphasizes the transfer of technology that occurs as countries trade with each other or start a process of economic integration; see Barro and Sala-i-Martin (1992). Flows of goods and capital also generate flows of knowledge. Goods that are imported can be imitated and produced locally, while foreign direct investment brings with the capital an associated know-how, and both contribute to a process of technological catch-up in which the productivity of poorer regions or countries increases faster than that of richer economies leading to convergence of (average) national productivity levels.

The economic geography literature has proposed an alternative approach, focusing on firms and the presence of increasing returns (and hence of imperfect competition). In this context, increased trade and access to a larger market allow the more productive firms to further exploit economies of scale, reducing costs and further increasing their productivity. As a result, integration and growth are associated with an *increase* in technological gaps across regions and, potentially, across countries (Combes, Mayer and Thisse, 2008).

The overall impact of economic integration on inequality is hence ambiguous. Indeed, it may foster technological catch-up that reduces income differences across countries at the same time as it creates agglomeration forces that increase regional productivity dispersion within countries. These observations provide the background for Florence Bouvet's article in this volume on the evolution of regional inequalities within the European Union. She estimates the inequality of average incomes across European regions and then decomposes the overall change into changes across countries and changes across regions within each country. The evidence indicates that regional inequalities have decreased, and that this is the result of a reduction in dispersion across countries. Within-country inequality exhibits different patterns depending on the area. Most notably, regional inequalities have increased in poorer EU economies after the establishment of EMU, in line with Bertola's finding that European integration has resulted in an increase in personal income inequality within EU countries.

## 6. CONCLUDING COMMENTS

In this paper I have taken a supply-side approach to growth that allows us to decompose a country's growth rate into the growth rates of technology, physical capital, human capital, and the labour input. 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:

- Inequality has two effects on the growth rate: a positive incentive effect, in line with the traditional literature, and a negative opportunity-creation effect, whereby an unequal distribution of wealth constrains investments in human capital.
- 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 results in greater earnings inequality. Either of these two offsetting forces could dominate, implying that growth can be accompanied by increases or reductions in inequality.
- Policy can affect both growth and distribution. Strong labour market institutions tend to reduce inequality but also employment and hence growth. Income redistribution plays a key role, although both the efficiency of policies and the fact that such policies are endogenously determined need to be considered when assessing the effect and feasibility of policy changes.
- Regional productivity differences are likely to be a key element affecting the personal distribution of income in a particular country. It is hence important to understand to what extent faster growth is associated with a convergence or a divergence in (average) regional productivities.

A number of important questions remain. First, we would like to know more about the different effects of income and wealth inequality. New data from the Luxembourg Wealth Study (Sierminska, Brandolini and Smeeding, 2006) will in a (hopefully) not too distant future allow us to address this issue. Second, the evidence presented by Bertola and Bouvet has a preliminary character because of the short time span since EMU. The issue will need to be addressed again once more data is available. The most important question that their analyses raise is whether the increased dispersion they identify is the result of changes in policy or due to underlying economic forces encouraged by European integration that have increased productivity gaps across regions.

Lastly, aspects of economic geography have received little attention in the literature concerned with the relationship between personal income inequality and growth. It is obvious that one of the reasons why we observe inequality within a country is that different regions have different levels of productivity, and we need to understand to what extent the dynamics of household income inequality in a country are due to changes in the dispersion of within-region and between-region components. If the European integration process has increased competition and hence the importance of economies of scale, leading to greater spatial concentration of production, what are the implications of this for the dynamics of household income inequality? We know that regions with greater population density have higher average wages and productivity, but are incomes more or less unequally distributed than in less dense regions? All these questions remain open.

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