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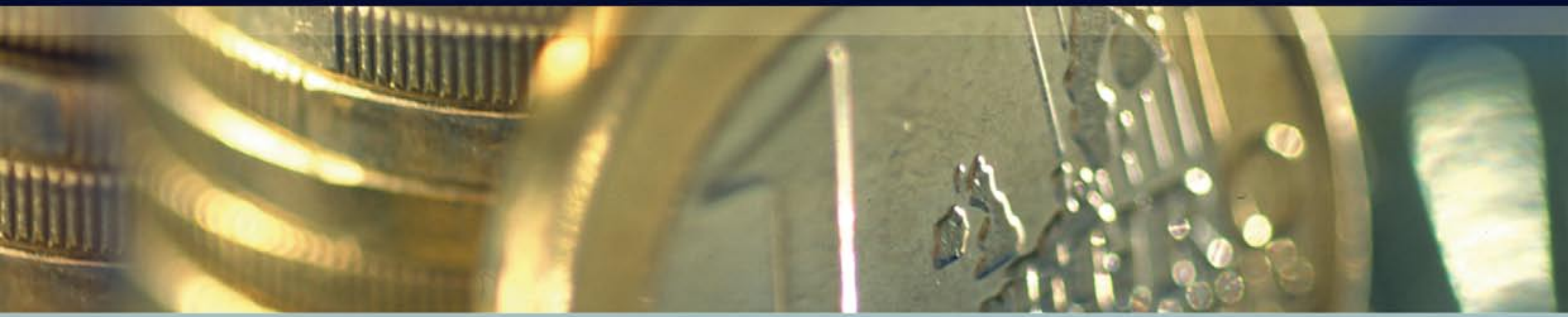

Growth and income distribution in an integrated Europe: Does EMU make a difference?

4th Annual Research Conference, 11-12 October 2007

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Introduction

The 4th DG ECFIN Annual Research Conference (ARC) was held on 11-12 October, 2007, in Brussels, with over 100 participants. The theme was *Growth and income distribution in an integrated Europe: Does EMU make a difference?*

The choice of topic for the 2007 ARC was inspired by growing concern about inequality in Europe. There appears to be a growing perception, not only in Europe but also – indeed perhaps even more so – in the US, that prosperity has been fairly unevenly distributed, resulting in a widening gap between rich and poor and a squeezing of the middle classes.

This concern was addressed in four sessions followed by a panel discussion:

1. The economics of distribution and growth. Recent issues and experience.
2. Distribution and growth in Europe – The empirical evidence.
3. Does the euro make a difference?
4. Is Europe different? (Economic integration, globalisation and distribution).

While a great deal of evidence was presented suggesting that differences do exist in measured inequality across countries and over time, there was no clear support for the popular view that inequality has been sharply increasing in continental Europe.

According to Thomas Harjes, it has increased only moderately or, in some cases, even declined (See *"Globalization and income inequality. A European perspective"*). Looking at long-term developments in the distribution of personal income, Anthony Atkinson said in his keynote address ("*Distribution and growth in Europe – The empirical picture*")*:* "The variety of experience points to the need for a variety of explanations. The distribution of personal income is a subtle combination of different mechanisms, each subject to exogenous and endogenous forces."

As emphasised many times during the conference, inequality is by no means a simple phenomenon to measure or characterise, as single indicators like the widely used Gini-coefficient and datasets are often inconsistent, making international comparisons more difficult. Against this background Atkinson found it misleading to talk of "trends" when describing the evolution of income inequality, preferring to think in terms of "episodes" when inequality rose or fell.

Public policies were found to matter for income distribution and, as argued by Antonio Afonso, Ludger Schuknecht and Vito Tanzi, there is still considerable scope for improvements in the efficiency of public spending ("*Income distribution determinants and public spending efficiency*"). As efficient social public spending, education performance and strong institutions are strongly correlated and higher per capita incomes are associated with more generous public spending, all EU countries could enhance their human capital equality through better designed public spending. This would also make redistribution policies more affordable and politically sustainable.

Daniel Waldenström noted that the reduction in progressive taxation at the top of the distribution seems to have had a negative effect on equality in a panel of 16 developed countries ("*Determinants of inequality over the twentieth century: Evidence from the twentieth century*" co-authored by Jesper Roine and Jonas Vlachos). The size of this effect is, however, fairly small, suggesting that taxation is relatively ineffective at reducing inequality by lowering the income shares of the top income earners. He concluded that economic growth and financial development seem to have been pro-rich over the twentieth century.

Do we have an adequate economic theory for the inequality-growth nexus? In her keynote address on "*The economics of distribution and growth. Recent issues*", Cecilia Garcia-Peñalosa noted that different combinations of factors of production determine growth and distribution. Causation may, however, vary and there may also be other factors, such as policies and technologies, which simultaneously determine growth and inequality. She argued that the growth process will not bring about a reduction of inequality by itself. Hence redistribution will remain a policy concern even in affluent societies. It was clear that economists are still searching for theoretical explanations on how growth and inequality interact, taking into account that individuals receive not only labour but also capital income.

Amparo Castelló-Climent demonstrated that the effects of inequality on growth depend on the level of development ("*Inequality and growth in advanced economies. An empirical investigation*"). There is a negative effect in less developed countries and a positive one in high income economies. However, this positive effect is not stable over time and is highly affected by atypical observations.

The conference tried to shed light on the possible impact of EMU on inequality, but did not reach a consensus. In his keynote address "*Economic integration, growth, distribution: Does the euro make a difference?*", Giuseppe Bertola stated that the euro has contributed to growth as aggregate euro-area production and trade integration have increased. Employment performances also appear to have improved in comparison to other EU countries. But euro-area countries also appear to have experienced increasing inequality, mainly due to social policy becoming less generous.

This evidence, while still preliminary and open to various interpretations according to Bertola, suggests that improvement of public and private instruments of income redistribution and risk sharing via financial markets should be given high priority in order to reduce the potential adverse effects of the euro on income distribution. During the lively debate following Bertola's keynote address it was mentioned that social spending has remained broadly stable in the euro area. It was also suggested that the usage of aggregated inequality data may have distorted the results.

Florence Bouvet analysed the evolution of per capita income inequality among European regions during the period 1977-2003 ("*Dynamics of regional income inequality in Europe and impact of EU regional policy and EMU*"). Inequality has decreased since 1977, owing to a decrease in between-country inequality, and despite an increase in within-country inequality since the mid-1990s. Inequality has been greater among low-income regions than among high-income regions. Her econometric analysis suggests that EMU has so far contributed to a reduction in regional inequality in richer EU countries, while it has exacerbated regional disparities in poorer countries.

In his keynote address ("*Issues in the comparison of welfare between Europe and the United States*"), Robert Gordon compared welfare in the EU15 and the US, asking how Europe can be so productive yet so poor. His answer was that work hours in Europe have fallen drastically in the past 40 years, reflecting long vacations, high unemployment, and low labour force participation. Low work hours in Europe are mainly due to higher labour taxation and the generosity of the welfare state together with employment and product market regulation and generous unemployment benefits.

Turning to real GDP comparisons, Gordon estimated Europe’s welfare in 2004 to be at about 79 percent of that in the US, whereas per capita incomes stood only at 69 percent. An additional dimension in his welfare comparison was the growing inequality in the US as compared to Europe. His paper surveyed the related literature and concluded that the transatlantic contrast is due to a mix of institutional and market-driven explanations. In particular he mentioned the common and more lucrative use of stock options at the managerial level in the US as one reason for the difference

Alena Bicáková and Eva Sierminska focused on financial market issues, notably the relationship between inequality of home ownership and access to credit markets and mortgage market development in five EU countries ("*Home ownership inequality and the access to credit markets*"). Mortgage availability affects home ownership in particular among the lower income deciles. Policies supporting home ownership among young households should preferably target low-income groups.

Many of the issues raised during the 2007 ARC were discussed by the concluding panel. It was noted that many EU policies that promote growth, market integration, trade, employment and competition also work in favour of social cohesion, fairness and equality. Several commentators recommended that additional research be carried out on the impact of EU policies on equality. There is also considerable scope for further work on data issues and empirical research as well as on the theoretical underpinnings of equality developments.

A selection of the papers presented at the research conference will be forthcoming in a special issue of *Journal of Economic Inequality*.

Lars Jonung and Jarmo Kontulainen

The economics of distribution and growth: Recent issues

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[0]This survey draws heavily from joint work with Stephen Turnovsky.

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 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.[1]

A first aspect of the debate –both theoretical and empirical- concerns causation. Does the growth process have an impact on inequality? Or does the distribution of income and wealth among agents determine aggregate growth? Despite the controversy, one thing is clear. 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.

A second cause of controversy is that many of the theories proposed ex-

[1] See Aghion, Caroli, and García-Peñalosa (1999), Bertola (2000) and Bertola, Foellmi, and Zweimüller (2006) for overviews of the theoretical literature, and Forbes (2000), Banerjeee and Duflo (2003) and Voitchovsky (2005) for recent empirical analyses.

plore 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 industrial 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.[2]

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 industrial 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 may be present in one form or another.

It is important to emphasize a number of issues that I will not addressed in this paper. My discussion of the role of labour market institutions concentrates on their impact on the distribution of wages, and I will not considered how they affect unemployment and the possibility that higher unemployment increases income inequality. The reason for this is that the empirical

[2] Surprisingly, the bulk of the empirical literature has paid little attention to which countries should be included in the dataset to test a particular theory. A notable exception is Voitchovsky (2005).

literature finds no evidence of a significant relationship between unemployment rates and the distribution of income.[3] Also, my analysis of income risk will be limited, and I will not consider the implications of trade openness. A substantial literature exists on these questions, which complements the approaches reviewed in this paper.

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 considers the inequality-growth relationship when growth is driven by physical capital accumulation. Section 4 looks at technology and human capital, while section 5 addresses the question in terms of the effects of changes in the labour supply on inequality and growth. The last section concludes.

2 A Framework of Analysis

Consider an aggregate production function of the form

$$Y = F(K, AL),$$

where K denotes the aggregate physical capital stock, A the level of technology, L a measure of the aggregate labour input, and the function $F(.)$ exhibits constant returns to scale to capital and labour. We can then write the rate of output growth as

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

[3] See Checchi and García-Peñalosa (2005).

where s_K and s_L are, respectively, the capital share and the labour share in aggregate output, and $s_k + s_L = 1$. The labour input in turn depends on the quality and the quantity of labour. Let us express it as

$$L = Q \cdot (H \cdot P).$$

The first term, Q, captures the quality of labour, or human capital, while the term in brackets is the labour supply, itself the product of the number of hours each employed individual works, H, and the number of employed individuals, P, and hence measures the quantity of labour in the economy. Then, the rate of change of the labour input is given by

$$\frac{\dot{L}}{L} = \frac{\dot{Q}}{Q} + \frac{\dot{H}}{H} + \frac{\dot{P}}{P}$$

Of course, the quality of labour and the hours supplied may vary across individuals, so that we should write $L = \sum_{i=1}^{P} Q_i \cdot H_i$, or more generally $L = G(Q_i, H_i)$ if individuals with different levels of human capital are not perfect substitutes. Then, the rate of growth of aggregate labour would also depend on the distribution of human capital and on the covariance terms of individual's hours and human capital.

In the simple setup in which we can define an aggregate measure of labour as a function of the average Q_i and H_i but independent of their distribution we have

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

That is, the rate of growth depends on the growth rates of technology, physical capital, human capital, and the labour supply, as well as on the (possibly endogenous) factor shares.

The contribution of these factors to average per capita output growth varies across countries and over time. Table 1 reports a growth accounting exercise for three EU countries, 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. 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, in some instances (Portugal and Spain) more than TFP growth.

Table 1 around here

Let us now consider individual incomes. An individual's market income which is given by

$$Y_i = rK_i + wQ_iH_i,$$

where $Q_i > 0$ and $H_i \geq 0$. Our measure of inequality will be a function of the distribution of relative incomes. Defining y_i as agent i's income relative to mean income we have

$$y_i \equiv \frac{Y_i}{Y/N} = s_k k_i + s_L q_i h_i \frac{1}{p},$$

where k_i, q_i, and h_i denote, respectively the agent's physical capital, human capital, and hours relative to the mean, N is the population, and $p \equiv P/N$ is the participation rate. Alternatively, if the agent's wage rate is not proportional to her human capital so that $w_i = w(q_i)$, we can write

$$y_i = s_k k_i + s_L \omega_i h_i \frac{1}{p},$$

where $\omega_i \equiv w(q_i)/\overline{w}$ is the individual's wage relative to the average wage, $\overline{w}$. An inequality index, I, can then be defined as a function of individuals' relative incomes, that is $I = \Phi(y_i)$. Inequality then depends on factor shares, the distribution of capital (physical and human), the distribution of hours of work, and the participation rate. Each of these elements represents a channel that potential links, in a causal or non-causal way, inequality and growth.

3 Physical Capital Accumulation

3.1 A Simple Endogenous Growth Model

Let us start by considering a single source of heterogeneity, unequal initial capital endowments.[4] Consider an economy where output is produced by a representative firm according to a Cobb-Douglas aggregate production function of the form

$$Y(t) = K(t)^{\alpha}(A(t)L)^{1-\alpha}, \tag{1}$$

where $0 < \alpha < 1$ is the capital share in aggregate output. The labour input L is given and constant, output and factor markets are competitive, and agent i maximizes an objective function of the form

$$U_{i0} = \int_0^{\infty} \frac{C_i(t)^{1-\sigma} - 1}{1-\sigma} e^{-\beta t} dt, \qquad \sigma > 0, \tag{2}$$

[4] The discussion in this subsection follows closely the analysis in Bertola (1993). See also See García-Peñalosa and Turnovsky (2006)

subject to her budget constraint

$$\dot{K}_i(t) = rK_i(t) + w(t) - C_i(t). \tag{3}$$

The solution to the consumer's problem together with the firm's first-order condition for profit maximization yields the rate of growth. The rate of growth of consumption can be shown to be the same for all agents, equal to the rate of output growth, and given by the familiar Euler equation

$$g(t) = \frac{\alpha(A(t)L/K(t))^{1-\alpha} - \beta}{\sigma}. \tag{4}$$

Suppose also that aggregate productivity depends on the current capital stock through a learning-by-doing externality, so that $A(t) = K(t)$, as in Romer (1986). We can then express the equilibrium rate of growth as

$$g = \frac{\alpha L - \beta}{\sigma}. \tag{5}$$

We can now turn to individual incomes. Since the only difference between individuals is their initial capital stock, we can write agent i's relative income at time t as

$$y_i(t) = \alpha k_i(t) + (1 - \alpha). \tag{6}$$

An important feature of this model is that, since there are no transitional dynamics, all agents accumulate capital at the same rate and hence the distribution of relative capital remains unchanged. The distribution of income is then determined by the distribution of endowments and factor shares. A higher capital share, i.e. a higher value of α, will imply both a faster rate of growth and a more dispersed distribution of income.

3.2 Taxation

The above analysis implies that differences in the technology across countries will result in different rates of growth and distributions 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 budget constraint is now[5]

$$\dot{K}_i = (1-\tau) r K_i + (1-\tau) w + b - C_i. \tag{3'}$$

In this case, the rate of growth is given by

$$g = \frac{\alpha(1-\tau)L - \beta}{\sigma}, \tag{5'}$$

while agent i's relative net (or after-tax) income is

$$y_i^N = \alpha k_i + (1-\alpha) + \tau\alpha\left(1 - k_i\right), \tag{6'}$$

where we have used the government budget constraint to substitute for b. In this case, higher taxation will be associated with a more equal distribution of income and with slower growth.

Using this simple model, the early literature on inequality and growth argued that if the tax rate were endogenously determined through majority voting, greater wealth inequality -defined as a greater distance between the capital owned by the median and that owned by the mean individual- would result in a higher tax rate and hence lower growth.[6] This lower rate of growth can be associated with higher or lower after-tax income inequality due to the opposing effects of a more dispersed distribution of capital and a higher

[5] Time dependence of variables is ommitted whenever this causes no confussion.
[6] See Alesina and Rodrik (1994) and Persson and Tabellini (1994).

tax rate on disposable income.

To sum-up, when growth is driven by physical capital accumulation we find that

(i) differences in technology (α) result in a positive correlation between growth and pre-tax income inequality,

(ii) differences in income tax rates (τ) lead to a positive correlation between growth and post-tax income inequality,

(iii) greater wealth inequality -measured in a particular way- leads to slower growth,

(iv) differences in wealth inequality may lead to a positive or negative correlation between growth and post-tax income inequality.

The striking conclusion is that, even in this simple model, the sign of the relation between inequality and growth is ambiguous, and depends crucially on the way in which we measure inequality. We could turn to the data to try to find support for one or other of these mechanisms. Unfortunately, the empirical evidence has generated a fuzzy picture. Early studies, such as Alesina and Rodrik (1994), found a negative correlation between income inequality and growth, while a positive correlation and the fact that both variables are jointly determined are consistent with the more recent findings of Barro (2000), Forbes (2000), and Lundberg and Squire (2003). The one consistent result is that there is no support for the "political economy" argument behind (iii) and (iv); tax rates are not correlated with pre-tax income inequality, nor is higher taxation correlated with slower growth.[7]

[7] See, among others, Perotti (1996) and Rodriguez (1999).

3.3 Wealth and Income Dynamics

One of the major drawbacks of the AK model sketched above is that there are no wealth dynamics. The constant growth rate implies that all agents accumulate at the same rate and hence the distribution of relative wealth remains unchanged. However, in a Ramsey-type model with diminishing returns to capital this is not the case.

In a recent paper, Caselli and Ventura (2000) have characterized relatively mild conditions under which various sources of heterogeneity are nevertheless compatible with viewing the aggregate (average) economy behaving as if it is populated by a single representative consumer. In particular, when the only difference across agents is their initial wealth and preferences are homothetic, then saving is a constant fraction of total lifetime wealth, defined as the sum of all future labour earnings and interest payments. Because savings are linear in individual wealth, then aggregate savings are independent of the distribution of capital in the economy. In other words, the behaviour of the aggregate economy with heterogeneous agents is identical to that of the representative consumer economy.

Aggregate dynamics do, however, have a distributional impact. To understand why the evolution of wealth inequality depends on aggregate dynamics consider two individuals having different capital endowments. Homothetic preferences imply that they both spend the same share of total wealth at each point in time and have the same rate of growth of total wealth. Total wealth has two components, physical capital and the present value of all future labor income. Since wages are growing at the same rate for both agents but represent a higher share of total wealth for the poorer individual, then his capital must be changing more rapidly than that of the wealthier agent. When the economy is accumulating capital, this means that his capital stock is growing faster and wealth inequality is diminishing.

What will happen to the distribution of income? Recall that with the Cobb-Douglas production used above, the income of agent i is given by $y_i(t) = \alpha k_i(t) + (1-\alpha)$. If the distribution of capital is becoming more equal over time, then the distribution of income will also become more equal.

The effect on incomes of a narrowing wealth distribution can be weakened or strengthened by changes in the labour share. Consider, instead of the Cobb-Douglas production function, a more general function of the form

$$Y(t) = \left(\alpha K(t)^{\rho} + (1-\alpha)(AL)^{\rho}\right)^{1/\rho}, \tag{1'}$$

where $\rho \leq 1$ and $1/(1-\rho)$ is the elasticity of substitution between capital and labour. The share of labour is now

$$s_L(t) = \frac{1-\alpha}{1-\alpha+\alpha(AL/K(t))^{\rho}}. \tag{7}$$

With a CES production function, the shares of capital and labour in total output change as the economy accumulated capital the labour share changes. Since individual incomes are given by

$$y_i(t) = (1 - s_L(t))k_i(t) + s_L(t). \tag{6''}$$

the endogenous evolution of $K(t)$ will determine $s_L(t)$ and hence the weight of capital income in the individual's budget constraint. If the elasticity of substitution is less than 1, that is if $\rho < 0$, a growing capital stock implies a rising labour share, reinforcing the effect of declining wealth inequality. However, if the elasticity is greater than 1, income and wealth inequality may move in opposite directions. The labour share falls during the transition and offsets, partially or totally, the impact of the changing wealth distribution on income inequality.

4 Technology and the Quality of Labour

Building on the seminal work of Nelson and Phelps (1966), one of the most important lessons that the new growth theories have taught us is that we cannot separate the process of human capital accumulation from that of technological change. Nelson and Phelps argue 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 R&D 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. 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.

4.1 The Effect of Technical Change on Labour Market Inequalities

The basic idea behind the hypothesis of biased technical change is that different types of labour are not perfect substitutes.[8] This can be captured by an aggregate production function of the form

$$Y = K^{\alpha}(\lambda(A_s L_s)^{\gamma} + (1-\lambda)(A_u L_u)^{\gamma})^{(1-\alpha)/\gamma}, \tag{8}$$

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

where L_s is skilled labour and L_u unskilled labour.[9] 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. Note that with $\gamma = 0$ we would be back to the Cobb-Douglas function with perfect substitution across different types of workers of section 2. The relative wage is given by

$$\ln \frac{w_s}{w_u} \simeq \gamma \ln \frac{A_s}{A_u} - (1-\gamma) \ln \frac{L_s}{L_u}. \tag{9}$$

If $\gamma > 0$, i.e. if skilled and unskilled labour are substitutes, then whenever skilled productivity grows faster than unskilled productivity the relative wage will increase. That is, if technological improvements lead to a faster increase in A_s, we will say that there is skill-biased technical change and growth will be accompanied by a higher relative wage.

One of the problems of this approach is that, although intuitive, it requires large differences in the rate of growth of relative productivity to explain observed changes in the skill-premium in the last decades of the 20th century. A complementary approach is to also allow for *capital-skill complementarity*, as suggested by Krussell et al. (2000). They argue that we should distinguish between structure capital, denoted K_s and comprising buildings and infrastructure, and equipment capital, denoted K_e and capturing investments in IT technology. They propose a production function of the form

$$Y = {K_s}^{\alpha} \left[\lambda \left[\mu (A_e K_e)^{\rho} + (1-\mu)(A_s L_s)^{\rho} \right]^{\gamma/\rho} + (1-\lambda)(A_u L_u)^{\gamma} \right]^{(1-\alpha)/\gamma}, \tag{8'}$$

[9] The literature tends to define those with only college education as "unskilled workers" and those with college education as "skilled workers", although there are clearly sources of skills other than formal education.

which allows for a different degree of complementarity between equipment capital and skilled workers than between equipment and unskilled labour. The skill premium is then given by

$$\ln \frac{w_s}{w_u} \simeq \gamma \ln \frac{A_s}{A_u} - (1-\gamma) \ln \frac{L_s}{L_u} + \lambda \frac{\gamma - \rho}{\rho} \ln \frac{K_e}{L_s}. \tag{9'}$$

Their estimates using US data imply $\gamma > 0$ and $\rho < 0$, indicating that there is capital-skill complementarity which implies that the skill premium can increase even if the relative productivity of the two types of workers and the relative supplies remain constant. The source of the change in the relative wage is an increase in equipment capital which, since this type of capital is complementary with skilled labour, raises the marginal product of the skilled. In other words, under the assumption of capital-skill complementarity, innovations that reduce the cost of equipment capital and hence raise their supply will tend to increase the skill premium.

4.2 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 technological change is by not being able to attribute changes in the skill premium to other causes. These other causes have been argued to be changes in the internal organization of firms and in labour market institutions. Bust what is the source of changes in firms' organization and 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 technological change.

A number of recent contributions have argued that technological change, and in particular IT-technologies, have changed the internal organization of firms; see, for example, Garicano and Rossi-Hansberg (2006) or Saint-Paul (2001).[10] 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.

Technological progress has also been argued to be a source of changes in labour market institutions; see Acemoglu, Aghion and Violante (2001) and Ortigueira (2007). 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 equipment-specific technological progress and equipment-skill complementarity. 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.[11]

4.3 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, suggesting that even if growth matters in shaping the distribution of income, policy choices also play a crucial role. For example, in 1993, social security benefits accounted for 14% of household income in the UK (Atkinson, 1997), and in rich industrial economies, the difference between market income and disposable income is between 10 and 19 15 Gini points (see Brandolini and

[10] Empirical support for the complementarity between technology, organizational change and human capital is provided by Bresnahan at al. (2002) and Caroli Van Reenen (2001).

[11] See Koeninger, Leonardi and Nunziata (2007) and Checchi and García-Peñalosa (2005).

Smeeding, 2007). It is then essential to understand the way in which taxes and transfers affect the relationship between growth and inequality.

An obvious question that arises is what determines the degree of redistribution, or, more generally, the size of the welfare state.[12] The idea that inequality, human capital accumulation, and the welfare state are jointly determined has been explored by Bénabou (2000, 2005).

Bénabou examines an overlapping generations model in which growth is driven by the accumulation of human capital. Individuals are endowed with different levels of human capital and with 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 constraints. Third, individuals vote over the extent of redistribution, and do so *before* they know their own 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,

$$\tau = \Gamma(\mathit{inequality}), \text{ with } \Gamma' < 0. \tag{10}$$

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.

[12] A more egalitarian welfare state may take the form of direct income redistribution, but also of stronger labour market institutions that would tend to reduce inequality in market incomes.

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,

$$Inequality = \Phi(\tau), \text{ with } \Phi' < 0. \tag{11}$$

Since the two relationships are decreasing, they may intersect more than once and give rise to two stable equilibria for the same preferences and technological parameters. 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 important implications. First, the equilibrium relationship between inequality and redistribution will be negative, rather than positive as the more naive approach in section 3 suggested. 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 -mainly in terms of the labour supply of the rich- and the positive effect of a greater investment in education by the poor. The latter effect is likely to be weak in industrial societies with well-developed financial system, and hence we would expect the former effect to dominate. That is, the equilibrium with a more redistributive policy will exhibit less inequality and slower growth, the latter being the result of the reduction in working hours induced by taxation.

Before we turn to the question of taxation and labour supply in the next section, 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 increase the uncertainty faced by individuals with a given level of human capital and lead to greater support for redistribution. That is, trade openness would result in 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.

5 Labour Supply

5.1 Leisure: Extending the basic growth model

The 1990s witnessed a substantial widening of the gap between working hours in the United States and Europe. While in the 1970s both German and French workers spent about 5 percent more time at work, by the mid-90s working hours in these two countries had fallen to 75 and 68 percent of hours worked in the US.[13] This observation has recently sparked a debate about the causes and effects of differences in labour supply; see Beaudry and Green (2003), Prescott (2004) and Alesina et al. (2005). The literature has largely focused on whether taxes or preferences have driven these differences, and on the impact of labour supply on growth. However, little attention has been paid to the distributional implications of an endogenous labor supply.

[13] See Prescott (2004).

In this section I discuss how an endogenous supply of labour affects both growth and inequality, and the role that taxes play.

5.1.1 Factor returns and factor shares

Consider the AK model with heterogeneous capital endowments of section 3.1, but suppose now that utility depends both on consumption and on leisure, denoted l_i, so that agent i maximizes[14]

$$U_{i0} = \int_0^\infty \frac{1}{1-\sigma}(C_i l_i^\eta)^{1-\sigma} e^{-\beta t} dt, \qquad \sigma > 0, \eta > 0 \tag{12}$$

Suppose also that all agents are endowed with one unit of labour, so that $H_i = 1 - l_i$ are the hours worked by agent i. The budget constraint is then

$$\dot{K}_i = rK_i + w(1 - l_i) - C_i. \tag{13}$$

The first implication of allowing for flexible labour is that the elasticity of leisure in the utility function, η, becomes a crucial parameter determining both the rate of growth and the distribution of income. In particular, the macroeconomic equilibrium is determined by the following expressions

$$g = \frac{r-\beta}{\sigma}, \tag{14}$$

$$C = \frac{w}{\eta} l, \tag{15}$$

$$g = \frac{Y}{K} - \frac{C}{K}, \tag{16}$$

where l is average leisure and average hours worked are $H = 1 - l$. The first equation is the Euler equation, the second equates the marginal utility from consumption and leisure, and the third is simply the aggregate budget constraint.

[14] See García-Peñalosa and Turnovsky (2006).

With a Cobb-Douglas production function and normalizing the labour force to one, we can write output as $Y_t = {K_t}^\alpha (A_t H)^{1-\alpha}$. Further assuming that $A_t = K_t$, the three equations above can be expressed as

$$
\begin{aligned}
g &= \frac{\alpha(1-l)^{1-\alpha} - \beta}{\sigma}, && \text{(E1)}\\
g &= (1-l)^{1-\alpha}\left(1 - \frac{1-\alpha}{\eta}\frac{l}{1-l}\right), && \text{(E2)}
\end{aligned}
$$

which jointly determine the equilibrium rate of growth and leisure. An increase in η, that is, a stronger preference for leisure, will result in a lower average labour supply and slower growth. The intuition for this is straightforward. A stronger preference for leisure tends to reduce the labour supply, which reduces the marginal product of capital and hence the rate of growth.

The degree of income inequality is also affected by the parameter η. Recall that agent i's relative income is given by

$$
y_i = (1 - s_L)k_i + s_L h_i \tag{17}
$$

and hence depends on her relative supply of hours, h_i. The work time chosen by agent i will depend both on the aggregate labour supply, as it affects the wage rate, and on her capital stock, which creates a wealth effect that induces capital-rich agents to work fewer hours. It is possible to show that

$$
h_i - 1 = \left[\frac{1}{1+\eta}\frac{1}{1-l} - 1\right](1 - k_i) \tag{18}
$$

where the term in square brackets is positive (from the transversality condition).

The key mechanism generating the endogenous distribution of income is the positive equilibrium relationship between agents' relative wealth (capital) and their relative leisure. This relationship has a very simple intuition.

Wealthier agents have a lower marginal utility of wealth. They therefore choose to work less and to enjoy more leisure, and given their relative capital endowments, this generates an equilibrium income distribution. There is substantial empirical evidence documenting this negative relationship between wealth and labour supply. [15]

We can then write relative income as

$$y_i = k_i + \frac{1}{1+\eta} \frac{s_L}{1-l} (1 - k_i) \tag{19}$$

where s_L is the share of labour, which is simply $1-\alpha$ with the Cobb-Douglas production function. We can rewrite this expression as

$$y_i - 1 = \left(1 - \frac{1}{1+\eta} \frac{1-\alpha}{1-l}\right) (k_i - 1) \tag{20}$$

which implies that income is less unequally distributed than capital. The reason is that the distribution of labour supplies is negatively correlated with that of wealth endowments, thus reducing the variability of income relative to that of capital.

Moreover, using the equilibrium conditions (E1) and (E2), it is possible to show that a stronger preference for leisure, that is a higher value of η, results in a more equal distribution of income. The reason is that a higher η leads to an increase in leisure and hence a lower income for all agents. However, the capital-rich reduce their working hours by (relatively) more and hence experience a greater decline in income, thus leading to a less dispersed distribution. Another way to think about this, is that a lower labour

[15] Holtz-Eakin, Joulfaian, and Rosen (1993) find evidence to support the view that large inheritances decrease labor force participation. Cheng and French (2000) and Coronado and Perozek (2003) use data from the stock market boom of the 1990s to study the effects of wealth on labor supply and retirement, finding a substantial negative effect on participation. Algan, Chéron, Hairault, and Langot (2003) use French data to analyze the effect of wealth on labor market transitions, and find a significant wealth effect on the extensive margin of labor supply.

supply implies a higher wage and a lower return on capital. Since capital endowments are more unequally distributed than labour endowments, the change in factor returns will result in a more equal distribution of income.[16]

The effect of different hours worked can be weakened or strengthened by changes in the labour share. For this we need to consider again a CES production function of the form

$$Y_t = (\alpha {K_t}^{\rho} + (1-\alpha)(A_t H)^{\rho})^{1/\rho} \, . \tag{21}$$

As in section 3, the labour share is given by

$$s_L = \frac{1-\alpha}{1-\alpha+\alpha H^{\rho}}, \tag{22}$$

where we have used the fact that $A_t = K_t$. With a CES production function, the endogenous labour supply will also determine the shares of capital and labour in total output, and hence the weight of capital income in the individual's budget constraint. If the elasticity of substitution is greater than 1, that is if $\rho > 0$, the lower labour supply induced by a higher η increases the labour share and further reduces income inequality. If the elasticity is less than 1, then the resulting fall in the labour share will mitigate the effect of endogenous labour on inequality.

5.1.2 Taxation

One possible reason why labour supplies differ across countries is different preferences for leisure. As we have seen, a stronger preference for leisure results in a lower labour supply, slower growth and a more equal distribution of income. If preferences are the cause of differences in labour supply, growth

[16] The argument that the behaviour of capital returns is essential to understanding distributional differences has, however, been emphasized by Atkinson (2003) and is supported by recent empirical evidence for the OECD (see Checchi and García-Peñalosa, 2005).

rates and inequality levels across countries, then there are no strong policy implications.[17] An alternative view, put forward by Prescott (2004) among others, is that differences in time use are due to differences in taxes between the US and the EU. That is, they are the result of government policy.

Prescott's argument that higher labour and consumption taxes are the main cause of the reduction in working hours in Europe raises a puzzle. 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 contrasts with the positive correlation between average hours worked in a country and the Gini coefficient of income reported by Alesina et al. (2005) for OECD economies. Table 2 reports the effective tax rate on labour income (a combination of the consumption tax, τ_c, and the tax on labour income, τ_w) and the Gini coefficient of disposable income for France, Germany, and the US. It indicates that a higher tax rate is associated with both fewer working hours and a lower degree of post-tax income inequality.

Table 2 around here

Let us now examine the simultaneous response of the aggregate labour supply and personal income inequality to changes in taxation, and try to understand to what extent increases in the effective tax rate on labour can result in a more equal distribution of income. To do this, consider the model of the previous subsection, but suppose that now capital income, labour income and consumption are taxed at rates τ_k , τ_w, and τ_c, respectively.[18] Then, the individual's budget constraint is

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

[18] See García-Peñalosa and Turnovsky (2007a) for the details, and well as García-Peñalosa and Turnovsky (2007b) for a similar analysis in the context of a Ramsey model.

$$\dot{K}_i = (1-\tau_k)rK_i + (1-\tau_w)w(1-l_i) - (1+\tau_c)C_i. \tag{16'}$$

The resulting macroeconomic equilibrium is now given by

$$g = \frac{\alpha(1-l)^{1-\alpha}(1-\tau_k)-\beta}{\sigma}, \tag{E1'}$$

$$g = (1-l)^{1-\alpha}\left(1-\frac{1-\alpha}{\eta}\frac{1-\tau_w}{1+\tau_c}\frac{l}{1-l}\right), \tag{E2'}$$

and it is straight forward to show that higher taxes on wages and consumption lead to a lower labour supply and growth rate, in line with recent empirical evidence; see Cardia, Kozhaya, and Ruge-Murcia (2003).

Now consider what is the effect of taxation on income inequality. Because the taxes have redistributive effects, we need to consider the net (or after-tax) income of agent i, y_i^N, which can be shown to be given by

$$y_i^N = y_i + \frac{1}{1+\eta}\frac{s_L}{1-l}\frac{s_k(\tau_k-\tau_w)}{s_L(1-\tau_w)+s_k(1-\tau_k)}(1-k_i). \tag{23}$$

Clearly, net income will be more equally distributed than market income, y_i, if $\tau_k > \tau_w$. In the mid-90s the tax rate on capital income was about 40 percent in the US, Germany, and France.[19] In the case of the US, since τ_w was also 40 percent, the model implies that y_i^N was approximately equal to y_i and hence taxation had no direct distributive implications. Meanwhile, the tax rates observed in Europe imply negative redistribution.

But taxation also affects the distribution of income indirectly, through its impact on factor returns. Recall that market income is given by

$$y_i = k_i + \frac{1}{1+\eta}\frac{s_L}{1-l}(1-k_i). \tag{22}$$

With a constant labour share, the effect of the taxes will operate through

[19] See Carey and Rabesona (2004).

leisure, l. Higher taxation of labour and consumption will reduce the labour supply, increasing wages and reducing the return on capital, and thus resulting in a less dispersed distribution of income. This effect can be sufficiently strong to overcome the direct distributive effect of the taxes, so that a higher effective tax on labour is associated both with lower working hours and a more equal distribution of post-tax income, consistent with the positive correlation between average hours worked in a country and the Gini coefficient of income reported by Alesina et al. (2005) for OECD economies.

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 slightly over the period.[20] 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.

There are two reasons why we could expect a relationship between female

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

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 industrial countries there is still a large gap between the hourly wages of men and those of women. Wage gaps are particularly evident in two types of jobs. One are female dominated jobs, such as nursing, which tend to command lower wages as compared to 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 (see OECD, 2004). 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 US, 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, (Gottschalk and Danziger, 2005; Burtless, 2007). 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 income among *households*. Increased female participation and the increased dispersion of female earnings will have 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 will also depend on the correlation between the income of a husband and that of his wife. Household income inequality will increase or decrease 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. Moreover, in the US 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 (Burtless, 1999).

6 Conclusions

In this paper I have discussed recent developments in the theory of growth and distribution, focussing on those approaches that are most relevant for modern industrial economies. I have argued that a country's growth rate can be decomposed into the growth rates of technology, physical capital, human capital, and labour supply, and that each of these represents a channel through which inequality and growth are related.

The revival of interest in the relationship between inequality and growth in the early 1990s by papers such as Galor and Zeira (1993) and Aghion and Bolton (1997) led to two conclusions. First, these models postulated a causal relationship from distribution to growth. Second, they predicted that greater inequality would result in slower growth, at least in countries with highly imperfect capital markets. The literature I have reviewed contrasts with this approach. Most of the mechanisms proposed in the paper imply a correlation between our variables of interest, rather than a causal relationship. This correlation can operate through various mechanisms. On the one hand, I have argued that technology and preference parameters affect both growth and the distribution of income. On the other, policy choices may be at its heart. The mechanisms I have discussed predict that faster growth will be associated with a more unequal distribution of income. Nevertheless, in some cases, the sign of the correlation may depend on the income concept that we use. For example, policies aimed at fostering growth through increased female participation will reduce wage inequality across genders but probably increase it across households.

Where does this leave us in our understanding of the relationship between distribution and growth? I draw two 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. The second is that 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 ex post the causes of a particular episode of increasing inequality. This understanding is essential for the design of suitable redistributive policies.

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Table 1: Growth decomposition

	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	2.4

Source: Lebre de Freitas (2000). The growth decomposition uses a Cobb-Douglas production function, where the labour share is country specific and equal to the average over the period.

Table 2: Labour supply and income inequality: 1993-96

	Per person, relative to US Hours worked	Output	$\frac{1-\tau_w}{1+\tau_c}$	Gini coefficient
US	100	100	0.40	0.35
France	68	74	0.59	0.29
Germany	75	74	0.59	0.27

Source: Relative hours, output and the tax rate are from Prescott (2004), table 1; the Gini coefficients are computed on household disposable income and are from the Luxembourg Income Study (2007) for the year 1994.

Determinants of inequality over the twentieth century: Evidence from top income data*

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Abstract

This paper examines the long-run determinants of income inequality using a newly assembled panel of 16 developed countries over the entire twentieth century. We find that economic growth disproportionately benefits the top percentile income earners ("the rich"), at the expense of the rest of the top decile ("the upper middle class"). Financial development is also significantly pro-rich, particularly in the early stages of a country's development. Openness to trade has no clear distributional impact. If anything openness reduces top income shares. Tax progressivity significantly reduces top income shares whereas government spending has almost no effect on inequality at all.

Keywords: Top incomes, income inequality, financial development, trade openness, government spending, taxation, economic development

JEL: F10, G10, D31, N30

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1 Introduction

The relationship between inequality and development is a central issue in the study of economics. From fundamental concerns about whether markets forces have an innate tendency to equalize or increase differences in economic outcomes to much debated questions about the effects of "globalization" distributional concerns are always present: Does economic growth really benefit everyone equally or does it come at the price of increased inequality? Is the effect perhaps different over the path of development? Is it the case that increased openness benefits everyone equally, is it perhaps especially the poor that gain, or is it the case that it strengthens the position only of those who can take full advantage of increased international trade? Does financial development really increase the opportunities for previously credit constrained individuals or does it only create increased opportunities for the already rich? What is the role of government in all this? Theoretically such questions are difficult to resolve as there are plausible models suggesting equalizing effects from these developments, as well as models suggesting the opposite.[1] Empirically problems often arise because these effects should be evaluated over long periods of time and data is typically only available for relatively short periods.

This paper empirically examines the long-run associations between income inequality and economic growth, financial development, trade openness, top marginal tax rates, and the size of government.[2] While these variables are not direct measures of typically suggested causes of changes in income distribution, such as globalization, technological change or social norms, their relation to the development of inequality seem an important step toward understanding such broader concepts. The main novelties of our study lie in the uniquely long time period for which we have data and in the focus

[1] Just to give some examples: one may distinguish between theories that predict markets to be innately equalizing, disequalizing or both (depending on initial conditions). Mookherjee and Ray (2006) give a useful overview of the literature on development and endogenous inequality based on such a division. Winters et al. (2004) give an overview of evidence on the relation between trade and inequality, Cline (1997) summarizes different theoretical effects of trade on income distribution, while Claessens and Perotti (2005) provide references for the links between finance and inequality, presenting theories which suggest both equalizing effects as well as the opposite. We will discuss some of the suggested mechanisms in more detail in Section 2 below.

[2] As our focus is on *pre-tax* income we do not explicitly address questions of redistributive policy but rather the effects of taxes and government size on income before taxes and transfers. See Bardhan, Bowles and Wallerstein (eds.), 2006, for several contributions on the relation between various facets of globalization and their impact on the possibilities to redistribute income).

on top income shares. We use a newly compiled dataset for 16 countries over the whole of the twentieth century.[3] While previous studies have only had comparable data from the 1960s (at best), our series start at the end of the "first wave" of globalization (1870–1913), continues over the interwar de-globalization era (1913–1950), the postwar "golden age" (1950–1973) and ends with the current "second wave" of globalization.[4] Hence, in contrast to relying on shorter periods of broader cross-country evidence, our dataset allows us to study how inequality has changed over a full wave of shifts in openness as well as several major developments in the financial sector. In terms of the role of government, our long period of analysis implies that we basically cover the entire expansion of the public sector and the same is true for the role of income taxation, which was non-existent or negligible at the beginning of the twentieth century.[5]

The focus on top incomes and concentration within the top means that we can address a special subset of questions regarding the extent to which economic development is particularly pro-rich.[6] In particular, our data allows us to distinguish between the effects on, broadly speaking, the "*rich*" (top executives and individuals with important shares of capital income), the "*upper middle class*" (high income wage earners), and the rest of the population.[7] As has frequently been pointed out in the recent top income literature, the lower half of the top decile typically consists of employed wage earners while there are major differences in both composition of income and in fluc-

[3] Even though the choice of countries - mostly developed economies - is mainly a result of data availability it has some positive side effects. We are, for example, able to trace a fixed set of relatively similar countries as they develop rather than letting different countries represent stages of development. Having similar countries is also important especially when thinking about theoretical predictions from openness which are often diametrically different for countries with different factor endowments, technology levels etc.

[4] These periods are quoted in, for example, O'Rourke and Williamson (2000), O'Rourke (2001), and Bourguignon and Morrison (2002). These studies discuss various aspects of globalization and inequality over these early periods but they did not have sufficient data to analyze developments in detail. Also see Cornia (2003) for a discussion of differences in within-country inequality between the first and second globalization.

[5] In fact, the introduction of a modern tax system is typically what limits the availability of data on income concentration.

[6] Examples include, models of how aspects of these developments creates extreme returns to "superstars", or models of capitalists and workers where capitalists benefit disproportionately would, when taken to the data, translate to isolated effects for a small group in the top of the income distribution.

[7] A similar classification but with respect to wealth is made in Hoffman, Postel-Vinay and Rosenthal (2007).

tuations over time higher up in the distribution.[8] Depending on whether developments seem to affect everyone in the top of the distribution in similar ways or, if there are clear differences within the top, holds important keys to what is driving developments of inequality.

Our empirical analysis exploits the variation within countries to examine how changes in top income shares are related to changes in economic development, financial development, trade openness, government expenditure, and taxation. Using a panel data approach allows us to take all unobservable time-invariant factors, as well as country specific trends into account. We also allow the effects to differ depending on the level of economic development, between Anglo-Saxon countries and others, and between bank- and market-oriented financial systems.[10]

Several findings come out of the analysis. First, we find economic growth to be strongly pro-rich. In periods when a country's GDP per capita growth has been above average, the income share of the top percentile has increased. By contrast, the next nine percentiles (P90-99) seem to loose out in these same periods. As we find this relation to be similar at different stages of economic development, it could indicate that recent findings of high productivity growth mainly benefiting the rich in the U.S. postwar era (Dew-Becker and Gordon, 2005, 2007), is a more general phenomenon across both countries and time. This result is in line with top incomes being more responsive to growth (e.g., through compensation being related to profits).

Furthermore, we find that financial development, measured as the relative share of the banking and stock market sectors in the economy, also seems to increase the income share of the top percentile. When interacted with the level of economic development it

[8] For evidence on much of changes in top income concentration stemming from the very top, see Piketty (2003), Piketty and Saez (2003, 2006), and Atkinson and Piketty (2007).

[10] As we will discuss in more detail below, these are some of the dimensions in which we may expect differences in development of inequality either on theoretical ground or based on previous empirical findings.

[12] We do also find weak support for positive effects of financial development spreading down the distribution over the path of development.

turns out that the result is mostly driven from a strong effect in the early stages of development. This result is in line with the model suggested by Greenwood and Jovanovic (1990) where financial markets initially benefit only the rich but as income levels increase (and with them the development of financial markets) the gains spread down through the distribution.[12] It is also of particular interest since a recent study by Beck, Demirguc-Kunt and Levine (2007) finds that financial development disproportionately benefits the poor.[13]

Our results with respect to the role of government indicate that higher marginal taxes have a robustly negative, though fairly modest short-term effect on top income shares, both in the top and the bottom of the top decile.[14] However, this effect could be sizeable over time. Our simulations of cumulative effects of taxation indicate that they, especially in combination with shocks to capital holdings, can explain large long-run drops in top income shares.[15] Government spending as share of GDP, however, has no clear effect on the incomes of the top percentile, but seem to be negative for the upper middle class and positive for the rest of the population.

Finally, with respect to the elusive concept of globalization there are at least two findings that relate to its effects on income inequality. First, openness to trade (the trade share of GDP), which is often used as a measure of 'globalization', does not have a clear effect on inequality, but if anything, seems to have a negative effect on top income shares. Second, the effects of growth can be interpreted as casting doubt on the idea that top income earners have their incomes set on a global market while others have theirs set locally. Assuming that domestic development determines incomes on the local labor market while global growth determines the compensation for the elite,

[13] These findings are not necessarily conflicting. For example, both the poor and the richest group can benefit at the expense of the middle. IMF (2007) also finds that financial development is related to increases in income inequality.
[14] Atkinson and Leigh (2007c) find slightly stronger negative effects of marginal taxation on top income shares in their study focusing on Anglo-Saxon countries.
[15] The combination of shocks to capital holdings and increased marginal taxes have been suggested to be a major sources of decreasing top income shares after World War II (see in particular Piketty, 2003, and Piketty and Saez, 2003). Our simulations indicate that our estimated effects are well in line with this type of explanation.

domestic economic growth (above the world average) should decrease inequality between the two groups, not increase it as we find.[16]

The remainder of the paper is organized as follows. Section 2 outlines some common theoretical arguments linking the incomes of the rich and the variables included in the study. Section 3 describes the data and their sources while Section 4 provides a brief overview of the relationships between the different variables. Section 5 presents the econometric framework and Section 6 presents the main results and a number of robustness checks. Section 7 concludes.

2 Potential determinants of trends in top income shares

A number of recent contributions to the study of income inequality have increased the availability of comparable top income data over the long-run. Following seminal contributions by Piketty (2001, 2003) on the evolution of top income shares in France, series on top income shares over the twentieth century have been constructed for a number of countries using a common methodology.[18] The focus in this literature has mainly been on establishing facts and to suggest possible explanations for individual countries. To the extent that general themes have been discussed these have focused on accounting for some common trends such as the impact from the Great Depression and World War II (on countries that participated in it) and on the differences between Anglo-Saxon countries and Continental Europe since around 1980. Broadly speaking the explanations for the sharp drop in top income shares in the first half of the twentieth century have revolved around shocks to capital ownership, leading to the top income earners losing much of the wealth that provided them with much of their in-

[16] Note that our result is not in conflict with Gersbach and Schmutzler (2007) or Manasse and Turrini (2001) that emphasize the distribution of incomes within the elite group (rather than the average) and predict that globalization leads to an increased spread in incomes for the elite. Others such as Gabaix and Landier (2007) emphasis the firm size effect, while Kaplan and Rauh (2007) stress technological change, superstar effects (Rosen, 1981), and scale effects as plausible explanations for increasing top incomes.

[18] Other recent studies include Australia (Atkinson and Leigh, 2007), Canada (Saez and Veall, 2005), Germany (Dell, 2005), Ireland (Nolan, 2007), Japan (Moriguchi and Saez, 2006), the Netherlands (Atkinson and Salverda, 2005), New Zealand (Atkinson and Leigh, 2007), Spain (Alvaredo and Saez 2006), Sweden (Roine and Waldenström, 2007) and Switzerland (Dell, Piketty and Saez, 2007). Much of this work is summarized and discussed in Atkinson and Piketty (2007).

come, thus decreasing their income share substantially. High taxes after World War II (and the decades thereafter) prevented the recovery of wealth for these groups. As we will show, our estimates of the effect of top marginal taxes are compatible with this type of explanation. After roughly 1980 top income shares have increased substantially in Anglo-Saxon countries but not in Continental European countries. However, this has not been due to increases in capital incomes but rather due to increased wage inequality (see Piketty and Saez, 2006 for more details on the proposed explanations for the developments).

Even though a number of plausible explanations have been suggested in this literature it is fair to say that so far no attempts at exploiting the variation across countries and across time in an econometrically rigorous way has been made. In fact, in overviews (Piketty 2005 and Piketty and Saez 2006) of this literature it is suggested that – even though there will always be severe identification problems – cross country analysis seems a natural next step. A first question when contemplating such an analysis is, of course, what variables that could be expected to have a clear relationship to top income shares. Beside variables suggested in the top income literature, such as growth, taxation and the growth of government, we think variables capturing financial development and openness to trade, are especially interesting.

The next question is; what should we expect these relationships to look like? When it comes to the impact of financial development, it is fair to say that standard theory typically predicts that financial development should decrease inequality, at least if we think of financial development as increasing the availability for previously credit constrained individuals to access capital (or that financial markets allow individuals with initially too little capital to "pool their resources" to be able to reach a critical minimum level needed for an investment).[19] This is the standard mechanism in growth theories where a country can be caught in a situation where badly developed financial markets make it impossible for much of the population to realize projects that would increase growth (as, for example, in Galor and Zeira, 1993, and in Aghion and Bolton, 1997). The situation would be one of low growth (compared to the country's potential), high inequality and badly developed financial markets. With the development of

[19] Recent evidence for financial development being pro-poor is given in Beck et al. (2007).

financial markets, increased growth goes hand in hand with less inequality as the financial markets improve the allocation of resources. A larger fraction of individuals are then given the possibility to realize profitable projects.

There are, however, a number of suggested mechanisms that could turn this prediction around. In an overview of the links between finance and inequality, Claessens and Perotti (2005) give a number of references (e.g., Rajan and Zingales, 2003 and Perotti and Volpin, 2004) to theory, as well as evidence, of financial development, which benefits insiders disproportionately (consequently leading to increased inequality). The idea, in various garbs, is that understanding the potential threat to their position from certain types of development of capital markets, the political elites, implicitly the top income earners, would block such developments, possibly to the detriment of the economy. Hence, these theories agree that *in principle* the development of financial markets could have an equalizing effect but *in practice* only developments that disproportionately benefit the elite will materialize.

Beside theories suggesting either increased equality or increased inequality from financial development there are also a number of theories suggesting that financial development, much like the classic Kuznets curve, leads to increased inequality in early stages of development but at later stages also benefits the poor, leading to increased equality. An influential article suggesting precisely this is Greenwood and Jovanovic (1990). Their idea is that at low levels of development when capital markets are non-existent or at an early stage of development only relatively rich individuals can access the benefits of these (as there are certain fixed costs involved). At this stage further developments of financial markets increase growth but disproportionately benefit the rich. However, as the economy grows richer, a larger and larger portion of the population will be able to access the capital market and more and more individuals will benefit. Consequently resource allocation improves even more, growth continues to increase, but now accompanied by decreasing inequality. Eventually the economy reaches a new steady state where financial markets are fully developed, growth is higher and inequality has gone through a cycle of first increasing and then decreasing over the path of development.

When it comes to standard trade theory the inequality effect of openness varies depending on relative factor abundance and productivity differences, and also on the extent to which individuals get income from wages or capital. Easterly (2005) provides a good overview of the arguments, stressing the importance between differences (between countries) stemming from variations in endowments or productivity. Assuming, which seems realistic, that our sample contains countries that (over the whole of the twentieth century) have been relatively capital rich compared to the global average and are places where capital owners coincide with the income rich, we should, in general, expect trade openness to increase the income shares of the rich in our sample.[20] Even if theory is far from clear cut in its predictions, the basic argument that trade openness – as well as other aspects of globalization – may somehow "naturally" benefit the rich underlie calls for political intervention whereby a "loosing majority" could be compensated given that the total gains are large enough (as shown in Rodrik, 1997). The importance for such compensation has recently forcefully been argued in Scheve and Slaughter, 2007 (see also the recent collection of articles in Bardhan, Bowles and Wallerstein (eds), 2006).

Looking at the possible effects of taxation the theoretical predictions are again ambiguous. Higher taxes have immediate effects on work incentives and on capital accumulation (and hence on capital income over time) and if these are relatively more important for the top income groups we should expect higher taxes to be negatively related to top income shares.[21] However, as pointed out in Atkinson (2004), there are theoretical reasons to expect gross income inequality to *increase* as a result of increased taxation. Even in the simplest model, an increased tax for the rich (or increased progressivity) has a substitution effect causing a decrease in effort but also an

[20] An example of when this is not the case would be if differences between countries are due to productivity differences that are so large that the richer countries (the ones in our sample) can export labor intensive goods (productivity advantage offsets labor scarcity). Then trade would reduce inequality in the rich countries. Another potentially important point is the fact that these countries have largely traded with each other, and therefore the predictions could still be different for different countries in our sample.

[21] It should be emphasized that the dynamic effects on capital accumulation, stressed in the literature on top incomes (see Piketty, 2003, and Piketty and Saez, 2003), are not captured well in the econometric estimates (as the impact from these are cumulative). As we discuss the results below we will therefore combine our results with simulations to get a better sense of the order of magnitude over time.

income effect pulling in the other direction. Unless this is zero, such an increase should be expected to increase *gross* income inequality.[22]

Overall, the conclusion we draw from reviewing the literature on possible determinants of top income shares is that theory provides us with many plausible alternatives. The main contribution we can make lies in using the uniquely long period for which we have data to test whether there are robust relationships over time as well as to address issues of changing relationships along the path of development (such as testing whether financial market development has a different effect in early stages of development compared to later stages).

3 Data description

This section outlines our data, describing the variables included in the analysis and their sources. Further details can be found in the appendix.

Top income shares. In income inequality research, top income earners are often defined as everyone in the top decile (P90–100) of the income distribution. However, recent studies by Piketty (2001) and others have shown that the top decile is very heterogeneous.[23] For example, the income share of the bottom nine percentiles of the top decile (P90–99) has been remarkably stable over the past century in contrast to the share of the top percentile (P99–100), which fluctuated considerably. Moreover, while labor incomes dominate in the lower group of the top decile, capital incomes are relatively more important to the top percentile. In order to analyze the determinants of top income shares in detail we will differentiate between these groups of income earners within the top decile.

Based on the work of several researchers following the methodology first outlined in Piketty (2001, 2003), we have constructed a new panel dataset over top income shares

[22] Atkinson (2004) also point to taxes having ambiguous effects in "tournament theory" (Lazear and Rosen, 1981) where an increased tax decreases the return of advancement to the next level but also reduces the risk of attempting such advancement, and in the "winner-take-all" context considered in Frank (2000) where progressive taxation reduces the expected returns of entry. See Atkinson (2004) pages 135-138.

[23] See Atkinson and Piketty (2007).

for 16 countries covering most of the twentieth century.[24] The main source is personal income tax returns, and income reported is typically *gross total income*, including labor, business and capital income (and in a few cases realized capital gains) before taxes and transfers. Top income shares are then computed by dividing the observed top incomes by the equivalent total income earned by the entire (tax) population, had everyone filed a personal tax return. In most countries only a minority of the people filed taxes before World War II and the computation of reference totals for income regularly include both tax statistics and various estimates from the national accounts. For this reason the reference total income is likely to be measured with some error. Despite the explicit efforts to make the series consistent and comparable there remain some known discrepancies in the data that are potentially problematic.[25]

We use three income variables to capture what we think are key aspects of the whole income distribution given the data limitations. *Top1* (P99–100) measures the fraction of total income received by the percentile with the highest incomes, *Top10-1* (P90–99) is the share received by the next nine percentiles, and *Bot90* (P0–90) is the residual share received by the lowest ninety percent of the population. As already mentioned we think there are good reasons to approximate *the rich* by *Top1*, in that their income share is of a different makeup in terms of sources compared to the rest of the population and also shows considerable variation over time. Similarly it is fair to describe *Top10-1* as *the upper middle class* since this group, with remarkable consistency across countries and over time, has been composed of mainly (highly) salaried wage earners.[26] Finally, *Bot90* consists clearly not of a homogenous group of income

[24] See the Table B2 in the Appendix for specific references and Atkinson and Piketty (2007) for details.

[25] Some differences in both income and income earner (tax unit) definitions remain. For example, realized capital gains are excluded from the income concept in all countries except for Australia, New Zealand and (partly) the UK. Tax unit definitions vary even more. In Argentina, Australia, Canada, China, India and Spain they are *individuals* but in Finland, France, Ireland, the Netherlands, Switzerland and the United States they are *households* (i.e., married couples or single individuals). Moreover, in Japan, New Zealand, Sweden and the United Kingdom the tax authorities switched from household to individual filing. In Germany there is a mixture of the two, with the majority of taxpayers being household tax units whereas the very rich filing as individuals. For a longer and more detailed discussion of these problems, see Atkinson and Piketty (2007, ch. 13).

[26] Needless to say, this division is as artificial as the classical distinction between workers and capitalists and it is likely that the precise division between the rich (whatever one means by this term) and the upper middle class is different across time and between countries. Nevertheless, the results from the top income literature indicate a surprisingly stable relation in that at least the lower half of the top decile is very different from the top percentile. We therefore use this terminology hoping that it invokes key distinctions between the very top and the group just below.

earners. Nonetheless this group, by construction, captures the aggregate outcome for the rest of the population and, as we will show, there seem to be some clear patterns of outcomes for "the top" and "the rest" of the population.

Beside the measures of shares out of total income we also use some measures of inequality *within the top* of the distribution. Specifically we use *Top1/10,* defined as the share of the top percentile in relation to the top decile, i.e., P99–100/P90–99, as well as *Top01/1*, the top 0.1 percentile income share divided by the rest of the top percentile's income share, P99.9–100/P99–99.9. These measures serve two purposes. First, they measure the inequality within the top of the distribution, which is different from inequality overall especially when considering theories that predict a widening gap among high income earners. Second, these measures are not sensitive to measurement error in the reference total income mentioned above.[27]

Financial development. The challenge in estimating financial sector development over the whole twentieth century is to find variables that are available and comparable for all countries for such a long period. We use three different measures aimed at capturing the relative importance of private external finance: *Bank deposits* (deposits at private commercial and savings banks divided by GDP), *Stock market capitalization* (the market value of listed stocks and corporate bonds divided by GDP), and *Total market capitalization* (the sum of the first two, which is also our preferred measure). The variable *Bank deposits* closely matches private credit in the economy.[28] By using these three different measures, we are also able to address possible distributional differences between bank-based and market-based financial development.

Our sources for bank deposits are Mitchell (1995, 1998a, 1998b) for the pre-1950 period and International Financial Statistics (IFS) and Financial Structure Database (FSD) for the post-1950 period. Data on stock market capitalization before 1975 come from Rajan and Zingales (2003), who present data for the years 1913, 1929, 1938, 1950, 1960 and 1970. We linearly interpolate between these years (but not over the world wars) to get 5-year averages which we then link to post-1975 data from FSD.

[27] To see this in the case of *Top1/10*, note that P99–100 = Inc_{Top1}/Inc_{All} and P90–100 = Inc_{Top10}/Inc_{All}, which means that *Top1/10* = $(Inc_{Top1}/Inc_{All})/(Inc_{Top10}/Inc_{All} – Inc_{Top1}/Inc_{All}) = Inc_{Top1}/(Inc_{Top10} – Inc_{Top1})$.

[28] We use bank deposits instead of private credit since we have much longer series of deposit data. For the country-years when the two measures overlap, however, the correlation is high (0.82).

One problem with the stock market capitalization measure is its potentially close connection to our income measure, which includes capital income (although not realized capital gains), i.e., returns on stocks and bonds. Hence, there could be a mechanical relation between top income shares and financial development if, for example, dividends tend to be high when stock market capitalization is high. This potential problem is, however, considerably smaller in the case of bank deposits, which hence also serves as a robustness check on the market capitalization results.

Openness. We use a standard measure of trade openness: the sum of exports and imports as a share of GDP. Data on trade for the pre-1960 period come from Mitchell (1995, 1998a, 1998b), Rousseau and Sylla (2003) and López-Córdoba and Meissner (2005), and for the post-1960 period we use data from IFS.

Central government spending. In order to account for the activity and growth of government over the period, we include a measure of *Central government spending*, defined as central government expenditure as a share of GDP. Data are from Rousseau and Sylla (2003). Ideally we would have liked to include both central and local governments since the spending patterns at these two administrative levels may both vary systematically across countries and within countries over time. For example, Swedish municipalities and counties have gradually taken over the state's responsibility for the provision of traditional public sector goods such as health care and schooling, thereby potentially causing a decrease in central government spending but not in total government spending. However, lacking a measure of total government spending, we think that our chosen alternative is the best available measure for capturing the growth of government over time.[29]

Top marginal tax rate. We use two measures of top marginal tax rates. Our first measure, called *Margtax1*, combines data on the statutory top marginal tax rates with some newly created series on marginal tax rates paid by those with incomes equal to five times GDP per capita, an income level approximately equal to the 99th income percentile. The reason for not only using the statutory top rates is that we know that

[29] Rousseau and Sylla (2003) use this variable in their study of the determinants of economic growth in an historical context. Central government spending to GDP is also the variable that is available in databases such as the *Penn World Tables*, the World Bank's *World Development Indicators*, and the IMF:s *International Financial Statistics*.

they are binding to quite varying degrees both across countries and over time.[30] The new datasets on marginal tax rates are available thanks to previous efforts by Bach et al. (2005) for Germany (since 1958), Roine and Waldenström (2007) for Sweden (whole period), and Rydqvist et al. (2007) for Canada, the UK, and the US (postwar period). These series were calculated from national tax schedules for each of these countries. Our second measure of marginal tax rates, *Margtax2*, consists simply of the full set of statutory rates from all countries for which such data are available.

GDP per capita and Population. For the variables *GDP per capita* and *Population size* we use data from Maddison (2006).[33]

4 A first look at the data

To get a sense of the relationships between our variables of interest it is useful to just look at the trends over time. After all, when it comes to some of the main findings in the individual country studies on top incomes, such as the effects of the Great Depression and World War II, these are apparent just from looking at the data. *Figure 1* shows the development of our main dependent variable, *Top1*, over the Twentieth Century for all countries in our sample.

Besides clearly showing the impact of the depression and World War II for many countries, another striking feature of the series is the strong common trend. With the exception of a few countries the development is remarkably similar over time, at least until around 1980. The same is, in varying degree, true for the main right-hand-side variables (at least for the development of GDP/capita, top marginal tax rates and central government spending). The panels in *Figure 2* show the development of these since 1900.

[30] For example, Roine and Waldenström (2007) shows for Sweden that over the entire century the top income percentile only paid a marginal tax rate equal to the statutory top rate in the years around 1980. More generally, the statutory top rates have been relatively more binding to larger groups of income earners in Scandinavia and the U.K than in, e.g., Japan or the U.S.

[33] When computing GDP shares for financial development and trade volumes, however, we use nominal GDP series in Bordo et al. (2001), Mitchell (1995, 1998a, 1998b) and Rousseau and Sylla (2003).

These signs of interdependencies are perhaps not so surprising given our focus on economies that have been relatively closely interconnected through events such as the Great Depression affecting top incomes in many of these countries in similar ways. One may also think of broad policies (taxation, liberalization, etc.) or changes in technology (financial innovation, factor flows, etc.) as being reflected in common trends of top income shares across countries. In the extreme this could be a problem for our econometric approach since we rely on within country changes in the relevant variables to identify effects, holding common trends constant. If there are changes across time in the explanatory variables but these are exactly the same everywhere, we would not find any effect even if there may be a relation. In other words, by taking out common trends, we run the risk of falsely rejecting a hypothesis because the patterns are too similar across countries. However, since no two countries are affected in exactly the same way by the developments throughout the 20th century, there should be enough variation in the data to disentangle the effects (see section 5 below). This problem is not unique to our study; exploiting the residual variation after having controlled for common effects is the standard way of approaching cross-country data.

Can we by just looking at the data find any clear patterns between the top income shares and the proposed explanatory variables over time? The short answer would have to be “no”. As can be seen in *Figure 2* the level of financial development is quite volatile up until the middle of the postwar period when it starts to increase. Trade openness, on the other hand, exhibits a more monotonic increase (except for the drastic drop in the Netherlands during World War I), and a similar pattern goes for GDP per capita. Government spending is increasing in all countries, with the well-known war-related spike in the 1940s. Top marginal taxation increases before World War II, but continues to be high throughout the postwar period up to its peak around 1980 when it mostly starts to decrease. Overall, there are no obvious links between any of these variables and the top income shares, although there is quite notable cross-country variation to use in a more sophisticated analysis of the panel. Piketty (2005) makes a similar simple eyeballing exercise to provide some suggestive evidence on the inequality-growth links in the specific case of France, but in the end he concludes that “Using all countries in the database might allow to produce more convincing results".[34] The natural next step, therefore, is to study these relationships more rigorously.

5 Panel estimations: Econometric method

The theoretical discussion concerning the potential determinants of top income shares is suggestive, but inconclusive. Financial development has been suggested to increase as well as to decrease top income shares and the same goes for trade openness and the effect of economic growth. Even if theory on the effect on taxation is ambiguous, we do, however, expect to find that a larger government and higher tax rates (especially higher top marginal taxes) are associated with lower top income shares.[35] When it comes to finding possible relations between variables based on simply eye-balling the time series, we have concluded that there are no obvious links to be suggested. We therefore proceed with panel estimates of the effects on these variables on top income shares. Panel estimations allow us to take all unobservable time-invariant factors into account. Further, it allows us to control for both common and country specific trends. Thus, we can test for specific hypotheses regarding the relation between different variables on top income shares.

When estimating the determinants of top income shares using a long and narrow panel of countries, the assumptions underlying the standard fixed effects model are likely to be violated. In particular, serial correlation in the error terms can be expected. We therefore apply the less demanding first difference estimator which relies on the assumption that the first differences of the error terms are serially uncorrelated. This means that we start with the following regression:

$$\Delta y_{it} = \Delta \mathbf{X}'_{\mathbf{it}} b_1 + \gamma_t + \mu_i + \varepsilon_{it} \tag{1}$$

This is a standard first difference regression including fixed time effects γ_t and country specific trends (here captured by a country specific effect μ_i). Further, $\Delta \mathbf{X_{it}}$ is the vector of (first-differenced) variables that we are interested in as well as other control

[34] Piketty (2005), p. 8.
[35] This is partly assuming that disincentive effects dominate, but also based on the potential dynamic effects on capital accumulation. Some of the individual country studies on top incomes have also found that higher marginal taxes have indeed lowered top income shares.

variables. Of course, the assumption of no serial correlation in the error terms does not necessarily hold, even after first-differencing. Indeed, some preliminary tests suggest that serial correlation is a problem in this setting.[36] To account for serial correlation, we follow two different strategies. Our main approach is to estimate (1) using GLS and directly allow for country specific serial correlation in the error terms.

As an alternative approach, one could include the lagged dependent variable, thereby explicitly allowing for the dynamics that give rise to serial correlation. This means that we estimate the following regression:

$$\Delta y_{it} = b_0 \Delta y_{it-1} + \Delta \mathbf{X}'_{\mathbf{it}} b_1 + \gamma_t + \mu_i + \varepsilon_{it} \tag{2}$$

Applying the same test as above shows that serial correlation is no longer a problem when using a dynamic specification. However, the inclusion of the lagged dependent variable is not unproblematic since it is correlated with the unobserved fixed effects. Thereby, we could get biased estimates. This bias is reduced when T is large (Nickell, 1981). T does in this case depend on the actual time horizon on which the data is based. In other words, in our case where T is 100 years, the bias is not likely to be a major problem even if we only use 20 periods based on 5-year averages. Furthermore, the standard way of dealing with the dynamic panel data problem is to use GMM-procedures along the lines of Arellano and Bond (1991) or Arellano and Bover (1995).[37] But these GMM-procedures are not appropriate in a setting with small N and large T such as ours (Roodman, 2007). For these reasons we run regression (2) without any adjustments or instrumentation. Both when using dynamic first differences and first differenced GLS, we allow for heteroskedasticity in the error terms. In order to limit the number of tables, we only report the GLS results in the main paper, but all regressions are also run using the first difference approach.

The fact that we control for trends and time invariant country factors does not mean that we have fully addressed potential endogeneity problems. First of all, we could

[36] The test procedure follows Wooldridge (2002, Chapter 10.6): We run regression (1) and keep the residuals. We then rerun the regression and include the lagged residuals in the estimation. Since the coefficient on the lagged residual is positive and significant, we can conclude that serial correlation is a problem even after taking first differences.

[37] Lagged levels and differences of the endogenous variable/s are used as instruments.

have direct reverse causality from top income shares to our explanatory variables. This would be the case if, for example, top income shares would have a direct effect on economic growth, rather than the other way around. Similarly, high top income shares could affect financial development positively if individuals in the top of the income distribution are relatively prone to make use of the financial markets for saving and investment. It is more difficult to see a problem of reverse causality from top incomes to trade and government spending, but a high income concentration can of course affect the political trade-offs facing a government. This, in turn, can affect trade policies, government spending and how the tax system is structured. Second, it is possible that some uncontrolled factor affects both top income shares and the respective control variables. This would then give rise to an omitted variable bias of our estimates.

The ideal way of dealing with these endogeneity problems is to find some credible instrument for each respective explanatory variable. Since our approach here is to take an agnostic view on several potential explanations for top incomes over a long period, instrumentation is not feasible. Therefore, we will be analyzing partial correlations between top incomes and a set of explanatory variables, and we do not claim to establish causality. Rather, we regard our contribution as being a first systematic take on the various explanations of top income shares that have been proposed in the literature.

6 Results

In this section, we report the results from panel regressions using the above estimation methods. Throughout, we have used both first differenced GLS (FDGLS) and dynamic first differences (DFD), but as these give very similar results we only display the FDGLS results in our main tables while showing the DFD output in Appendix C.[38] In all tables showing the results, the dependent variables are the five different income shares presented in the data section: the top percentile (*Top1*), the next nine percentiles in the top decile (*Top10–1*), the bottom nine deciles (*Bot90*), the top percentile

[38] We choose to present the results from FDGLS because it deals more directly with serially correlated errors.

divided by the rest of the top decile (*Top1/10*) and, finally, the top 0.1 percentile divided by the rest of the top percentile (*Top01/1*).

The presentation of the results starts by looking at average long-run effects over the whole income distribution. We then allow for: different effects across levels of development, differences between Anglo-Saxon and other countries and differences between bank- and market-oriented financial systems. Thereafter we show that our results are robust to restricting the sample in a number of ways as well to using alternative marginal tax measures.

6.1 Main results

Table 1 presents the results from our baseline FDGLS regressions. The explanatory variables in all regressions are growth in GDP per capita, financial development (as measured by total capitalization), population size, central government spending, and openness to trade. The difference between odd and even numbered columns is that the latter also includes top marginal tax rates.

Table 1 shows a number of clear and interesting results. First, there is a strong positive relation between GDP per capita growth and the income share of the top. The regression coefficients for *Top1*, *Top1/10* and *Top01/1* are all significantly positive suggesting that growth has been "pro-rich" over the entire 20th century and that it has been relatively more so the higher up the distribution one gets. In sharp contrast to those results is the *negative* relationship between growth and income share for the next nine percentiles in the top decile, *Top10–1*, which we think of as the upper middle class group. The most plausible explanation for this finding is perhaps simply that the top percentile group has a larger share of their income tied to the actual development of the economy, while the following nine, as pointed out in much of the top income literature, are mainly highly salaried workers but with relatively limited bonus programs, stock options, and other performance related payments. Their capital income share is also significantly lower than that of the rich.[40] The unclear result for the

[40] One should of course note that some of these stylized facts have changed over time. For example, the capital share is less significant in the top today as compared to the beginning of the twentieth century. However, the characterization that the top percent is different from the following nine percent in income composition is still valid.

rest of the population is likely to reflect the heterogenous experiences within this group. Quantitatively the estimated effects suggest that an average growth rate of 10 percent, which seems reasonable over a five year period, increases the income share of the top percentile by about 0.6 percentage points (the mean of *Top1* is 10.6). As for the effects within top income earner, columns 7 and 8 shows an increase of approximately 0.03 (the mean of *Top1/10* is 0.45).

Financial development also turns out to have been pro-rich over the past century, with increases in total capitalization being significantly associated with increases in the top income percentile. Unlike the growth effects, however, the effect for the following nine percentiles is statistically insignificant, while the effect on the nine lowest deciles seems to be negative (although with varying degree of statistical certainty). It is not trivial to gauge the size of the estimated effects, but the following exercise can be useful. Increasing total capitalization by one standard deviation (0.5, or 50 percent of GDP), is related to an increase in income share of the top percentile by about 0.5 percentage points. As the mean income share of this group is about 10 percent, this effect is quite small. If we instead use the estimates from *within* the top decile (columns 7 and 8), we see that the same increase in is related to an increase in the income share of the top percentile by about 0.15. As the top percentile on average has an income share of 0.45 of the top90-99 group, this effect must be considered very large. In other words, financial development has large redistributive consequences within the group of high-income earners, but the consequences for the overall distribution of income are more limited.

Looking at the role of the state, the effects on inequality are in line with what one might expect. Central government expenditures increases the income share of the nine lowest deciles, decreases the share of the upper middle class group, but has no significant effect on the top percentile. Increasing central government spending by one standard deviation (about 0.07) is related to a reduction in the income share of the upper middle class by about 1.6 percentage points. As the average income share of this group is about 23 percent. The most surprising finding regarding the amount of government spending.is that the highest income earners appears to be unaffected.

Furthermore, top marginal taxes have a negative effect on the whole top group, both the top percentile and the following nine percentiles, while the effect for the lower nine deciles is strongly positive. As our income shares are *pre-tax* this suggests that high marginal tax rates have an equalizing effect beyond the direct impact of taxation, something which is not theoretically obvious.[41] The direct effects of taxation are relatively small. Increasing top marginal taxes from 50 to 70 percent (approximately one standard deviation), reduces the income share of the top percentile by 0.86 percentage points. Within the top decile, the same increase in taxes leads to a reduction of the earnings of the top percentile by 0.03 which should be compared to the mean of 0.45. However, when taking the cumulative effects of taxation into account may still be important in explaining changes in inequality. Appendix B contains results from simple simulations of the dynamic effects under different assumptions about capital accumulation in response to tax increases and shocks to the capital stock (as well as their combined effect).[42] Assuming that capital owners (overrepresented in the top of the distribution) use some of their capital to uphold consumption the tax increase will not only affect disposable income in the current period but also future (capital) income. Piketty and Saez (2006) argue that the tax increases in the 1940s and 1950s had precisely this type of effect when combined with the shocks to capital during World War II. Our stylized simulations show that tax increases in the order of magnitude that took place in many countries around the 1950s could indeed have important cumulative effects. For example, in response to a tax increase from 0.3 to 0.5, the income share of the top percentile would decrease from 15 percent to 14.2 percent in five periods (assuming they uphold consumption by decreasing savings). After ten periods it would be 13.5 percent and after 15 periods 12.6 percent. When combined with a shock to capital the numbers would be 12.3, 11.2, and 9.9 percent after 5, 10, and 15 periods respectively. As illustrated in Appendix B changing the consumption response or altering the level of tax increase or capital shock does not alter the basic insight: Small short term effects – of the size that we find in our panel estimation – can be significant over time through their effect on capital accumulation.

Finally, contrary to what is often asserted *openness,* i.e., the trade to GDP-ratio, is if anything negatively related to top income shares. As we include time fixed effects and

[41] See e.g., Atkinson (2004)

[42] These simulations are very similar to those in Piketty (2001b).

thereby control for any general changes in globalization it is still possible that while "general globalization" increases income inequality country specific trade openness does not. However, the mechanism behind such a result would be quite difficult to spell out.

6.2 Different effects depending on the level of economic development

As discussed in section 2, the effect of several variables on top income shares could theoretically be expected to depend on the level of economic development. In this section, we analyze this possibility by splitting the sample into three similar sized groups based on per capita GDP. Thereafter we interact these groups with the respective variable of interest. Table 2 presents the results from this exercise.

Overall, there is little evidence that the effect of GDP growth on top incomes depends on the level of development. The point estimates have the same signs and levels of significance in almost all cases and F-tests of equal coefficients across development groups are mostly not rejected.

When it comes to the effect of financial development depending on the level of economic development, however, a more interesting variation is observed. According to the basic idea of Greenwood and Jovanovic (1990), financial development should benefit the rich in early stages of development, but then spread to benefit everyone as the economy becomes more developed. Our results seem to be in line with this idea; the very richest among the top income earners benefit more from financial development especially at low levels of development. Note that once again it seems to be primarily the rest of the top decile (P90-99) that loose out on this development.

We also analyzed the effects on inequality coming from trade openness and central government spending over the level of economic development but could not find any observable differences and therefore suppress these results in our tables.

6.3 Are Anglo-Saxon countries different?

Based on the different developments from 1980 and onwards, it has been suggested that the evolution of top income shares in Anglo-Saxon countries differs from that of continental Europe.[44] Empirically speaking, there are two possibilities: Anglo-Saxon countries may either have had a different development in the underlying determinants of top income shares, or the response of top incomes to the underlying determinants differs – for some reason – between the two groups of countries. In Table 3, we address this issue by interacting a dummy variable indicating that a country is Anglo-Saxon with the main variables of interest.[45] We can then directly answer the question if the slope coefficients differ between Anglo-Saxon and other countries.

The results do not indicate any systematic distributional effects from either economic growth or trade openness that differ between the two country-groups. In a few cases the estimated coefficients are statistically significant, but they fail to provide a consistent pattern.[46] Another possibility that has been discussed in the literature is that the different groups of countries differ in their acceptance of inequality.[47] One, admittedly quite weak, way to test this hypothesis is to analyze if government spending is relatively pro-rich in Anglo-Saxon countries. When we interact government expenditures with the Anglo-Saxon indicator the interaction term is, however, not statistically significant (suppressed in the table). We can therefore not see any indication that the distributional impact of government spending is different in the two country groups.

6.4 Does type of financial system matter?

Anglo-Saxon countries tend to have more stock market based financial systems, while most of continental Europe and the rest of the world have relatively more bank based financial systems (see, e.g., Boot and Thakor, 1997, Allen and Gale, 2000, and Levine, 2005). Hence, if there are differences between these systems in terms of allocating capital and generate returns to savings that would give rise to differences in the relative size of capital income and hence the development of income inequality across Anglo-Saxon and other countries.[48]

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[44] See, e.g., Atkinson and Piketty (2007).
[45] Anglo-Saxon countries are Australia, Canada, New Zealand, the UK and the US.
[46] See, e.g., the negative effects of openness and growth in anglo-saxon countries on both *Bot90* and *Top01/1* while at the same time *Top1/10* in these countries is positively affected by openness.
[47] See, for example the discussion in Piketty and Saez (2005).
[48] As mentioned above, this difference is one of the main findings in the recent research on top incomes. Indeed, the title of the recent volume edited by Anthony Atkinson and Tomas Piketty, collecting much of this work is *Top Incomes over the Twentieth Century: A Contrast between European and English-Speaking Countries.*

In Table 4, we analyze this issue explicitly by breaking up our combined measure of financial development, total capitalization, into its components. In odd-numbered columns we use *Bank deposits* and in even-numbered columns we use *Stock market capitalization* to measure financial development. Besides their potentially differential effect on capital income shares, these alternatives are partly used due to a possibility of a rather mechanical relationship between the capital incomes of the rich and stock market capitalization. The main findings in Table 4 show, however, that there are no systematic differences in distributional influences across the two types of financial systems. While playing down both the role of a capital income differential and the possibility of a mechanical effect on income inequality, this result also complements to the previous section's findings on fairly small differences between Anglo-Saxon and other countries in this context.

6.5 Sample restrictions and robustness of the results

In Table 5, we conduct a set of robustness tests, based on sample restrictions and alternative measures used. The first restriction focuses on the post World War II-period, with all observations prior to 1945 dropped. The main reason for doing this is that the pre-war period includes the great depression era, during which the volatility of growth rates and changes in the income distribution were quite extreme. Further, top income shares declined rapidly during the Second World War, possibly for reasons unrelated to the economic forces we are analyzing. The main results are unchanged by this sample restriction.[50]

The second restriction is to drop Japan from the sample. One reason behind this exclusion is that we do not have data on the top decile for Japan and have replaced it with the top five percent, which affects most of our inequality metrics. Another reason is that Japan integrated with the world economy quite late compared to the other countries in the sample. It is therefore possible that the evolution of top incomes were affected by other factors than in other countries. However, excluding Japan does not change the main results.

[50] The change in the umber of observations between the two samples is larger when using *Bank deposits* to measure financial development. The results are, however, similar using this measure.

Finally, our third restriction is to replace the main marginal tax rate measure, *Margtax1*, by the alternative *Margtax2*, which is based solely on statutory top rates. The correlation between the two series 0.80 (in first differences), which is fairly high. Table 5 also reports basically the same negative relation between marginal taxes and income inequality as were reported in Table 1 for all income groups but the bottom nine decile where the relation is positive. Yet the alternate measure, *Margtax2*, produces notably smaller coefficient sizes as well as somewhat lower degrees of statistical significance. Overall, however, as a robustness check the switch of measures do not alter the conclusions drawn from our main analysis.

7 Conclusions

This paper set out to empirically analyze the long-run relationships between top income shares and financial development, trade openness, the size of government, and economic growth. While these relationships, of course, have been extensively studied before, the unique contribution of this paper lies in the long time period for which we have data. Combining findings from a number of recent studies on top incomes with other historical data, our results are based on developments over the whole of the twentieth century. Using a panel data approach allows us to take all unobservable time-invariant factors, as well as country specific trends into account.

Two findings stand out as being significant and robust across all specifications. First, economic growth seems to have been pro-rich over the twentieth century. More precisely, in times when a country has grown faster than average, top income earners have benefited more than proportionally. A likely reason for this result is simply that, top incomes are (and have been) more closely related to actual performance than incomes on average. This result is similar at different levels of development and is not different between Anglo-Saxon and other countries. Second, we also find financial development to have been pro-rich over the twentieth century. This effect is also similar in Anglo-Saxon countries and elsewhere, it does not depend on whether financial development is proxied using bank deposits or stock market capitalization (often said to be a difference between Continental Europe and Anglo-Saxon countries), *but* it seems to depend on economic development. In line with the model in Greenwood and

Jovanovic (1990) we find that the effect is strongest at relatively low levels of economic development.

When it comes to the much debated distributional effects of trade openness we do not find any evidence of this being disproportionately beneficial for top income earners on average. If anything the relationship is negative in some specifications. However, here there is a difference across groups of countries. Increased trade is associated with increased top incomes in Anglo-Saxon countries; but not in continental Europe. The difference is large enough to explain a substantial part of the different development of top incomes in the two country groups since 1980. While we can only speculate about the causes behind these different responses to trade, it is possible that labor market institutions might play a role.[51]

Finally, when it comes to government spending and top marginal tax rates these seem to have been equalizing as increases in both these variables are associated with disproportionate gains for the nine lowest deciles. Higher marginal tax rates have been negative for both the rich and the upper middle class, but interestingly government spending seems to have been neutral for the top percentile but negative for the next nine percentiles.

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[51] As has been documented by Botero et al (2004), countries of English legal origin have weaker employment protection, weaker trade unions, and weaker social security laws. All of these can affect the impact of trade on the distribution of income.

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Table 1. The determinants of top income shares

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	5.766***	6.416***	–8.783***	–6.902***	5.563**	–1.301	0.284***	0.358***	0.232***	0.257***
	(1.03)	(1.34)	(1.73)	(2.61)	(2.73)	(3.53)	(0.052)	(0.062)	(0.053)	(0.060)
ΔPop	–4.619	–12.98**	–0.567	–12.20	9.833	24.09**	–0.232	–0.660***	0.0242	–0.368*
	(5.03)	(5.62)	(6.31)	(8.04)	(11.5)	(12.0)	(0.22)	(0.22)	(0.21)	(0.22)
ΔGovspend	5.767	3.347	–16.28***	–23.40***	22.39***	23.96***	–0.101	0.116	–0.203	–0.252
	(4.62)	(4.66)	(4.99)	(7.11)	(8.53)	(8.89)	(0.18)	(0.19)	(0.20)	(0.21)
ΔFindev	0.985***	1.270***	0.156	0.193	–0.530	–1.890***	0.0333***	0.0626***	0.0189	0.0343***
	(0.32)	(0.30)	(0.33)	(0.44)	(0.62)	(0.66)	(0.011)	(0.012)	(0.012)	(0.012)
ΔOpenness	–8.833***	–2.459	–0.244	0.413	3.291	0.145	–0.00704	–0.0636	–0.0747	0.142
	(2.26)	(2.55)	(2.42)	(3.75)	(4.40)	(5.05)	(0.085)	(0.093)	(0.089)	(0.11)
ΔMargtax1		–4.344***		–3.223**		10.22***		–0.146***		–0.304***
		(1.21)		(1.56)		(2.21)		(0.045)		(0.050)
Obs	126	92	99	77	99	77	109	87	126	92
N countries	14	12	12	10	12	10	13	11	14	12

Notes: FDGLS estimations allowing for country specific AR(1) processes and heteroskedasticity in the error terms. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2. The effects at different levels of economic development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc		5.392***		–8.515***		4.921*		0.258***		0.171***
		(1.06)		(1.71)		(2.80)		(0.051)		(0.049)
ΔPop	–4.902	–5.859	–2.784	4.157	9.842	5.087	–0.255	–0.553**	0.0668	–0.0545
	(5.03)	(5.18)	(6.64)	(6.44)	(12.0)	(11.9)	(0.22)	(0.24)	(0.22)	(0.22)
ΔGovspend	3.381	5.752	–17.79***	–18.87***	23.87***	23.37***	–0.185	0.0143	–0.162	–0.289
	(4.72)	(4.65)	(5.39)	(4.83)	(9.15)	(8.56)	(0.18)	(0.17)	(0.21)	(0.19)
ΔFindev	1.051***		0.204		–0.553		0.0350***		0.0163	
	(0.33)		(0.33)		(0.63)		(0.012)		(0.013)	
ΔOpenness	–9.147***	–8.494***	–0.344	–0.783	3.795	3.964	–0.0115	0.0426	–0.0595	–0.0302
	(2.26)	(2.26)	(2.45)	(2.31)	(4.44)	(4.42)	(0.084)	(0.086)	(0.091)	(0.087)
ΔGDPpc×Lowdev	5.037***		–9.016***		4.560		0.321***		0.231***	
	(1.13)		(2.08)		(3.27)		(0.056)		(0.056)	
ΔGDPpc×Meddev	6.373***		–7.319***		5.980		0.236***		0.216***	
	(1.50)		(2.40)		(3.98)		(0.067)		(0.072)	
ΔGDPpc×Highdev	2.449		–9.773***		8.332*		0.143*		0.279***	
	(2.26)		(2.69)		(4.43)		(0.084)		(0.10)	
ΔFindev×Lowdev		1.672*		–3.274**		2.084		0.161***		0.141***
		(0.94)		(1.37)		(2.06)		(0.036)		(0.037)
ΔFindev×Meddev		0.878*		0.329		–1.015		0.0263*		0.0123
		(0.52)		(0.63)		(0.99)		(0.015)		(0.018)
ΔFindev×Highdev		0.864*		0.379		–0.868		0.00791		0.00219
		(0.44)		(0.37)		(0.79)		(0.016)		(0.017)
F-test: Low=Med[a]	0.31	0.45	0.52	0.02	0.74	0.18	0.17	0.00	0.83	0.00
F-test: Low=High[a]	0.25	0.42	0.80	0.01	0.45	0.18	0.03	0.00	0.62	0.00
F-test: Med=High[a]	0.07	0.98	0.34	0.94	0.59	0.90	0.22	0.36	0.50	0.67
Obs	126	126	99	99	99	99	109	109	126	126
N countries	14	14	12	12	12	12	13	13	14	14

Notes: Interactions between low, medium and high GDP per capita and ΔGDPpc and ΔFindev. See also the notes of Table 1. [a] P-value of an F-test of equality of coefficients.

Table 3: Are Anglo-Saxon countries different?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	5.616***	5.496***	–9.442***	–9.212***	7.532**	6.808**	0.259***	0.281***	0.304***	0.236***
	(1.13)	(1.04)	(1.98)	(1.73)	(3.03)	(2.71)	(0.058)	(0.051)	(0.057)	(0.054)
ΔPop	–4.786	–4.421	–0.291	1.789	8.245	0.555	–0.283	–0.100	–0.00320	0.0534
	(5.06)	(4.94)	(6.29)	(6.42)	(11.3)	(11.3)	(0.22)	(0.22)	(0.21)	(0.21)
ΔGovspend	5.866	5.645	–15.61***	–16.78***	20.40**	23.91***	–0.0819	–0.0357	–0.276	–0.247
	(4.63)	(4.61)	(4.91)	(5.00)	(8.32)	(8.38)	(0.17)	(0.17)	(0.19)	(0.18)
ΔFindev	0.996***	0.983***	0.176	0.183	–0.592	–0.435	0.0343***	0.0324***	0.0183	0.0177
	(0.32)	(0.31)	(0.33)	(0.33)	(0.63)	(0.62)	(0.012)	(0.011)	(0.012)	(0.012)
ΔOpenness	–8.836***	–9.906***	0.412	–1.509	1.114	6.109	0.00701	–0.0621	–0.0541	0.145
	(2.26)	(2.42)	(2.69)	(2.50)	(4.57)	(4.33)	(0.087)	(0.092)	(0.089)	(0.11)
ΔGDPpc×Anglo-Saxon	0.421		1.954		–6.617*		0.0504		–0.197***	
	(1.59)		(2.27)		(3.52)		(0.067)		(0.066)	
ΔOpenness×Anglo-Saxon		3.084		5.965		–16.49***		0.265**		–0.292***
		(2.56)		(3.98)		(6.18)		(0.11)		(0.099)
Obs	126	126	99	99	99	99	109	109	126	126
N countries	14	14	12	12	12	12	13	13	14	14

Notes: Interacting a dummy for Anglo-Saxon countries (Australia, Canada, New Zealand, U.K. and U.S.) and ΔGDPpc and ΔOpenness. See also the notes of Table 1.

Table 4. Does type of financial system matter?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	4.617***	5.585***	–9.205***	–8.606***	6.155***	5.577**	0.184***	0.275***	0.155***	0.229***
	(0.96)	(1.12)	(1.35)	(1.73)	(2.04)	(2.73)	(0.040)	(0.054)	(0.042)	(0.054)
ΔPop	0.998	–4.880	3.361	–1.071	–6.925	9.532	0.106	–0.203	–0.0162	0.0674
	(3.45)	(5.27)	(5.07)	(6.32)	(7.42)	(11.6)	(0.11)	(0.22)	(0.14)	(0.22)
ΔGovspend	2.931	4.426	–15.43***	–16.01***	19.30**	23.26***	–0.207	–0.135	–0.472**	–0.240
	(4.58)	(4.78)	(5.20)	(5.03)	(7.59)	(8.56)	(0.17)	(0.18)	(0.18)	(0.20)
ΔOpenness	–1.965	–8.334***	–0.355	–0.325	2.366	3.043	–0.0660	0.0174	–0.0687	–0.0661
	(1.34)	(2.33)	(1.67)	(2.42)	(2.60)	(4.39)	(0.048)	(0.086)	(0.045)	(0.089)
ΔBankdeposits	3.006***		0.296		–3.391**		0.0982***		0.119***	
	(0.80)		(0.89)		(1.37)		(0.028)		(0.031)	
ΔMarketcap		0.876**		0.329		–0.693		0.0276**		0.0101
		(0.38)		(0.39)		(0.71)		(0.013)		(0.014)
Obs	168	128	129	101	129	101	140	109	167	128
N countries	16	15	13	13	13	13	14	13	16	15

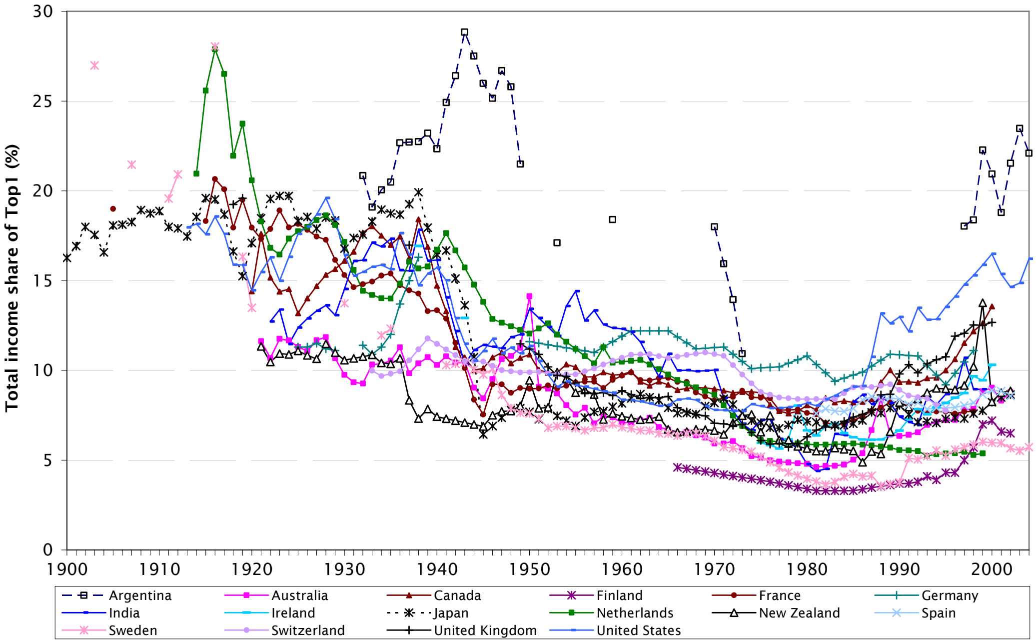
Note: Splitting up Findev into the GDP shares of total bank deposits (Bankdeposits) and stock market capitalization (Marketcap). See also the notes of Table 1.

Table 5. Sample restrictions and alternative measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Δtop1	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1	Δtop01/1
ΔGDPpc	5.159***	6.858***	6.372***	–7.031***	–8.783***	–9.981***	4.462*	5.563**	6.691**	0.265***	0.402***	0.329***	0.263***	0.327***	0.186***
	(1.02)	(1.12)	(1.31)	(1.84)	(1.73)	(1.95)	(2.55)	(2.73)	(2.78)	(0.057)	(0.060)	(0.052)	(0.052)	(0.061)	(0.060)
ΔPop	–7.645	–9.627	–4.456	–5.368	–0.567	–12.42*	6.978	9.833	32.10***	–0.309	–0.135	–0.578**	–0.0936	–0.363	0.166
	(5.09)	(5.96)	(5.24)	(6.52)	(6.31)	(6.94)	(11.1)	(11.5)	(11.2)	(0.23)	(0.23)	(0.23)	(0.21)	(0.23)	(0.24)
ΔGovspend	–1.494	3.476	13.41***	–17.04***	–16.28***	–17.02***	31.57***	22.39***	17.11**	–0.194	0.0447	0.134	–0.667***	–0.336	0.0317
	(4.23)	(5.07)	(4.98)	(4.98)	(4.99)	(6.40)	(8.14)	(8.53)	(8.66)	(0.18)	(0.18)	(0.19)	(0.18)	(0.21)	(0.22)
ΔFindev	0.627**	0.918***	1.250***	0.363	0.156	–0.00766	–0.720	–0.530	–1.294*	0.0348***	0.0369***	0.0554***	0.0180*	0.0243*	0.0213
	(0.28)	(0.35)	(0.32)	(0.31)	(0.33)	(0.42)	(0.58)	(0.62)	(0.67)	(0.012)	(0.012)	(0.012)	(0.011)	(0.013)	(0.014)
ΔOpenness	–0.780	–9.382***	–8.350***	–0.00979	–0.244	0.767	–0.0103	3.291	1.048	0.00474	–0.0160	–0.0457	0.0727	–0.100	–0.0606
	(2.34)	(2.35)	(2.53)	(2.57)	(2.42)	(3.19)	(4.26)	(4.40)	(4.57)	(0.090)	(0.091)	(0.092)	(0.096)	(0.090)	(0.097)
ΔMargtax2			–2.232**			–3.464***			6.589***			–0.0506			–0.135***
			(1.00)			(1.14)			(1.71)			(0.036)			(0.046)
Restriction	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2
Obs	112	114	103	93	99	82	93	99	82	103	99	92	112	114	103
N countries	14	13	12	12	12	10	12	12	10	13	12	11	14	13	12

Note: Postwar = sample is 1945 onwards, ~Japan = Japan excluded from sample and Margtax2 = Margtax2 replaces Margtax1. See also the notes of Table 1.

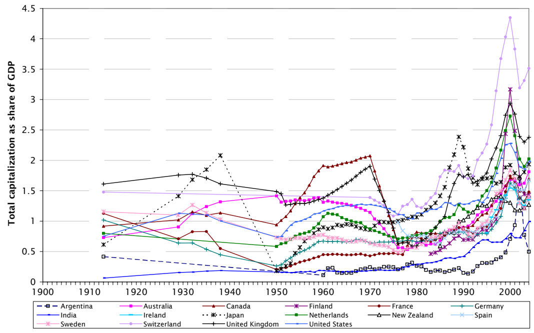
Figure 1: Top income percentile for 16 countries over the twentieth century.



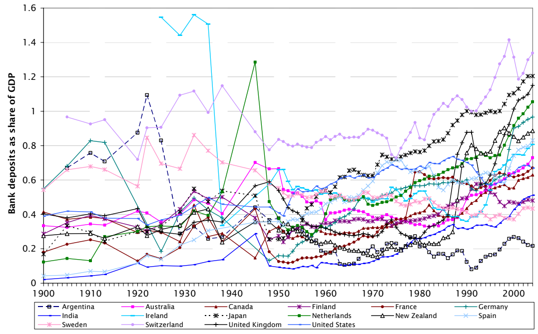
Source: See Table A2.

Figure 2: Variables included in the regression analysis, all countries, 1900–2000.

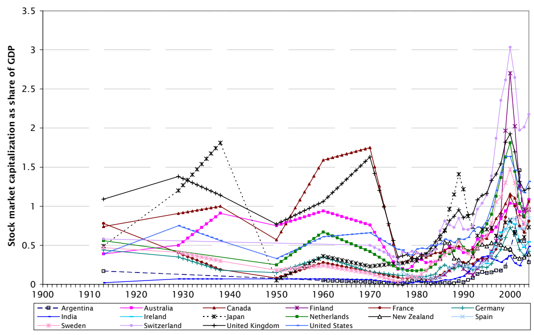
a) Total capitalization



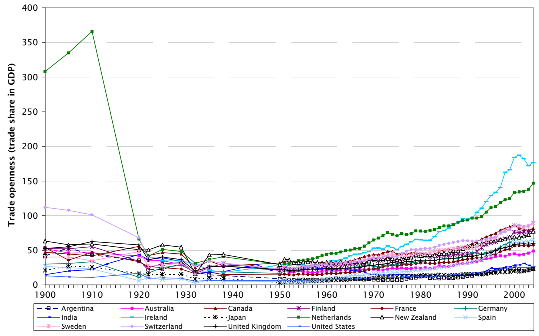
b) Bank deposits



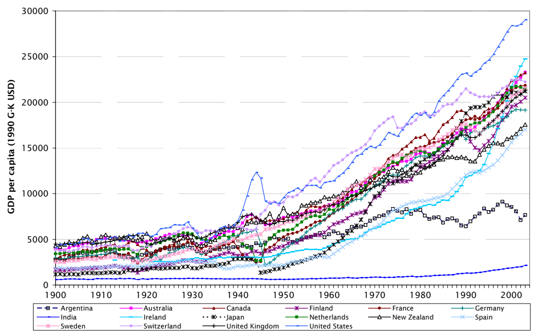
c) Stock market capitalization



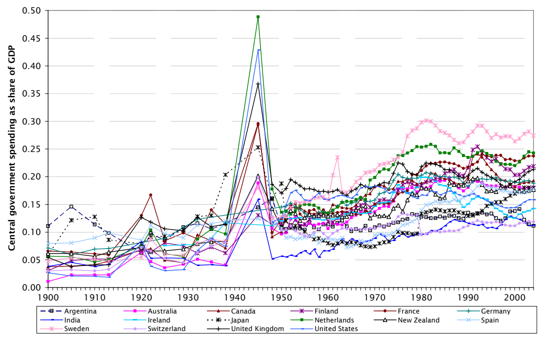
d) Trade openness



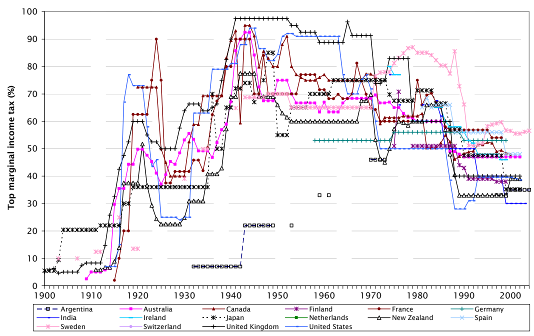
e) GDP per capita



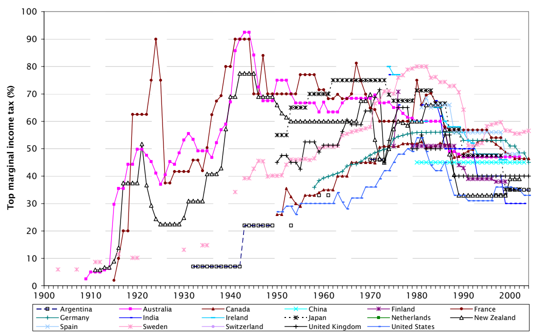
f) Government spending



g) Top marginal tax rate 1



h) Top marginal tax rate 2



Appendix A: Definitions and sources

Table A1: Variable definition

Variable	Variable definition	Source
Top1	Share of total income earned by those with the 1% highest incomes (P99–100).	See Table A2.
Top10–1	Income share of top 10% less share of top 1% (P90–99).	See Table A2.
Bot90	Income share of bottom nine deciles of the entire income distribution (P0–90).	See Table A2.
Top1/10	Top1/Top10–1 (P99–100/P90–99).	See Table A2.
Top01/1	Income share of top 0.1% divided by income share earned by the rest of top 1% (P99.9–100/P99–99.9).	See Table A2.
Findev	Financial development: Total capitalization as the sum of Bankdeposits and Marketcap.	-1950: Mitchell, RZ, Bordo; 1950-: IFS, FSD, RZ.
Bankdeposits	Bank deposits: Share of commercial and savings bank deposits in GDP.	-1950: Mitchell, Bordo; 1950-: IFS, FSD.
Marketcap	Stock market capitalization: Market value of publicly listed stocks divided by GDP.	-1975: RZ; 1975-: IFS, FSD.
Openness	Trade openness: Imports plus exports divided by GDP.	-1950: Mitchell, LM, Bordo; 1950-: IFS, FSD.
Govspend	Central government expenditure divided by GDP.	-1950: Mitchell, RS, Bordo; 1950-: IFS, FSD.
Margtax1	Top marginal tax rate: Margtax2 except for Germany, Japan, Sweden, UK and US where it is calculated for incomes ≈ 5×GDPpc.	Table A2, OECD, BCS, RW and RSS.
Margtax2	Top marginal tax rate (statutory top rates)	Table A2, OECD
GDPpc	GDP per capita	Maddison (2006)
Pop	Population	Maddison (2006)

Note: BCS = Bach, Corneo and Steiner (2005); Bordo = Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001); FSD = Financial Structure Database; IFS = International Financial Statistics; LM = López-Córdoba and Meissner (2005); Mitchell = Mitchell (1995, 1998a, 1998b); OECD = OECDE world tax database; RS = Rousseau and Sylla (2003); RSS = Rydqvist, Spizman and Strebulaev (2007); RW = Roine and Waldenström (2006), RZ = Rajan and Zingales (2003).

Table A2: Income inequality data*

Country	Source	Full sample period	No. of 5-year periods in... Top10_1	Top1	Top10_01
Argentina	Alvaredo (2006)	1932-73[a],1997-2004	0	9	0
Australia	Atkinson and Leigh (2007a)	1921-2002	13	17	13
Canada	Saez and Veall (2005)	1920-2001	13	17	13
Finland	Riiehlä et al. (2005)	1966-85[a],1990-2002	8	8	7
France	Piketty (2003)	1915-1998	18	18	18
Germany	Dell (2007)	1925-38,1944-98	13	13	13
India	Banerjee and Piketty (2005)	1922-1999	0	16	0
Ireland	Nolan (2007)	1938,-43,-65,1973-2000	8	8	8
Japan	Moriguchi and Saez (2007)	1886-2002	17[b]	21	17[b]
Netherlands	Atkinson and Salverda (2005)	1914-1999	17	17	17
New Zealand	Atkinson and Leigh (2007b)	1921-2002	17	17	17
Spain	Alvaredo and Saez (2006)	1981-2002	5	5	5
Sweden	Roine and Waldenström (2007)	1903-35[a],1941-2004	20	20	20
Switzerland	Dell et al. (2007)	1933-1996	14	14	14
United Kingdom	Atkinson and Salverda (2005)	1908-1999	14	14	14
United States	Piketty and Saez (2003)	1913-2002	18	19	18

[a] There are years with missing values in this subperiod

[b] The shares-within-shares data for Japan is based on the top five percent (P95–100).

[*] Due to data limitations for some of the variables, the actual country coverage for the main specifications is shown in Table A3.

Table A3. Actual country sample for main regressions

	Top10_1		Top 1		Top 10_1 (w/ taxes)[b]	
	DFD	FDGLS	DFD	FDGLS	DFD	FDGLS
Argentina[a]			X	X		
Australia	X	X	X	X	X	X
Canada	X	X	X	X	X	X
Finland	X	X	X	X	X	X
France	X	X	X	X	X	X
Germany	X	X	X	X	X	X
India			X	X		
Ireland	X		X			
Japan	X	X	X	X	X	X
Netherlands	X	X	X	X		
New Zealand	X	X	X	X	X	X
Spain	X	X	X	X	X	X
Sweden	X	X	X	X	X	X
Switzerland	X	X	X	X		
UK	X	X	X	X	X	X
US	X	X	X	X	X	X

[a] Argentina is included in the non-reported regressions using Top 1 as the dependent variable and *Bank deposits* as the measure of financial development.

[b] Sample of countries for which top marginal taxes data are also available.

Appendix B: Simulations of dynamic effects of taxation and shocks to capital

The tables below show the cumulative effects on top incomes from increases in taxation and shocks to the capital stock under very stylized assumptions. In all cases we assume that there are two groups of income earners; a top group that derives half their income from capital (the rate of return is assumed to be 5 percent) and the other half from wages, while the rest only have a wage income. Initially the income share of the top group is 15 percent of all income and their consumption is such that their capital stock remains unchanged. These assumptions are of course not calibrated to fit a particular economy but they are at the same time approximate representations of the relationship between the top percentile and the rest of the population, both in terms of the importance of capital (with a broad interpretation) and the income share around World War II.

Gross wage income is assumed to be unchanged when taxes change implying that the (gross) income remains the same over time but they are forced to alter consumption in accordance with tax increases (alternatively one could think of this as a case where their effective consumption can be maintained through taxes being redistributed back to them). The rich group, however, can consume part of their capital stock so as to maintain their consumption level. This of course erodes their capital stock, giving rise to a decreasing capital income share, and also a lower top income share overall.

Table A4 shows the effects of a tax increase from 0.3 to 0.5 in period 0 (columns 1-3), the effects of a shock to the capital stock causing 30 percent of it to disappear in period 0 (columns 4-6) and finally the combined effect of these changes given that the rich group does not alter consumption. With respect to the effects of taxation it illustrates that a one time change can have a small effect in the short run but through its cumulative effect can be important over time. The effect on the top income share from one period to the next is only 0.13 percentage points, but over 5 periods it has grown to almost 0.7 percentage points, and after 25 periods the effect is almost 5 percentage points.

Cumulative effect of one time changes affecting capital accumulation and capital income (percent changes)

Period	Tax increase only			Shock to the capital stock only			Combined tax increase and shock to the capital stock		
	(1) Remaining capital stock	(2) Capital income share	(3) Top income share	(4) Remaining capital stock	(5) Capital income share	(6) Top income share	(7) Remaining capital stock	(8) Capital income share	(9) Top income share
0	100.0	50.0	15.00	100.0	50.0	15.00	100.0	50.0	15.00
1	98.0	49.5	14.87	70.0	41.2	13.04	70.0	41.2	13.04
2	96.0	49.0	14.74	69.0	40.8	12.97	67.3	40.2	12.86
3	93.8	48.4	14.61	67.9	40.4	12.90	64.4	39.2	12.67
4	91.7	47.8	14.47	66.7	40.0	12.83	61.5	38.1	12.48
5	89.5	47.2	14.32	65.6	39.6	12.75	58.6	36.9	12.27
6	87.2	46.6	14.18	64.4	39.2	12.67	55.5	35.7	12.07
7	84.9	45.9	14.03	63.1	38.7	12.58	52.4	34.4	11.86
8	82.5	45.2	13.87	61.8	38.2	12.50	49.2	33.0	11.64
9	80.1	44.5	13.71	60.5	37.7	12.40	46.0	31.5	11.41
10	77.6	43.7	13.55	59.1	37.2	12.31	42.6	29.9	11.18
11	75.0	42.9	13.38	57.7	36.6	12.21	39.2	28.2	10.94
12	72.4	42.0	13.20	56.2	36.0	12.11	35.7	26.3	10.69
13	69.7	41.1	13.02	54.7	35.3	12.01	32.1	24.3	10.44
14	67.0	40.1	12.84	53.1	34.7	11.90	28.4	22.1	10.17
15	64.1	39.1	12.65	51.4	34.0	11.79	24.6	19.7	9.90
16	61.2	38.0	12.46	49.7	33.2	11.67	20.7	17.1	9.62
17	58.3	36.8	12.25	48.0	32.4	11.55	16.7	14.3	9.34
18	55.2	35.6	12.05	46.2	31.6	11.42	12.6	11.2	9.04
19	52.1	34.3	11.83	44.3	30.7	11.29	8.4	7.8	8.73
20	48.9	32.8	11.61	42.3	29.7	11.16	4.1	4.0	8.42
21	45.6	31.3	11.39	40.3	28.7	11.02	0	0	8.11
22	42.3	29.7	11.15	38.2	27.7	10.87	0	0	8.11
23	38.8	28.0	10.91	36.1	26.5	10.72	0	0	8.11
24	35.3	26.1	10.67	33.8	25.3	10.56	0	0	8.11
25	31.7	24.1	10.41	31.5	24.0	10.40	0	0	8.11

In period 0 there is a one time change which has cummulative effects. Columns (1)-(3) show the effects of a tax increase from 30 to 50 percent, columns (4)-(6) the effects of a shock to the capital stock such that it decreases to 70 percent of it's initial value, and columns (7)-(9) show the effects of these two changes in combination.

Table A5 shows the results of the same exercise but changing the increases in taxation up and down and also changing the size of the capital shock, as well as when consumption is changed. The results are intuitively clear: higher tax increases cause the capital to shrink faster as does larger shocks to capital under the assumption that consumption is to remain unchanged and decreasing consumption can lead to a recovery of the capital stock. Again what is important to note is the potential cumulative effect of taxation when interpreting our coefficients.

Cumulative effects of different changes to taxes and the capital stock (percent changes)

	Tax increase			Shock to the capital stock			Combined tax increase and shock to the capital stock		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period	Remaining capital stock	Capital income share	Top income share	Remaining capital stock	Capital income share	Top income share	Remaining capital stock	Capital income share	Top income share
0	100.0	50.0	15.00	100.0	50.0	15.00	100.0	50.0	15.00
	Tax increase from 0.3 to 0.4			Capital shock, 90 remaining			Combined effect		
5	95.8	48.9	14.73	88.5	47.0	14.26	84.6	45.8	14.00
10	89.8	47.3	14.35	86.4	46.3	14.12	76.8	43.4	13.49
15	82.9	45.3	13.90	83.8	45.6	13.96	67.8	40.4	12.90
20	74.9	42.8	13.37	80.8	44.7	13.76	57.3	36.4	12.19
25	67.5	40.3	12.88	77.9	43.8	13.57	47.8	32.3	11.54
	Tax increase from 0.3 to 0.6			Capital shock, 50 remaining			Combined effect		
5	87.6	46.7	14.20	42.6	29.9	11.18	33.5	25.1	10.54
10	70.7	41.4	13.09	31.9	24.2	10.42	11.0	9.9	8.92
15	52.1	34.2	11.83	19.1	16.0	9.51	0	0	8.11
20	31.5	23.9	10.40	3.9	3.7	8.40	0	0	8.11
25	8.7	8.0	8.75	0	0	8.11	0	0	8.11
	Changing consumption to 0.9 of previous level								
	Tax increase from 0.3 to 0.5			Capital shock, 70 remaining			Combined effect		
5	96.5	49.1	14.78	70.5	41.3	13.08	63.4	38.8	12.60
10	92.6	48.1	14.52	72.1	41.9	13.18	55.1	35.5	12.04
15	88.1	46.8	14.23	74.0	42.5	13.31	45.7	31.4	11.39
20	83.0	45.3	13.90	76.2	43.2	13.46	35.0	25.9	10.64
25	77.2	43.6	13.52	78.9	44.1	13.63	23.0	18.7	9.79
	Changing consumption to 0.7 of previous level								
	Tax increase from 0.3 to 0.5			Capital shock, 70 remaining			Combined effect		
5	Consumption decrease exceeds tax increase			79.0	44.1	13.64	71.8	41.8	13.16
10				94.2	48.5	14.63	76.4	43.3	13.47
15	Capital stock grows			Capital stock recovered			81.5	44.9	13.81
20							87.3	46.6	14.19
25							93.9	48.4	14.61

Appendix C: Results using Dynamic First Differences (DFD)

Table C1. The determinants of top income shares

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	6.026***	6.921***	–10.44***	–8.084*	4.599	1.767	0.293***	0.355***	0.208	0.336**
	(1.85)	(1.83)	(3.03)	(4.79)	(3.75)	(5.46)	(0.098)	(0.12)	(0.14)	(0.16)
ΔPop	–14.15	–16.75*	–8.161	–11.36	25.17	35.59**	–0.681*	–0.900**	0.107	–0.329
	(8.99)	(8.81)	(9.18)	(9.49)	(15.6)	(14.2)	(0.35)	(0.36)	(0.30)	(0.31)
ΔGovspend	5.290	9.779	–20.46***	–22.71**	28.91***	24.43*	0.0257	0.241	–0.139	0.140
	(7.63)	(7.72)	(7.29)	(9.45)	(9.69)	(12.9)	(0.27)	(0.34)	(0.40)	(0.51)
ΔFindev	1.045*	1.354***	0.0314	0.0581	–1.126	–1.643**	0.0447**	0.0715***	0.00924	0.00396
	(0.56)	(0.42)	(0.41)	(0.45)	(0.69)	(0.64)	(0.019)	(0.019)	(0.020)	(0.017)
ΔOpenness	–7.187	–0.431	0.703	4.092	–0.949	–3.967	0.0414	–0.0501	–0.0000176	0.246
	(4.57)	(3.00)	(3.73)	(5.49)	(5.35)	(7.26)	(0.13)	(0.14)	(0.12)	(0.16)
ΔMargtax1		–5.615***		–4.991*		11.37***		–0.136		–0.299***
		(1.72)		(2.75)		(3.94)		(0.083)		(0.096)
Δ2top1	–0.0262	–0.0198								
	(0.12)	(0.18)								
Δ2top10-1			0.206	0.237						
			(0.13)	(0.15)						
Δ2bot90					0.203*	0.284**				
					(0.11)	(0.11)				
Δ2top1/10							0.0616	–0.00757		
							(0.14)	(0.21)		
Δ2top01/1									0.164	0.0879
									(0.13)	(0.18)
Obs	123	91	96	76	96	76	106	86	123	91
R–squared	0.54	0.68	0.53	0.49	0.58	0.67	0.71	0.64	0.59	0.62

Notes: DFD estimations which allow for heteroskedasticity in the error terms. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C2. The effects at different levels of economic development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc		5.970***		–10.83***		5.056		0.276***		0.187
		(1.92)		(3.01)		(3.77)		(0.090)		(0.13)
ΔPop	–14.82	–15.78*	–7.894	–3.040	23.85	24.32	–0.665*	–0.948**	0.100	–0.152
	(9.08)	(8.89)	(9.20)	(11.4)	(15.7)	(17.7)	(0.37)	(0.37)	(0.30)	(0.29)
ΔGovspend	3.166	5.597	–21.10***	–21.95***	30.99***	29.42***	–0.0418	0.184	–0.167	–0.0878
	(7.85)	(7.76)	(7.77)	(7.51)	(10.1)	(10.4)	(0.30)	(0.27)	(0.38)	(0.39)
ΔFindev	1.094*		0.0507		–1.178		0.0466**		0.0102	
	(0.59)		(0.42)		(0.72)		(0.020)		(0.019)	
ΔOpenness	–7.632	–7.260	0.833	0.442	–1.635	–0.934	0.0284	0.0947	–0.00380	–0.000574
	(4.61)	(4.66)	(3.89)	(3.77)	(5.50)	(5.54)	(0.13)	(0.13)	(0.11)	(0.12)
ΔGDPpc×Lowdev	5.838***		–9.625**		1.466		0.329**		0.221	
	(1.86)		(3.71)		(4.73)		(0.12)		(0.16)	
ΔGDPpc×Meddev	6.886***		–10.72***		6.391		0.271***		0.167	
	(2.30)		(3.43)		(4.31)		(0.096)		(0.12)	
ΔGDPpc×Highdev	4.087		–11.93***		9.871*		0.162		0.135	
	(3.52)		(4.05)		(5.81)		(0.14)		(0.13)	
ΔFindev×Lowdev		1.747		–1.970		–0.678		0.211***		0.116**
		(1.39)		(2.13)		(3.00)		(0.056)		(0.058)
ΔFindev×Meddev		1.286**		–0.215		–0.776		0.0301*		0.0110
		(0.54)		(0.59)		(0.82)		(0.018)		(0.020)
ΔFindev×Highdev		0.739		0.706		–1.560		0.0300		–0.0103
		(0.75)		(0.51)		(0.99)		(0.024)		(0.036)
Δ2top1	–0.0189	–0.0174								
	(0.12)	(0.12)								
Δ2top10-1			0.217	0.207						
			(0.15)	(0.13)						

Δ2bot90					0.236**	0.199*				
					(0.11)	(0.11)				
Δ2top1/10							0.0509	0.0592		
							(0.16)	(0.12)		
Δ2top01/1									0.158	0.162
									(0.14)	(0.12)
F-test: Low=Med[a]	0.56	0.74	0.73	0.45	0.17	0.97	0.67	0.00	0.60	0.06
F-test: Low=High[a]	0.64	0.48	0.60	0.23	0.20	0.77	0.24	0.00	0.60	0.10
F-test: Med=High[a]	0.40	0.49	0.70	0.21	0.50	0.51	0.29	0.99	0.79	0.61
Obs	123	123	96	96	96	96	106	106	123	123
R–squared	0.55	0.55	0.53	0.54	0.59	0.59	0.71	0.74	0.59	0.60

Notes: Interactions between low, medium and high GDP per capita and ΔGDPpc and ΔFindev. See also the notes of Table 1. [a] P-value from an F-test of equality of coefficients.

Table C3: Are Anglo–Saxon countries different?

	(1)	(2)	(4)	(5)	(7)	(8)	(10)	(12)	(13)	(14)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	6.172***	5.925***	–9.727***	–10.74***	3.336	6.024	0.279**	0.262***	0.231	0.227
	(1.85)	(1.82)	(3.52)	(3.15)	(4.51)	(3.89)	(0.12)	(0.094)	(0.17)	(0.15)
ΔPop	–14.10	–13.86	–8.433	–7.176	25.48	20.80	–0.681*	–0.583*	0.121	0.0572
	(9.19)	(8.70)	(9.26)	(9.75)	(15.7)	(16.3)	(0.35)	(0.34)	(0.31)	(0.31)
ΔGovspend	4.994	5.417	–21.16***	–20.74***	30.34***	30.37***	0.0321	–0.0273	–0.170	–0.159
	(6.94)	(7.46)	(7.38)	(7.28)	(10.3)	(9.72)	(0.27)	(0.26)	(0.36)	(0.37)
ΔFindev	1.032*	1.044*	0.0228	0.0193	–1.103	–1.071	0.0451**	0.0420**	0.00785	0.00950
	(0.56)	(0.56)	(0.40)	(0.41)	(0.67)	(0.69)	(0.019)	(0.018)	(0.020)	(0.019)
ΔOpenness	–7.178	–7.707	–0.0267	0.204	0.212	1.311	0.0621	–0.0401	0.00139	0.0948
	(4.60)	(4.89)	(4.14)	(3.88)	(5.75)	(5.27)	(0.13)	(0.14)	(0.12)	(0.19)
ΔGDPpc× Anglo-Saxon	–0.580		–2.000		3.148		0.0519		–0.0857	
	(3.99)		(3.37)		(4.56)		(0.12)		(0.13)	
ΔOpenness×Anglo-Saxon		1.116		2.179		–9.919*		0.317**		–0.203
		(6.23)		(4.62)		(5.66)		(0.15)		(0.20)
Δ2top1	–0.0311	–0.0253								
	(0.12)	(0.12)								
Δ2top10-1			0.217	0.210						
			(0.14)	(0.14)						
Δ2bot90					0.198*	0.218*				
					(0.11)	(0.11)				
Δ2top1/10							0.0819	0.0740		
							(0.18)	(0.14)		
Δ2top01/1									0.139	0.157
									(0.15)	(0.13)
Obs	123	123	96	96	96	96	106	106	123	123
R–squared	0.55	0.55	0.53	0.53	0.59	0.59	0.71	0.72	0.59	0.59

Notes: Interacting a dummy for Anglo–Saxon countries (Australia, Canada, New Zealand, U.K. and U.S.) and ΔGDPpc and ΔOpenness. See also the notes of Table 1.

Table C4. Does type of financial system matter?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1
ΔGDPpc	4.124**	6.024***	–8.106***	–10.50***	4.576	4.283	0.242***	0.303***	0.154	0.202
	(1.80)	(1.86)	(2.86)	(3.07)	(4.36)	(3.77)	(0.080)	(0.10)	(0.11)	(0.14)
ΔPop	–1.716	–14.44	–5.544	–8.569	5.301	25.08	0.0886	–0.634	0.273	0.140
	(7.25)	(9.29)	(6.48)	(9.32)	(9.92)	(16.7)	(0.22)	(0.38)	(0.22)	(0.31)
ΔGovspend	–1.513	6.288	–21.82***	–21.09***	33.26***	28.17***	–0.116	0.0215	–0.203	–0.133
	(6.64)	(7.71)	(7.42)	(7.41)	(10.7)	(9.70)	(0.27)	(0.27)	(0.37)	(0.40)
ΔOpenness	–3.759	–5.113	–2.166	–0.456	6.835*	–0.907	–0.130**	0.0665	–0.00499	0.0655
	(2.35)	(3.80)	(2.05)	(2.42)	(3.48)	(3.54)	(0.065)	(0.082)	(0.069)	(0.10)
Dbankdeposits	2.506		1.813		–5.155*		0.132**		0.0537	
	(1.61)		(1.45)		(2.64)		(0.051)		(0.048)	
Dsmcap		1.018*		–0.132		–0.768		0.0307*		0.00180
		(0.54)		(0.45)		(0.63)		(0.017)		(0.021)
Δ2top1	0.0201	–0.0416								
	(0.076)	(0.12)								
Δ2top10-1			0.148	0.200						
			(0.11)	(0.13)						
Δ2bot90					0.172*	0.190*				
					(0.099)	(0.11)				
Δ2top1/10							0.0263	0.0620		
							(0.13)	(0.14)		
Δ2top01/1									–0.00582	0.159
									(0.11)	(0.13)
Obs	153	125	120	98	120	98	130	108	152	125
R–squared	0.52	0.53	0.52	0.54	0.54	0.59	0.63	0.69	0.57	0.58

Note: Splitting up Findev into the GDP shares of total bank deposits (Bankdeposits) and stock market capitalization (Marketcap). See also the notes of Table 1.

Table C5. Sample restrictions and alternative measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Δtop1	Δtop1	Δtop1	Δtop10-1	Δtop10-1	Δtop10-1	Δbot90	Δbot90	Δbot90	Δtop1/10	Δtop1/10	Δtop1/10	Δtop01/1	Δtop01/1	Δtop01/1
ΔGDPpc	5.240***	6.924***	6.753***	–9.287***	–10.44***	–9.748**	2.506	4.599	4.454	0.294**	0.456***	0.328***	0.238	0.240	0.265*
	(1.83)	(2.48)	(1.59)	(3.39)	(3.03)	(4.06)	(4.18)	(3.75)	(4.48)	(0.12)	(0.12)	(0.10)	(0.17)	(0.18)	(0.14)
ΔPop	–13.28	–24.32**	–5.679	–7.215	–8.161	–8.559	23.50	25.17	30.13*	–0.683*	–0.559	–0.825**	–0.143	–0.252	0.141
	(8.65)	(10.9)	(8.18)	(8.95)	(9.18)	(10.4)	(15.2)	(15.6)	(16.8)	(0.35)	(0.41)	(0.37)	(0.32)	(0.34)	(0.35)
ΔGovspend	2.334	3.099	15.96**	–20.36***	–20.46***	–17.77*	28.91***	28.91***	17.79	0.0161	0.0303	0.260	–0.334	–0.146	0.386
	(6.47)	(8.78)	(7.56)	(7.25)	(7.29)	(9.17)	(9.90)	(9.69)	(12.2)	(0.26)	(0.28)	(0.36)	(0.39)	(0.43)	(0.50)
ΔFindev	0.741	1.009*	1.589***	0.0431	0.0314	–0.0900	–1.149*	–1.126	–1.346*	0.0450**	0.0463**	0.0672***	0.00446	0.00767	0.00599
	(0.47)	(0.55)	(0.56)	(0.41)	(0.41)	(0.48)	(0.68)	(0.69)	(0.75)	(0.019)	(0.019)	(0.020)	(0.018)	(0.022)	(0.019)
ΔOpenness	2.033	–9.025*	–8.478	1.557	0.703	4.378	–2.148	–0.949	–4.938	0.0322	0.0592	–0.00328	0.155	–0.0539	–0.0108
	(3.08)	(4.67)	(5.19)	(3.82)	(3.73)	(5.69)	(5.58)	(5.35)	(7.60)	(0.13)	(0.13)	(0.14)	(0.14)	(0.13)	(0.13)
ΔMargtax			–2.920*			–4.916***			8.960***			–0.0605			–0.181**
			(1.47)			(1.76)			(2.71)			(0.086)			(0.076)
Δ2top1	–0.0331	–0.0120	–0.0922												
	(0.16)	(0.12)	(0.11)												
Δ2top10-1				0.190	0.206	0.240*									
				(0.13)	(0.13)	(0.14)									
Δ2bot90							0.176	0.203*	0.322***						
							(0.11)	(0.11)	(0.11)						
Δ2top1/10										0.0539	0.123	0.0352			
										(0.18)	(0.14)	(0.17)			
Δ2top01/1													0.134	0.214*	0.143
													(0.16)	(0.12)	(0.15)
Restriction	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2	Postwar	~Japan	Margtax2
Obs	111	111	101	92	96	80	92	96	80	102	96	90	111	111	101
R–squared	0.63	0.58	0.62	0.43	0.53	0.59	0.59	0.58	0.65	0.63	0.75	0.72	0.61	0.62	0.57

Note: Postwar = sample is 1945 onwards, ~Japan = Japan excluded from sample and Margtax2 = Margtax2 replaces Margtax1. See the notes of Table 1.

Income Distribution Determinants and Public Spending Efficiency*

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Abstract

In this paper we examine the impact of public spending, education, and institutions on income distribution in advanced economies. We also assess the efficiency of public spending in redistributing income by using a DEA (Data Envelopment Analysis) non-parametric approach. We find that public policies significantly affect income distribution, notably via social spending, and indirectly via high quality education/human capital and via sound economic institutions. Moreover, for our set of OECD countries, and within a two-step approach, several so-called non-discretionary factors help explaining public social spending inefficiencies.

Keywords: income redistribution, public spending, efficiency, DEA.

JEL Classification Numbers: C14, H40, H50.

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Contents

Non-technical summary

Income distribution and the role of the market, the public sector and globalisation have gained increasing attention in recent years. In this paper we examine the impact of public spending, education, and institutions on income distribution in advanced economies from a cross-country perspective. This is, to our knowledge, an important and remarkable gap in the literature.

This study examines empirically the role and efficiency of public spending policies in affecting income distribution from a cross-country perspective. The study first discusses conceptually the determinants of income equality: initial conditions and public policies affect income distribution directly (via the effect of taxes and spending) or indirectly (via the effect on earning opportunities, human capital and institutions). It then studies empirically the relation between distribution indicators on the one hand and public spending and policy outcomes on the other. To assess the efficiency of public spending in promoting and achieving more equalization of income, the study uses a non-parametric DEA approach, following, for instance, the analytical framework by Afonso, Schuknecht, and Tanzi (2005) for public sector performance expenditure in the OECD and by Afonso and St. Aubyn (2005, 2006a, b) for the education and health sectors.

The study finds that redistributive public spending (except pensions) and education performance have a significant effect on income distribution as reflected in stylised facts and in the regression analysis. Results for the role of institutions and personal income taxes point in the right direction but are not robust while more open countries do not have less equal income distribution. In addition, DEA analysis suggests that while some Southern and large continental European countries show a relatively consistent picture of low efficiency and some Nordic countries report relatively high efficiency, the picture is very variable for Anglo-Saxon countries. Moreover, effectiveness and efficiency of public social spending is enhanced in countries with a strong education performance (and to a less robust extent education spending. The direct link from the institutional framework to income distribution appears more tenuous in regressions while the two-step analysis point to a strong indirect role with favourable institutional indicators significantly correlated with the efficiency of social spending.

We must point to a number of caveats, notably the quality of data, the measurement of income distribution and the factors that influence it (including the appropriate measure of public spending) and the small number of observations.

The analysis of exogenous factors has another caveat which implies some careful interpretation of the results. Treating non-discretionary factors such as PISA scores, institutions and GDP as exogenous explanatory variables in explaining efficiency, is certainly interesting and more policy relevant from a short-term perspective as it can help to gage their quantitative relevance. However, this should not serve as an excuse for poor income distribution indicators and efficiency but rather as an enticement to do better. The policy implication of this study is hence to improve on all these factors that are endogenous in the long run: keep spending as low and well-targeted as possible, improve education performance and strengthen the quality of the institutional framework and public administration.

1. Introduction

Income distribution and the role of the market, the public sector and globalisation have gained increasing attention in recent years. This study examines empirically the role and efficiency of public spending policies in affecting income distribution from a cross-country perspective. This is, to our knowledge, an important and remarkable gap in the literature in advanced economies. The study first discusses conceptually the determinants of income equality: initial conditions and public policies affect income distribution directly (via the effect of taxes and spending) or indirectly (via the effect on earning opportunities, human capital and institutions). It then studies empirically the relation between distribution indicators on the one hand and public spending and other factors on the other.

To assess the efficiency of public spending in promoting and achieving more equalization of income, the study uses a non-parametric approach based on Data Envelopment Analysis (DEA), following, for instance, the analytical framework by Afonso, Schuknecht, and Tanzi (2005) for public sector performance expenditure in the OECD and by Afonso and St. Aubyn (2005, 2006a, b) for the education and health sectors.

The study finds that redistributive public spending (except pensions) and education performance have a significant effect on income distribution as reflected in stylised facts and in the regression analysis. Results for the role of institutions and personal income taxes point in the right direction but are not robust while more open countries do not have less equal income distribution. In addition, DEA analysis suggests that while some Southern and large continental European countries show a relatively consistent picture of low efficiency and some Nordic countries report relatively high efficiency, the picture is very variable for Anglo-Saxon countries. Moreover, effectiveness and efficiency of public social spending is enhanced in countries with a strong education performance (and to a less robust extent education spending. The direct link from the institutional framework to income distribution appears more tenuous in regressions while the two-step analysis point to a strong indirect role with favourable institutional indicators significantly correlated with the efficiency of social spending.

The effectiveness and efficiency of policies to affect income distribution should not be seen as "God given" and the findings of the paper suggest significant scope for reform (and further work). The functioning of the institutional framework and the effectiveness and competence of government in providing education or in attaining the objectives of redistributional policies can be improved by appropriate policy reforms. In some cases, when policy targets are well-achieved efficiency gains may nevertheless be reached by spending less money (e.g. via better targeting). In some other cases, targets may not be achieved but a better use of existing funds might already be sufficient to improve things.

The remainder of the paper is organised as follows. Section two provides conceptual considerations and reviews the literature on the determinants of income distribution and the role and efficiency of public policies in this regard. Section three provides some correlation and regression analysis in this regard. Section four and five set up and conduct the efficiency analysis public policies in equalizing income, using both DEA and Tobit analysis. Section six concludes.

2. Income distribution and its determinants: some conceptual considerations

What determines the distribution of income in a given country and at a given time? Why is the income distribution more even in some countries than in others? Can the distribution of income be changed through the intervention of the government? These and similar questions have been raised with increasing frequency by economists and political scientists. In the often undemocratic societies of the past, in which oligarchies ran governments, the distribution of income was seen as an almost natural condition of society. However, in modern, democratic societies, in which most adult citizens, rich or poor, have the right to vote for those who will represent them in the government, there is less tolerance for, or acceptance of, high inequality. As a consequence policymakers are pressured to introduce policies intended to make the distribution of income or of consumption more equal. Over the years the focus of attention has shifted form the distribution of (real) wealth to that of income and, more and more, to that of consumption.

Robert W. Fogel, the 1993 winner of the Nobel Prize in Economics, has argued that until the last third of the 19th century, the concern of economists had been with equality of opportunities. Then over the next hundred years the attention shifted to the equality of material conditions such as food, clothing, lodging and so on. This objective could be achieved by taxing the rich with high and progressive income taxes while subsidizing the incomes or the consumption of the poor. However, progressively, because of the potential disincentive effects that taxes could generate and because of the concentration of income taxes on dependent workers, taxes lost some or much of their potential impact on income distribution. They acquired the characteristic of "fiscal churning" that is reshuffling of income that changes only marginally the whole distribution. At the same time the income transfers that had been focused on the poor were largely replaced by universal entitlement programs, especially in health and education, which benefited all citizens and not just the poor. Fogel (2000) argues that because material goods account for a progressively smaller share of total spending for most people, in the future the fight for more equality or equity will be directed to the distribution of immaterial goods.

Overall, one should be aware of the fact that rising income inequality matters, as discussed, for instance, by Atkinson (1997), notably via its potential impact on economic growth. Additionally, and according to the results reported by Barro (2000), the effect of income inequality on economic growth may differ in developed and developing economies, somewhat in line with the Kuznets curve – whereby inequality first increases and later decreases during the process of economic development. Therefore, by focussing our empirical analysis on OECD countries we manage to address a more homogeneous country sample in that respect.[1]

This paper deals mainly with the role that the government has played in promoting more income equality, than it would exist without its intervention, at a given time. It thus attempts to link policies at a given time with measures of income distribution at the same time. However, it must be recognized that past government policies have also played some role in determining the current income distribution. These policies have contributed to the determination of so-called initial conditions. This means that it may not be possible to isolate completely the impact of past and present public policy on income distribution. This must be kept in mind when assessing the econometrically determined impact of these policies in the later parts of this paper.

[1] See also Garcia-Peñalosa (2007), Castello-Climent (2007) and Thomas Harjes (2007) for a discussion of various aspects of the income distribution growth nexus.

At a given point in time, and in a given country, without the current intervention of the government, through taxation, spending policies, and regulations, the income distribution that would emerge would be largely determined by the following factors:

(a) The inheritance of tangible and financial wealth;
(b) The inheritance of human capital, including within-the-family learning as well as the inheritance of attitudes toward learning, work, risk and so on. Whether inherited, genetic factors can play a role in this process is still a highly controversial area; the inheritance of useful connection, positional rents, and other valuable assets that determine a person's social capital;
(c) Societal arrangements and norms, such as whether individuals tend to marry individuals with similar wealth or educational background; real or de facto caste systems, and so on (see Tanzi, 2000);
(d) Individual talent;
(e) Past government policies.

In addition to the initial conditions mentioned above, that are largely determined by inheritance and societal traditions and norms, there are more individually-nested, or random factors, which also play important roles. These are (a) the distribution of skills, intelligence, and even look not directly inherited and (b) what could be called luck, or the role that randomness plays in determining incomes in non-traditional and market-oriented economies. The chance that someone will end up with the skills or acumen of Tiger Woods, Bill Gates, or Warren Buffett cannot be determined by the initial conditions or by government policies. In a market economy, individuals with exceptional skills in various areas (entertainment, sport, economic or financial activities, and so on) are more likely to end up with exceptional incomes. In many cases luck (or a randomness factor) will also play a role. Some of these individuals may end up in the annual Forbes or similar lists of the world richest individuals and will have an impact on Gini coefficients or on other measures of inequality.

Initial conditions, exceptional skills, luck, and past public policies will combine with the working of the market to determine the distribution of income that prevails in a society before the current intervention of the government. Afterwards, to determine the distribution of spending power among the population the government steps in with taxes, public expenditures, tax expenditures, and some relevant regulatory policies. Relevant regulations will be (a) those that control prices or rents; (b) that determine hiring quotas for some categories of individuals; (c) that establish property rights for patents or for other forms of intellectual property; (d) that pursue anti-trust policies and so on. We shall not be able to take into account regulations in our empirical work and will also ignore the impact that progressive tax systems can have on the after tax distribution of income. Much of the focus of this paper will be on public spending and policy outcome and their impact on inequality.

It may be worthwhile to stress that the impact of the government on the income distribution may be direct or indirect and that this distinction is in part linked with the current and past impact of the government.

The direct and current impact of the government can come through taxes and through spending and other public policies. The level of taxation and its progressivity is the most direct factor. This factor, per se, can make the distribution of after-tax incomes different, and presumably more equal than the pre-tax distribution. However, various forms of "tax expenditures" that indirectly subsidize some categories of private spending – education, health, training, expenses connected with mobility, etc. – will undoubtedly, over time, have some impact on income distribution. Through its features, the tax system can also influence the retirement age, the size of families, and individual effort, which are all features with a direct impact on income distribution.

On the expenditure side of public policies we can also identify direct and indirect effects. Public spending that injects income or spending power in the hands of individuals, through cash payment or direct support for spending that is important for poorer individuals (food stamps, subsidized housing, free child care for working mothers, subsidized tariffs for low levels of consumption of public utilities, etc.) has a clear effect on income distribution. However, public spending can have indirect but still significant effects on the distribution of income in other ways that mainly improve productivity and opportunities to find a job disproportionately for the less well off. For example an efficient public transportation system can widen the area in which poorer individuals can search for jobs by reducing travel costs. Spending for job training or retraining can move individuals from the unemployed to the employed category. Spending on education can benefit the poor disproportionately if it improves their relative endowment with human capital. Free access to health facilities can keep people healthy and make possible for them to be in the labour force.

In addition to the above, it has to be recognized that a good institutional set up that guarantees rule of law and fair and quick access to justice will also contribute to a better distribution of income by reducing abuses and corruption. Some studies have, for example, linked corruption with higher Gini coefficients. When rule of law is not fair or is not respected, poorer people are more likely to be exploited through lower compensation for their work and higher costs for some services, as for example in the case of usury when they borrow money.

The above description suggests clearly that while some public actions or policies have an immediate and direct impact on the distribution of income or on the income of some groups, others have an indirect impact or an impact only over time. Thus the empirical work that follows reflects some of these limitations because it is focused largely on current public spending on income distribution.

3. Cross-country and historical assessment

In this section, we first take a look at the data that underpins our analysis of income distribution, before providing some first descriptive statistics, correlations and regression analysis of the determinants of income distribution. We focus in particular on the impact of redistributional expenditure policies, education as a provider of human capital/opportunities and some tax policy and institutional issues.

3.1. Income distribution data: a brief stock-taking

Income distribution data reflects the different objectives of measurement.[2] We have identified five overall indicators. 1) The Gini coefficient is probably the most famous indicator where a low number suggests more equality and a high number inequality. 2) The income share per quintile is another popular indicator with the income share of the poorest or the poorest two quintiles being typically examined. Other indicators include 3)

[2] Different measurements may not only have different objectives but also implicitly reflect the value-judgement of analysts. The Gini coefficient for example measures the relative distribution within one society. A measure of per capita GDP for the poorest quintile across countries puts more weight on the absolute situation of the poor and the presumed trade-offs between income distribution and growth.

the poverty rate as the share of people with less than 50% (or any other share) of median income. These three indicators also allow cross-country comparisons with relative ease. 4) The absolute poverty rate which looks at the share of people living below some pre-defined threshold of income and 5) the absolute per-capita income of the poorest (or poorest two) quintile(s) are further alternatives. They are only reasonably comparable if they are adjusted (for the consumption basket or purchasing power parity). In addition, there are indicators that refer to segments of the population like 6) child poverty, 7) absolute child poverty or 8) old age poverty, to name only a few.

A few further caveats are worth mentioning. Indicators can refer to gross income, factor income or disposable income. They can look at families, households, individuals or taxpayers. They can include or exclude the self-employed. The sources can be surveys, censuses, tax or social security records. This illustrates that great care needs to be applied, especially when comparing indicators across countries and over time. Finland, for example, reported for the year 2000 a Gini coefficient for disposable income of 26.4, of factor income of 47.2 and of gross income of 31.2.

In a first step we would like to take stock of some of the available income distribution indicators and their distribution over time and countries. The largest dataset of Gini coefficients is to our knowledge published by WYDER which covers many countries and in some instances starts in the 19th century.[3] Chart 1a illustrates the data distribution for the period 1950 until most recently. It shows a trend towards greater equality until the 1980s followed by a more ambiguous pattern thereafter. But the chart also shows the enormous diversity of data for the reasons mentioned above. A reasonably homogenous and comparable dataset for Gini coefficients and disposable income is compiled by the Luxembourg income dataset in which, however, observations before 1980 are rather rare. Nevertheless, for the past 25 years the ambiguous pattern of the WYDER dataset is broadly confirmed (Chart 1b). From a global perspective, the World Development Report provides data for Gini coefficients and the income share per quintile for many countries and, via different vintages, different years.

[Chart 1]

[3] For an overview of historic developments also see Atkinson (2007).

The most important data source for income distribution indicators for advanced countries seems to be the OECD. Foerster and d'Ercole (2005) have put together an excellent set of cross-country data for the period 1985 to 2000, including for sub-groups of society. Taking a glimpse also at this dataset, it is interesting to note that the only group which experienced an unambiguous further fall in poverty rates since the 1980s is the elderly while child-poverty has tended to increase (Chart 1c-d).

Changes over the past two decades can also be illustrated by plotting the Gini coefficient for 1980, 1990 and 2000, as in Chart 2. Observations below the 45 degree line reflect an equalisation in income distribution over this decade while those above suggest a tendency towards less equality. For instance, for the period 1990-2000, while all countries are relatively close to the 45 degree line, equality appears to have increased most notably in Denmark, the Netherlands, France and Switzerland while it decreases in the US, Belgium, Sweden and Finland.

[Chart 2]

3.2. Determinants of income distribution: some correlations

Consistent with our earlier discussion of the likely determinants of income distribution, we conducted two types of quantitative analysis. This aims to get a better feel for the data and their interrelation. In this sub-section we conduct correlation analysis before, in the next one, we look at some simple regression analysis. We look at levels of indicators in recent years and at their changes over recent decades, as presented in Table 1 (for an overview of basic descriptive statistics see the Annex).

Starting with the role of public finances, there is a relatively strong correlation between public expenditure and income distribution in recent years (Table 1a). This correlation, however, is somewhat weaker for total expenditure (correlation coefficients of about 0.5) than for redistributional components, i.e. social spending, transfers and subsidies and family benefits (about 0.5-0.7). The correlation between pensions and old-age poverty is relatively weak (see Foerster and Mira d'Ercole, 2005, for a discussion). There is also a much weaker correlation between public spending and absolute income indicators. This is illustrated in the fourth column which shows the correlation between public spending and PPP-based per-capita GDP of the poorest quintile across countries.

There is a relatively strong correlation between the change in income distribution as measured by the change in the income share of the poorest 40% of households and the change in public spending between 1960 and 2000 (Table 1b). However, this relationship is already significantly weaker for the change in the Gini coefficient. Moreover, initial (unequal) income distribution is not a good predictor for subsequent spending increases.

[Table 1]

The magnitude of interrelations between income distribution and public spending can be illustrated very roughly by the bi-variate regressions displayed in Chart 3. To attain a 1% higher income share of the poorest 40% of households, it is necessary to rise social spending by roughly 3.3% of GDP (Chart 3a).[4] The correlation between the change in social spending and income distribution over the past 40 years is also rather positive (Chart 3b).

[Chart 3]

The picture changes significantly when looking at the past 20-25 years only. There is virtually no correlation between the change in total or social spending and income distribution since the 1980s (Table 1b). Chart 4, as quoted from Heipertz and Warmedinger (2007) confirms this picture with part a) confirming the positive correlation of levels and part b) showing an even negative correlation between changes in social spending and the Gini coefficient since the mid 1980s.

[Chart 4]

This picture is consistent with the findings of two of the authors in an earlier study (Schuknecht and Tanzi, 2006) where countries that undertook ambitious expenditure reform and notably lowered social spending did not experience much adverse effects on

[4] A 1% income share for the poorest two quintiles reflects an increase in relative per capita GDP in this group by about US$ 600 (given an average per capita GDP ppp across sample countries in 2000 of slightly below US$ 25000). A 3.3% of GDP spending increase implies roughly US$ 800 per capita. Perfect targeting would imply an increase in spending by US$250 per capita (fully spent on the poorest 40% and financed by the richest 60%).

the income share of the poorest quintile of households. At the same time, absolute incomes of the poor increased most strongly in the group of countries that undertook early and ambitious reforms, starting already in the 1980s (Table 2). This may be due to the elimination of poorly targeted benefits (that helped poor little) and the improvement of incentives and employment opportunities (that benefited the poor disproportionately).

[Table 2]

Synthesizing this first set of results, one can safely say that public and notably social spending matters for income distribution both in terms of levels and, perhaps a bit less strongly, for changes over the past 30-40 years. The picture, however, seems to have changed in recent decades when the correlation of changes in public social spending and income distribution may have broken down. We will come back to this issue in the next sub-section.

Turning to human capital as contributor to income distribution, there is also a surprisingly strong relationship between some measures of educational achievement (OECD PISA) and various income distribution indicators across countries (Table 1c). It is noteworthy that correlation coefficients between mathematical and problem solving skills and various income distribution indicators except old age poverty show high values above 0.4. Although the correlation coefficient with public education spending is similarly high, this may be spurious and reflect more the correlation of education and social spending than the human-capital related effects (as will also be shown in the next section). The correlation between public education spending and educational achievements is in fact very limited (see e.g., Hauptmeier et al., 2006).

We only undertook a very tentative and limited glimpse at the effect of taxation by looking at personal income taxes which should have an equalising impact on income distribution through progressivity as also implied by correlation coefficients of above 0.4 for personal income tax revenue and income shares and Gini coefficients (1d), assuming a link between the level of income taxes to GDP and tax progressivity.

The effect of initial conditions on today's income distribution can be assessed by correlating recent indicators with those of some decades ago. While the income share of the poorest two quintiles in 1960 and 2000 are not correlated, the 2000 Gini coefficient is still strongly related to that prevailing in about 1970 (1e).

Finally we look at institutional indicators and globalisation/openness (Table 1f). A strong correlation of better institutions and more income equality is confirmed for two of the four indicators, i.e., the degree of independence of the judiciary and the amount of red tape. Regulation quality and the size of the shadow economy appear to be less strongly correlated. The correlation between openness as measured by exports plus imports over GDP and income distribution is relatively high between 0.3 and 0.4 with more open economies having a more equal income distribution (contrary to some conjectures in the debate).

3.3. Determinants of income distribution: a first regression analysis

In this section, we undertake some simple cross-section regression analysis. The hypotheses are that public spending and notably redistributional spending and the tax system affect income inequality directly. Education/human capital and the institutional framework of a country do so indirectly via equalising the human capital endowment and providing a level playing field. In the literature is has also sometimes been claimed that globalisation may undermine equality. Our findings from regression analysis support the hypotheses on the role of public redistributive spending and education/human capital, results are mixed for institutional indicators and insignificant for personal income taxes and openness.

In a first set of equations, we look at income distribution across countries in recent years (about 2000) as measured by the income share of the poorest 40% of households and by the Gini coefficient (equations 1-4 in Table 3a). It is not very surprising that transfers and subsidies and social spending are highly significant in affecting income distribution. Coefficients around 0.3 suggest that 1% of GDP higher redistributive spending raises the income share of the poorest two quintiles by 0.3%. Despite the significant positive correlation, there is no significant correlation between personal income taxes and income distribution in any specification (including when replacing spending variables), although this could be largely due to multicollinearity with social spending.

[Table 3a]

Institutional variables have the right sign but they do not show a robust and significant direct relation with income distribution with variables reflecting red tape/bureaucracy, the size of the shadow economy and independent judiciaries being significant in some specifications. As mentioned, the positive relation between openness and income distribution is also supported in regression analysis but it is not significant (not indicated). The inclusion of GDP per capita and unemployment as additional control variables (proxying the possible growth-distribution trade off and the fact that the poor are typically disproportionately affected by unemployment) does not yield significant results in this set of equations (not indicated).

In line with the earlier correlation analysis, education achievement on average and notably for mathematics and problem solving is significantly related to income distribution. About 25 points more in PISA imply a 1% higher income share of the poorest 40% of households (for reference, the largest difference in our sample countries is 75 points between Finland and Portugal, and the largest difference in the income share is 7.6% between Finland and the US). Ten PISA points improve the Gini coefficient by one point according to these regressions. The inclusion of education achievement also significantly enhances the overall fit (adjusted R-square) of the models. Education spending, by contrast, does not significantly affect income distribution.

We also tested for the role of initial income distributions in 1960s/70s as reflecting initial conditions (wealth patterns, social norms and other factors that may change only very slowly over time). While this did not show up significantly in the equation on income shares for the poorest two quintiles (not indicated) it appears to be relevant for today's Gini coefficients (in line with the findings on correlations above).

There are two additional findings worth reporting which perhaps point to the need for more analysis. In equation 3 we use public education spending (an input indicator) instead of achievements (=output). This does not turn out to be a significant determinant of income distribution. In the same equation, however, regulatory quality becomes significant. The finding of insignificant institutional indicators in the other equations may hence be due to a correlation between education achievement and institutional quality (which may result in better policies including more efficient public education spending).

A second finding worth commenting on is represented in equation 5 where we regressed the Gini coefficient on social spending and an interaction term between social spending and educational attainment. While the former reverses sign and is now highly positive (suggesting a negative effect on income distribution) the latter is strongly significant and negative, implying that only high social spending coupled with good education positively affects income distribution. We will come back to this point in the DEA analysis.

A further equation 6 examines per capita GDP (PPP-adjusted) of the poorest quintile of households across sample countries, and suggests that each % of GDP of social spending raises per capita GDP of the 20% poorest households by US$232.[5] A higher unemployment rate is a significant factor in lowering the absolute income of the poorest quintile (a 1% higher unemployment rate lowers the income by 275$). Each additional PISA point raises income of the poor by about US$ 30.

A first tentative effort to explain changes in income distribution is reflected in equations (1)-(4) of Table 3b. These equations have to be seen with even more caution than the earlier ones as indicators may be less comparable over time and as the number of observations are very limited. Nevertheless, the results are broadly consistent with the earlier correlation analysis. Over long horizons, rising redistributive spending mattered and, for example, the change in the social spending ratio between 1960 and 2000 had a significant impact on the change in the income share of the poorest 40% of households (equation 1) while the finding is less robust for the Gini coefficient (equation 2). Personal income tax receipts have an equalising but non-robust effect on income distribution while the initial Gini level is correlated inversely with subsequent changes.[6]

[Table 3b]

[5] This implies that if the growth effect of lower social spending is 2 ½ times as high as the income effect, then the poor would be absolutely better off from reform. If reforms are designed in a manner that the income effect is smaller (e.g. through better targeting) then the threshold for the poor to benefit from higher growth will also be lower.

6 While we do not have time series data for education attainment, including the 2000 value is not very meaningful as this assumes no change in education quality. Doing so just for illustrative purposes in equations (2) and (4) suggests borderline significance.

When looking at changes over the past 20 years, public spending variables do not provide a robust picture. This is in line with the earlier findings from correlation analysis and the literature. Unlike for the longer horizon, initial income distribution is also not relevant for explaining subsequent changes. The results for education achievements (despite the above-mentioned caveat) are fully consistent with the earlier cross-section results.

All in all, income distribution appears to be significantly affected by public redistributive spending and education achievements. This relationship, however, does not appear to be very robust for changes, especially over the past 20 years. Moreover, there are hints that the beneficial effects of such spending may interact with better education quality. Results for the role of institutions and personal income taxes are not robust while more open countries do not have less equal income distribution. Further analysis beyond these very preliminary findings is certainly needed.

4. Efficiency of public spending

4.1. Literature

Previous research on the performance and efficiency of the public sector that applied non-parametric methods find significant divergence of efficiency across countries. Studies include notably Fakin and Crombrugghe (1997) for the public sector, Gupta and Verhoeven (2001) for education and health in Africa, Clements (2002) for education in Europe, St. Aubyn (2003) for education spending in the OECD, Afonso, Schuknecht, and Tanzi (2005, 2006) for public sector performance expenditure in the OECD and in emerging markets, Afonso and St. Aubyn (2005, 2006a, 2006b) for efficiency in providing health and education in OECD countries.[7] De Borger and Kerstens (1996), and Afonso and Fernandes (2006) find evidence of spending inefficiencies for the local government sector. Most studies apply the Data Envelopment Analysis (DEA) method while Afonso and St. Aubyn (2006a) undertook a two-step DEA/Tobit analysis, in the context of a cross-country analysis of secondary education efficiency. Nevertheless, little or no work has been done using such non-parametric methods to assess the efficiency of public policies in affecting income distribution.

Another relevant issue for the analysis of public spending inefficiencies is the fact that public expenditure financing must rely on distortional taxation. This implies that both

[7] See also Joumard et al. (2004) for additional information on OECD countries.

direct and indirect costs are relevant when estimating the economic impacts of inefficiency in public services provision. Indeed, the relative importance of indirect costs of public sector provision inefficiency, linked to financing through distortional taxation, increases with the magnitude of the inefficiency. Afonso and Gaspar (2007), in simple numerical exercises, with a calibrated model, found that indirect costs, associated with excess taxation burden, amplify the cost of inefficiency by between 20 and 30 per cent.

4.2. Non-parametric and parametric analysis

Non-parametric approach

Together with the set of already identified outputs, a set of inputs will be used to assess efficiency regarding income distribution measures. Among such inputs we can mention, as potential candidates, social spending, transfers and subsidies, spending on pensions, health, and education, tax and institutional indicators. Sometimes, principal component analysis may prove useful to reduce the number of variables used in the input side. In order to perform the efficiency study we use the DEA approach.

The DEA methodology, originating from Farrell's (1957) seminal work and popularised by Charnes, Cooper and Rhodes (1978), assumes the existence of a convex production frontier. The production frontier in the DEA approach is constructed using linear programming methods. The term "envelopment" stems from the fact that the production frontier envelops the set of observations.[8]

Regarding public sector efficiency, the general relationship that we expect to test can be given by the following function for each country i:

$$Y_i = f(X_i),\ i=1,\dots,n \qquad (1)$$

where we have Y_i – a composite indicator reflecting our output measure; X_i – spending or other relevant inputs in country i. If $Y_i < f(x_i)$, it is said that country i exhibits inefficiency. For the observed input level, the actual output is smaller than the best attainable one and inefficiency can then be measured by computing the distance to the theoretical efficiency frontier.

[8] Coelli et al. (1998) and Thanassoulis (2001) offer introductions to DEA.

The analytical description of the linear programming problem to be solved, in the variable-returns to scale hypothesis, is sketched below for an input-oriented specification. Suppose there are *k* inputs and *m* outputs for *n* Decision Management Units (DMUs). For the i-th DMU, y_i is the column vector of the inputs and x_i is the column vector of the outputs. We can also define *X* as the $(k \times n)$ input matrix and *Y* as the $(m \times n)$ output matrix. The DEA model is then specified with the following mathematical programming problem, for a given i-th DMU:[9]

$$\begin{aligned} & Min_{\delta,\lambda}\delta \\ \text{s. to } & -y_i + Y\lambda \geq 0 \\ & \delta x_i - X\lambda \geq 0 \ . \\ & n1'\lambda = 1 \\ & \lambda \geq 0 \end{aligned} \qquad (2)$$

In problem (2), δ is a scalar (that satisfies $\delta \leq 1$), more specifically it is the efficiency score that measures technical efficiency. It measures the distance between a country and the efficiency frontier, defined as a linear combination of the best practice observations. With $\delta < 1$, the country is inside the frontier (i.e. it is inefficient), while $\delta = 1$ implies that the country is on the frontier (i.e. it is efficient).

The vector λ is a $(n \times 1)$ vector of constants that measures the weights used to compute the location of an inefficient DMU if it were to become efficient, and 1 is an n-dimensional vector of ones. The inefficient DMU would be projected on the production frontier as a linear combination of those weights, related to the peers of the inefficient DMU. The peers are other DMUs that are more efficient and are therefore used as references for the inefficient DMU.. The restriction $n1'\lambda = 1$ imposes convexity of the frontier, accounting for variable returns to scale. Dropping this restriction would amount to admit that returns to scale were constant. Problem (2) has to be solved for each of the *n* DMUs in order to obtain the *n* efficiency scores.

[9] We simply present here the equivalent envelopment form, derived by Charnes et al. (1978), using the duality property of the multiplier form of the original programming model.

Using non-discretionary factors

The analysis via composite performance indicators and DEA analysis assumes that expenditure efficiency is purely the result of discretionary (policy and spending) inputs. They do not take into account the presence of "environmental" factors, also known as non-discretionary or "exogenous" inputs. However, such factors may play a relevant role in determining heterogeneity across countries and influence performance and efficiency. Exogenous or non-discretionary factors can have an economic and non-economic origin.

As non-discretionary and discretionary factors jointly contribute to country performance and efficiency, there are in the literature several proposals on how to deal with this issue, implying usually the use of two-stage and even three-stage models (see Ruggioero, 2004). Using the DEA output efficiency scores, we will evaluate the importance of non-discretionary factors below in the context of our new member and emerging market sample. We will undertake Tobit regressions by regressing the output efficiency scores, δ_i, on a set of possible non-discretionary inputs, *Z*, as as follows

$$\delta_i = f(Z_i) + \varepsilon_i \, . \qquad (3)$$

5. Efficiency analysis results

5.1. Relative efficiency via a DEA approach

As a starting point of our efficiency analysis we computed the DEA efficiency scores from a one input and one output specification. As an input measure we use total public social expenditure as a percentage of GDP, as an average for the period 1995-2000.[10] Our output measure is based on the Gini coefficient data, also as an average for the period 1995-2000. Since in the DEA programme we need to insert increasing outputs as the desired objective, and given that higher Gini coefficients imply a bigger inequality in terms of income distribution, our output variable, $Gini^T$, is constructed by transforming the Gini coefficient observations as follows:

$$Gini^T = 100 - Gini \, . \qquad (4)$$

[10] Social expenditure includes public and (mandatory and voluntary) private social expenditure at programme level and the main social policy areas are: old age, survivors, incapacity-related benefits, health, family, active labor market programmes, unemployment, housing, and other social policy areas. See the Data Annex and OECD (2007) for more details on how the OECD defines social expenditures.

Table 4 reports the results for the input and output oriented efficiency scores for the above described one input-one output model for a set of 26 OECD countries. From an output oriented perspective the most efficient countries in terms of influencing income distribution via social expenditure appear to be the Nordic countries, Japan, the Netherlands, and Slovakia while Anglo-Saxon and Southern European countries, Germany and France appear to be less efficient. On the other hand, and even if it may be more difficult to act in the short-run on the input side, it should be noticed that input efficiency scores give Anglo-Saxon countries a better ranking (US is 4th, Ireland 6th, Canada 7th, and Australia 9th) than the Nordic countries, apart from Denmark, which is on the frontier in both cases (Finland ranks 10th, Norway 13th and Sweden 18th).

[Table 4]

More concretely, the production possibility frontier is constructed with three countries: Denmark, Japan and the Slovak Republic, which envelop all the other countries (see also Chart 5).[11] Additionally, in Table 4 we report the ranking of the countries, given their respective efficiency scores (Rank 1) and taking into account, for the countries on the frontier, the number of times each of those countries is a peer of a county outside the frontier Rank 2).

[Chart 5]

Still from Table 4 we conclude for the existence of both input and output inefficiencies when relating the use of public social spending to assess the inequality in income distribution. The average input efficiency score is 0.76 implying that for the overall country sample it would be theoretically possible to attain the same level of income distribution, as measured by the Gini coefficient, with roughly 24 percent less public social spending. The average output efficiency score is 0.93, which means that with the same level of public social spending one could in principle increase income equality indicators by 7 percent. (This reflects the very low marginal product of higher spending in terms of equality as reflected in the rather flat production possibility frontier.)

[11] Note that we did not consider Korea in the sample since it biases the findings (however, results with Korea area available upon request). Indeed, social spending-to-GDP ratio for Korea was extremely (roughly four times) below the sample average.

Naturally, such averages encompass rather heterogeneous realities. For instance, several individual input efficiency scores are closer to the production possibility frontier (the US, the Czech Republic, Ireland, Canada, Luxembourg or Australia) while there are also situations were the room for improvement seems to be larger (France, Belgium, Italy, Germany, and Poland). On the other hand, output efficiency scores exhibit overall lower volatility with the relative positioning of the countries showing some differences vis-à-vis the results for the input oriented case (the correlation between the two rankings is around 0.6).

We also specified two alternative models that consider one input (social spending as before) and two output indicators, both income inequality measures: the Gini coefficient and the poverty rate or the income share of the poorest 40% of the population. Again as in the case of the Gini coefficient we had to transform the poverty rate data in the same fashion. Tables 5 and 6 report the results of these two one input and two outputs models.

[Table 5]

[Table 6]

The estimation of these models shows two things. First, input efficiency scores are somewhat higher. Second, in the models with two outputs, Southern European countries, the UK, France and Germany continue to show low efficiency of social expenditure. But a few countries, including a number of Anglo-Saxons (Canada, Ireland, the US and Australia) are now rather efficient and the Nordic countries do not drop dramatically..

Among the 22 country sample as reported in Table 5, six countries are on the production possibility frontier: Canada, Finland, Hungary, Ireland, Luxembourg and the US. Ireland is efficient by default in the output oriented specification since it is never a peer of any other country outside the frontier. Moreover, the US is a bit of a special case since it has in this country sample both the lowest public social spending as a % of GDP and the worst values for the two output indicators, Gini and poverty rate.

For the estimation presented in Table 6, there are seven countries on the production possibility frontier: Canada, Denmark, Finland, Ireland, Luxembourg, Norway and the US. Interestingly, we can also observe that both Finland and the US are labelled as efficient by default, respectively for input and output orientation. Finland is not the highest spending country in terms of the social spending-to-GDP ratio but it has one of the best Gini indicators and the best performance in terms of the income share of the poorest 40%.

As an additional illustration, Chart 6 shows in two dimension the production possibility curve for the output-oriented case, for the model involving a single input (social spending) and two outputs (Gin and income share of the poorest 40%). From the picture it is possible to notice that Ireland has done the best in the income share of 40%-to-social spending ratio while the US has done better in the Gini-to-social spending ratio. Together these two countries form the efficiency frontier in the context of constant returns to scale, as also shown in Table 6, putting an upper bound on the production possibilities for this particular 1 input and 2 outputs specification.

[Chart 6]

Overall, the results of this analysis should be seen as illustrative. While they reflect the significant data and measurement problems they are perhaps a first useful step in this largely unexplored domain. We summarise in Table 7 the main findings of our non-parametric efficiency analysis, confirming the very different degrees of efficiency across industrialised countries as we already detected in the earlier stylised facts.

[Table 7]

5.2. Explaining inefficiencies via non-discretionary factors

As an additional step, we extend our analysis to exogenous (non-discretionary) factors that might explain expenditure efficiency. The output efficiency score outcomes of the first two models as reflected in tables 4 and 5 serve as dependent variables.

As to exogenous factors, it is probably reasonable to conjecture that expenditure efficiency depends on the “technology” applied and skills available in the public sector, on institutional factors that influence, for example, the ability of private agents to protect their resources from public claims, on the monitoring capacities of public and private agents, and on international constraints. We proxy these considerations with the following independent variables: Education levels and education spending stand for human capital endowment that should increase the productivity of the public sector and facilitate its monitoring. Competence of the civil services more concretely proxies public sector “technology”. Institutional variables (independent judiciary, red tape, shadow economy, regulation quality) should signal the security of property rights and sound checks and balances that boost efficiency in public spending. Amongst other control variables, the population share above 65 aims to capture “competition” over public resources while openness aims to gauge international influences. Per capita GDP is an indicator of capital stock in the economy (that should lead to better technology) but we also face a causality problem: rich countries may be rich because they are more efficient in their redistribution (by discouraging rent seeking and other wasteful activities).

As a first step we look at correlations across dependent and independent variables. We report the correlation matrix for efficiency scores and several potentially relevant non-discretionary factors in the Annex. In a nutshell there seems to be significant correlation between expenditure efficiency on the one hand and PISA scores and several institutional variables on the other. Correlations are less high with education spending (consistent with the earlier regression analysis) and openness. When looking at correlations across independent variables (exogenous factors) it appears that the same institutional variables that are correlated with efficiency also show a strong relation with PISA scores and public sector competence while again public spending and openness show relatively lower coefficients. This observation points to multicollinearity problems for our regression analysis for certain variables with the economic intuition that countries with strong institutions are also likely to have efficient public sector policies in both the education and social domain.

Keeping this caveat in mind, regression analysis is broadly supportive of the above claims. More specifically, Tables 8 and 9 report the results from the Tobit analysis using the previously computed output efficiency scores from the DEA models respectively in

Tables 4 (1 input and 1 output) and 5 (1 input and 2 outputs).[12] It is noteworthy that PISA scores, the competence of civil servants, the quality of the judiciary and a small shadow economy are significant variables for explaining social expenditure efficiency. In addition high public education spending (only model 1), low property tax revenue and high per capita GDP contribute to explaining efficiency scores. Other variables are insignificant except for the elderly population ratio in model 2. Note, however, that the sample size ranges from only 18 to 22 countries, hence again suggesting to treat the results as illustrative.

[Table 8]

[Table 9]

In Tables 10 and 11 we report output efficiency score corrections for specifications 1 and 5 in Table 9 for the variables detected as statistically significant in the Tobit analysis (i.e., per capita GDP, PISA indicator, public spending in secondary education and the extent of shadow economy). The corrections were computed by considering that the non-discretionary factors varied to the sample average in each country, and countries' efficiency scores are then being corrected downwards if they have an above average per capita GPD and PISA scores. The output scores corrected for non-discretionary or environmental effects (truncated to one when necessary) are presented in columns four and five of Tables 10 and 11 respectively as a result of the sum of the previous three and four columns. One should also notice that, for instance in Table 11, the number of countries considered decreased from twenty-three in the DEA calculations to eighteen in the two-step analysis, since data for public spending in secondary education and the shadow economy were not available for all countries.

[Table10]

[Table11]

[12] We try to explain output inefficiency via exogeneuos factors given that policy makers are sometimes input constrained, being therefore more feasible to improve ouptut and outcomes using the same inputs.

The findings suggest a revision of efficiency scores and a reshuffle of the ranking of countries. Some inefficient countries appear to be so mainly due to exogenous factors, notably Greece, Portugal or New Zealand (to name only a few) where low per capita GDP results in a big adjustment parameter. Additionally, we illustrate in Chart 7 the changes in the efficiencies scores after taking into account the corrections prompted by the non-discretionary factors identified for models in Tables 10 and 11. Again, this is only a first step and much more analysis appears needed.

[Chart 7]

6. Conclusion

This study examines empirically the role and efficiency of public spending policies in affecting income distribution from a cross-country perspective. The study first discusses conceptually the determinants of income equality: initial conditions and public policies affect income distribution directly (via the effect of taxes and spending) or indirectly (via the effect on earning opportunities, human capital and institutions). It then studies empirically the relation between distribution indicators on the one hand and public spending and policy outcomes on the other. To assess the efficiency of public spending in promoting and achieving more equalization of income, the study uses a non-parametric DEA approach, following, for instance, the analytical framework by Afonso, Schuknecht, and Tanzi (2005) for public sector performance expenditure in the OECD and by Afonso and St. Aubyn (2005, 2006a, b) for the education and health sectors.

The study finds that redistributive public spending (except pensions) and education performance have a significant effect on income distribution as reflected in stylised facts and in the regression analysis. Results for the role of institutions and personal income taxes point in the right direction but are not robust while more open countries do not have less equal income distribution. In addition, DEA analysis suggests that while some Southern and large continental European countries show a relatively consistent picture of low efficiency and some Nordic countries report relatively high efficiency, the picture is very variable for Anglo-Saxon countries. Moreover, effectiveness and efficiency of public social spending is enhanced in countries with a strong education performance (and to a less robust extent education spending. The direct link from the institutional framework to income distribution appears more tenuous in regressions while the two-step analysis point to a strong indirect role with favourable institutional indicators significantly correlated with the efficiency of social spending.

We must point to a number of caveats, notably the quality of data, the measurement of income distribution and the factors that influence it (including the appropriate measure of public spending) and the small number of observations.

The analysis of exogenous factors has another caveat which implies some careful interpretation of the results. Treating non-discretionary factors such as PISA scores, institutions and GDP as exogenous explanatory variables in explaining efficiency, is certainly interesting and more policy relevant from a short-term perspective as it can help to gage their quantitative relevance. However, this should not serve as an excuse for poor income distribution indicators and efficiency but rather as an enticement to do better. The policy implication of this study is hence to improve on all these factors that are endogenous in the long run: keep spending as low and well-targeted as possible, improve education performance and strengthen the quality of the institutional framework and public administration.

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Data annex

Table A1 – Descriptive statistics and sources

	Mean	Maximum	Minimum	Std. Dev.	Source
Income distribution					
Income share, poorest 2 quintiles, 2000	20.5	23.7	16.1	2.8	DI: WDI,
Income share, poorest 2 quintiles, 1980	18.4	21.2	15.7	1.5	Luxembourg Income Study,
Income share, poorest 2 quintiles, 1960	15.4	19.7	10.0	3.0	T&S [a]
Gini coefficient, 2000	29.3	36.8	24.7	4.6	GI:Luxembourg
Gini coefficient, 1970	29.8	35.1	22.4	4.7	Income Study,
Gini coefficient, 1980	26.7	33.8	19.7	4.2	WYDER,OECD
Poverty rate, 2000	9.7	17.0	5.4	3.9	All other OECD
Per capita income poorest quintile, 2000, PPP	10240.6	12989.9	7369.7	1696.7	
Child poverty	10.7	21.9	2.8	6.8	
Poverty rate in old age	13.5	25.6	5.9	6.4	
Fiscal data (all public, % of GDP)					
Total expenditure, 2000	45.8	57.1	32.5	8.0	AMECO
Social expenditure, 2000	24.2	29.5	14.2	4.3	OECD
Transfers and subsidies, 2000	16.1	21.3	8.6	3.8	AMECO
Total expenditure, 1960	17.7	30.6	3.0	7.1	AMECO, T&S
Social expenditure, 1960	12.9	20.5	6.9	4.0	OECD [b]
Transfers and subsidies, 1960	6.0	9.7	1.3	2.9	AMECO, T&S
Family benefits, 2000	2.1	3.7	0.4	1.0	OECD
Pension spending, 2000	9.1	11.8	5.2	2.5	OECD
Public education spending	5.3	7.7	3.8	1.0	OECD
Personal income tax receipts	12.1	26.9	5.4	5.2	OECD
Education achievement/PISA (2003)					
Average	505.9	545.9	461.7	23.3	OECD
Maths	507.1	544.0	445.0	29.6	OECD
Problem solving	507.1	548.0	448.0	28.5	OECD
Institutions					
Judiciary [$]	6.0	6.7	4.5	0.7	Global
Regulation [$]	3.6	5.3	2.4	0.9	Competitiveness
Bureaucracy [$]	1.9	2.6	1.4	0.4	Report, 2001/02
Other controls					
Openness ((X+M)/GDP)	79.9	256	22.4	51.1	WEO
Per capita GDP, 2000, PPP	24294.8	31741.0	14979.0	3834.6	OECD
Unemployment rate (%), 2000	6.7	11.7	2.5	3.0	OECD

Notes:
a – Luxembourg Income Study (LIS). Income distribution data, http://www.lisproject.org/keyfigures.htm.
b – Social Expenditure Database (SOCX), www.oecd.org/els/social/expenditure.
The OECD defines social expenditures as "The provision by public and private institutions of benefits to, and financial contributions targeted at, households and individuals in order to provide support during circumstances which adversely affect their welfare, provided that the provision of the benefits and financial contributions constitutes neither a direct payment for a particular good or service nor an individual contract or transfer." Still according to the OECD, "social benefits include cash benefits (e.g. pensions, income support during maternity leave, and social assistance payments), social services (e.g. childcare, care for the elderly and disabled) and tax breaks with a social purpose (e.g. tax expenditures towards families with children, or favourable tax treatment of contributions to private health plans)" (see OECD, 2007).
$ - Scale from 1 to 7 base don survey data.

Table A2 – Correlation matrix for output efficiency scores and non-discretionary factors

	EFO1	EFO2	EFO3	GDP	PISA	PIT	Edu	Comp	Judic	Shadow	Pop 65	Red tape	Regulation	Rights	Open
EFO1	1														
EFO2	0.69	1													
EFO3	0.69	0.91	1												
GDP	0.47	0.70	0.70	1											
PISA	0.64	0.63	0.51	0.37	1										
PIT	0.41	0.52	0.39	0.43	0.60	1									
Edu	0.29	0.28	0.15	-0.07	0.24	0.41	1								
Comp	0.65	0.81	0.63	0.55	0.75	0.62	0.26	1							
Judic	0.70	0.79	0.71	0.57	0.81	0.55	0.15	0.81	1						
Shadow	-0.48	-0.72	-0.61	-0.64	-0.80	-0.53	-0.05	-0.71	-0.79	1					
Pop65	-0.04	-0.61	-0.58	-0.35	-0.39	-0.11	0.16	-0.42	-0.49	0.60	1				
Redtape	-0.55	-0.50	-0.45	-0.45	-0.50	-0.19	-0.29	-0.42	-0.63	0.41	0.12	1			
Regulat.	0.38	0.43	0.56	0.35	0.53	0.22	0.12	0.32	0.53	-0.57	-0.42	-0.56	1		
Rights	0.56	0.66	0.53	0.79	0.61	0.28	-0.09	0.67	0.69	-0.80	-0.29	-0.40	0.25	1	
Open	0.45	0.31	0.32	0.23	0.25	0.44	0.08	0.30	0.24	0.05	-0.09	-0.46	0.11	0.07	1

Notes:
EFO1, EFO2 and EFO3, output efficiency scores from the DEA models 1, 2 and 3, reported respectively in Tables 4, 5 and 6.
GDP – per capita GDP, ppp, 2000.
PISA – OECD PISA indicators on secondary performance, 2003.
PIT – Personal income tax revenues as a % of GDP, 2000.
Edu – public spending in education as % of GDP, average for 2000-2001.
Comp – index of competence of public officials, 2001/02.
Judic – index for the quality of judiciary, 2000/01.
Shadow – index of the informal sector in the economy, 2001/02.
Pop65 – share of population aged 65 years and above, 2000.
Redtape – index for bureaucracy, 2000/01.
Regulat – index of the burden of regulation, 2000/01.
Rights – index of property rights protection, 2001/02.
Open – degree of openness of the economy: (Imports+Exports)/GDP, 2003.

Tables and charts

Table 1 – Income distribution, public expenditure, education achievements, taxes, initial conditions, institutional variables and openness (correlations)

	Disposable income share of poorest 40% of households, 2000	Gini coefficient, 2000	Poverty ratio (less than 50% of median income), 2000	Per capita GDP, poorest quintile of population, ppp, 2000	Child poverty, 2000	Absolute poverty among children, 2000	Old-age pvoerty, 2000
	DI4000	GI00	POTO00	PABS00	POCH00	POCH200	POLD00
a) Public spending, % of GDP							
Transfers and subsidies, 2000	0.60	-0.57	-0.59	0.29			
Social spending 2000	0.61	-0.56	-0.65	0.46			
Total spending, 2000	0.52	-0.49	-0.48	0.18			
Family benefits, 2000					-0.73	-0.73	
Old age pensions, 2000							-0.07
	DI40, change 1960-2000	Gini, change 1970-2000			DI40, change 1980-2000	Gini, change 1980-2000	
b) Change in public spending, % of GDP							
Social spending, change 1960-2000	0.73						
Social spending, change 1970-2000		-0.31		Social spending, change 1980-2000	0.14	-0.04	
Total spending, change 1960-2000	0.72						
Total spending, change 1970-2000		-0.68		Total spending, change 1980-2000	-0.20	-0.09	
Transfers and subsidies, 1960-2000	0.70						
Transfers and subsidies, 1970-2000		-0.39		Transfers & subs. 1980-2000	0.31	0.20	
	DI4000	GI00	POTO00	PABS00	POCH00	POCH200	POLD00
c) Education achievements and spending							
Mathematics	0.46	-0.49	-0.57	0.35	-0.50	-0.49	-0.23
Projects	0.45	-0.43	-0.60		-0.55	-0.55	-0.27
Science	0.20	-0.14	-0.46		-0.37	-0.37	-0.22
Reading	0.31	-0.27	-0.32		-0.35	-0.34	-0.02
Public education spending	0.51	-0.53			-0.67		
	DI4000	GI00			DI4000	GI00	
d) Taxation				**f) Institutions and openness**1/			
Personal income tax receipts, % of GDP	0.41	-0.46		Independ. Judiciary	0.45	-0.48	
e) Initial conditions				Regulation quality	0.10	-0.09	
Income share poorest 40% households, 1960	-0.16			Size shadow econ.	-0.25	0.30	
Gini coefficient 1970		0.57		Red tape	-0.49	0.42	
				Openness	0.36	-0.39	

1/ A higher index number implies a more independent judiciary and higher quality regulation but more red tape and a larger shadow economy.

Table 2 – Income distribution and expenditure reform

a. Gini coefficient				
	Mid-1980s	Mid-1990s	2000	mid-1980s-2000
Average, all countries	28.0	29.0	29.4	1.3
Euro area	28.7	29.5	29.6	0.9

b. Income share of poorest quintile of households				
	Mid-1980s	Mid-1990s	2000	mid-1980s-2000
Average, all countries	8.6%	8.4%	8.2%	-0.4%
Euro area	9.0%	8.7%	8.5%	-0.4%
Ambitious reformers, early	9.4%	8.9%	8.9%	-0.5%
Ambitious reformers, late	9.9%	10.0%	9.4%	-0.5%
Timid reformers, early	8.3%	8.0%	7.8%	-0.5%
Timid reformers, late	8.3%	8.1%	7.9%	-0.4%
Non reformers	7.9%	7.6%	7.6%	-0.3%

c. Per-capita GDP poorest quintile, 1995 prices, PPP US$				
	Mid-1980s	Mid-1990s	2000	mid-1980s-2000
				% change
Average, all countries	7374	8677	9893	34.2
Euro area	6917	8128	9458	36.7
Ambitious reformers, early	7273	8456	10400	43.0
Ambitious reformers, late	9213	10532	11813	28.2
Timid reformers, early	6936	8141	9036	30.3
Timid reformers, late	7735	9047	9860	27.5
Non reformers	4299	4984	5819	35.4

Source: Schuknecht and Tanzi (2006) based on Förster and d'Ercole (2005).

Table 3a – Income distribution determinants, cross section regression analysis

Dependent variables	Income share, poorest 40% of households, 2000		Gini coefficient, 2000			Per capita income ppp poorest quintile, 2000
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables						
Transfers & subsidies, 2000	0.35*** (3.19)	0.28** (2.58)	-7.13*** (-3.93)			
Social spending 2000				-2.51*** (-4.10)	1.64*** (3.38)	233*** (7.07)
Personal income taxes	0.07 (0.09)		-1.51 (-1.17)			
Per capita income ppp, 2000						0.41 (7.12)***
Amount of red tape/ bureaucracy		-1.90 (-1.72)				
Gini 1970				0.47*** (4.85)		
Unemployment						-275*** (-3.05)
Education achievement, total			-0.86*** (-2.92)			28.75*** (3.07)
Education achievement, maths	0.02** (2.56)					
Education, problem solving				-0.90*** (-6.13)		
Education, public expenditure		0.53 (1.38)				
Social spending education					-0.004*** (-4.22)	
No. of observ.	17	18	22	11	22	18
R^2 adj.	0.58	0.52	0.56	0.92	0.66	0.86

Notes: t statistics in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 per cent.

Table 3b – Change in income distribution, cross section regression analysis

Dependent variables	Change in income share poorest 40% of households 1960-2000	Change Gini 1970-2000	Change in income share, poorest 40% of households, 1980-2000	
Independent variables	(1)	(2)	(3)	(4)
Social spending change 1960-2000	0.39* (1.91)			
Transfers and subsidies, change 1970-2000		-0.57 (-0.24)		
Social spending change 1980-2000			0.08 (0.81)	
Transfers & Subsidies change 1980-2000				0.23** (2.76)
Personal income taxes	0.05 (0.37)		0.18* (2.01)	
Education achievements, total		-1.19** (-3.34)		
Education achievements, maths				0.05** (2.95)
Initial income distribution	-1.11*** (-5.32)	-0.42** (-2.75)	-0.18 (-0.77)	
No.of observations	15	10	19	16
R^2 adj.	0.79	0.59	0.11	0.38

Notes: t statistics in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 per cent.

Table 4 – Model1, DEA results of income distribution efficiency, 1995-2000
(1 input, public social expenditure; 1 output, Gini coefficient)

Country	Input oriented			Output oriented			Peers	CRS
	VRS TE	Rank 1	Rank 2	VRS TE	Rank 1	Rank 2	Input / output	TE
Australia	0.808	9	9	0.923	16	16	JAP / SVK, JAP	0.799
Austria	0.644	19	19	0.938	11	11	JAP, SVK / DNK, SVK	0.580
Belgium	0.607	25	25	0.932	13	13	JAP, SVK / DNK, SVK	0.549
Canada	0.833	7	7	0.941	10	10	JAP, SVK / SVK, JAP	0.803
Czech Republic	0.903	5	5	0.974	7	7	JAP, SVK / DNK, SVK	0.790
Denmark	1.000	1	3	1.000	1	2	-	0.537
Finland	0.797	10	10	0.981	4	4	DNK, SVK / DNK, SVK	0.571
France	0.549	26	26	0.912	18	18	JAP, SVK / DNK, SVK	0.513
Germany	0.618	23	23	0.936	12	12	JAP, SVK / DNK, SVK	0.553
Greece	0.640	20	20	0.854	24	24	JAP / DNK, SVK	0.604
Hungary	0.708	15	15	0.905	19	19	JAP / DNK, SVK	0.703
Ireland	0.888	6	6	0.929	14	14	JAP / JAP, SVK	0.856
Italy	0.608	24	24	0.861	22	22	JAP / DNK, SVK	0.581
Japan	1.000	1	1	1.000	1	3	-	1.000
Luxembourg	0.827	8	8	0.980	5	5	JAP, SVK / DNK, SVK	0.703
Netherlands	0.774	11	11	0.972	8	8	JAP, SVK / DNK, SVK	0.662
New Zealand	0.746	14	14	0.876	21	21	JAP / DNK, SVK	0.714
Norway	0.747	13	13	0.975	6	6	JAP, SVK / DNK, SVK	0.630
Poland	0.633	22	22	0.903	20	20	JAP / DNK, SVK	0.632
Portugal	0.751	12	12	0.845	26	26	JAP / DNK, SVK	0.694
Slovak Republic	1.000	1	2	1.000	1	1	-	0.836
Spain	0.700	16	16	0.856	23	23	JAP / DNK, SVK	0.657
Sweden	0.655	18	18	0.966	9	9	DNK, JAP / DNK, SVK	0.506
Switzerland	0.637	21	21	0.928	15	15	JAP, SVK / DNK, SVK	0.590
United Kingdom	0.656	17	17	0.854	25	25	JAP / DNK, SVK	0.618
United States	0.982	4	4	0.913	17	17	JAP / JAP, SVK	0.902
Average	0.758			0.929				0.676

Notes: 1) Social expenditure, as a percentage of GDP, annual average for the period 1995-2000; Gini coefficient, annual average for the period 1995-2000. 2) VRS TE is variable returns to scale technical efficiency. 3) Rank 2, countries in the production possibility frontier are ranked taking into account the number of times they are peers of countries outside the frontier. 4) Countries in **bold** are located on the VRS efficiency frontier. 5) CRS TE is constant returns to scale technical efficiency.
DNK – Denmark; JAP – Japan; SVK – Slovak Republic.

Table 5 – Model2, DEA results of income distribution efficiency, 1995-2000
(1 input, public social expenditure; 2 outputs, Gini coefficient, poverty rate)

Country	Input oriented			Output oriented			CRS TE
	VRS TE	Rank 1	Rank 2	VRS TE	Rank 1	Rank 2	
Australia	0.966	7	7	0.988	10	10	0.886
Austria	0.795	15	15	0.978	14	14	0.643
Belgium	0.748	18	18	0.973	15	15	0.609
Canada	1.000	1	1	1.000	1	4	0.890
Finland	1.000	1	4	1.000	1	1	0.633
France	0.714	22	22	0.980	12	12	0.569
Germany	0.747	19	19	0.970	17	17	0.613
Greece	0.718	21	21	0.910	22	22	0.672
Hungary	1.000	1	2	1.000	1	3	0.810
Ireland	1.000	1	5	1.000	1	6	0.949
Italy	0.721	20	20	0.927	20	20	0.651
Luxembourg	1.000	1	3	1.000	1	1	0.779
Netherlands	0.935	10	10	0.991	9	9	0.734
New Zealand	0.960	8	8	0.985	11	11	0.824
Norway	0.937	9	9	0.994	7	7	0.699
Poland	0.855	11	11	0.972	16	16	0.710
Portugal	0.851	12	12	0.943	18	18	0.792
Spain	0.785	16	16	0.922	21	21	0.735
Sweden	0.838	13	13	0.994	8	8	0.561
Switzerland	0.811	14	14	0.979	13	13	0.654
United Kingdom	0.784	17	17	0.933	19	19	0.705
United States	1.000	1	3	1.000	1	4	1.000
Average	0.871			0.971			0.733

Notes: 1) Social expenditure, as a percentage of GDP, annual average for the period 1995-2000; Gini coefficient, annual average for the period 1995-2000; Poverty rate, data for 2000. 2) VRS TE is variable returns to scale technical efficiency. 3) Rank 2, countries in the production possibility frontier are ranked taking into account the number of times they are peers of countries outside the frontier. 4) Countries in **bold** are located on the VRS efficiency frontier. 5) CRS TE is constant returns to scale technical efficiency.

Table 6 – Model3, DEA results of income distribution efficiency
(1 input, public social expenditure; 2 outputs, Gini coefficient, income share of poorest 40%)

Country	Input oriented			Output oriented			CRS TE
	VRS TE	Rank 1	Rank 2	VRS TE	Rank 1	Rank 2	
Australia	0.963	8	8	0.983	10	10	0.895
Austria	0.830	10	10	0.953	11	11	0.691
Belgium	0.768	16	16	0.941	13	13	0.645
Canada	1.000	1	2	1.000	1	3	0.924
Denmark	1.000	1	6	1.000	1	2	0.626
Finland	1.000	1	7	1.000	1	5	0.701
France	0.660	21	21	0.916	16	16	0.587
Germany	0.806	13	13	0.949	12	12	0.667
Greece	0.700	19	19	0.871	21	21	0.697
Ireland	1.000	1	1	1.000	1	6	1.000
Italy	0.673	20	20	0.875	19	19	0.666
Luxembourg	1.000	1	4	1.000	1	1	0.812
Netherlands	0.935	9	9	0.988	8	8	0.758
New Zealand	0.829	11	11	0.926	15	15	0.808
Norway	1.000	1	5	1.000	1	4	0.783
Portugal	0.781	14	14	0.895	18	18	0.779
Spain	0.775	15	15	0.901	17	17	0.767
Sweden	0.824	12	12	0.984	9	9	0.608
Switzerland	0.766	17	17	0.939	14	14	0.674
United Kingdom	0.706	18	18	0.874	20	20	0.700
United States	1.000	1	3	1.000	1	7	1.000
Average	0.858			0.952			0.752

Notes: 1) Social expenditure, as a percentage of GDP, annual average for the period 1995-2000; Gini coefficient, annual average for the period 1995-2000; Income share of poorest 40% of the population, data for 2000. 2) VRS TE is variable returns to scale technical efficiency. 3) Rank 2, countries in the production possibility frontier are ranked taking into account the number of times they are peers of countries outside the frontier. 4) Countries in **bold** are located on the VRS efficiency frontier. 5) CRS TE is constant returns to scale technical efficiency.

Table 7 – Descriptive statistics of DEA efficiency scores and model specification

			Model1	Model2	Model3
Efficiency scores	Average	Input	0.758	0.871	0.858
		Output	0.929	0.975	0.952
	Maximum		1	1	1
	Minimum	Input	0.549	0.714	0.660
		Output	0.845	0.910	0.871
	Std. dev.	Input	0.134	0.110	0.125
		Output	0.049	0.029	0.048
Nº of DMUs			26	22	21
Nº of efficient DMUs			3	6	7
DMUs on the frontier			DNK, JAP, SVK	CAN, FIN, HUN, IRL, LUX, USA	CAN, DNK, FIN, IRL, LUX, NOR, USA
Inputs			- public social expenditure as a % of GDP	- public social expenditure as a % of GDP	- public social expenditure as a % of GDP
Outputs			- Gini coefficient	- Gini coefficient - Poverty rate	- Gini coefficient - Income share of poorest 40%
DMUs efficient by default				IRL (out)	FIN (in), USA (out)

Note: summary of VRS TE results.

Table 8 – Censored normal Tobit results
(dependent variable: output efficiency scores from Model 1 in Table 4)

	1	2	3	4	5	6
Constant	0.318*	0.625***	0.616***	0.712***	0.402**	0.883***
	(1.92)	(9.66)	(8.56)	(5.76)	(2.51)	(9.78)
Per-capita GDP	5.53E-06***	6.23E-06***	3.39E-06	4.65E-06	6.82E-06***	4.71E-06***
	(3.32)	(4.45)	(1.12)	(1.43)	(4.74)	(2.66)
PISA	0.0009***				0.0004	
	(2.47)				(1.52)	
Public education spending		0.026***	0.021**	0.025***	0.024***	
		(3.27)	(2.40)	(2.83)	(2.84)	
Competence of civil servants			0.034*			
			(1.69)			
Quality of judiciary						
Shadow economy				-0.021		
				(-0.99)		
% of pop. aged 65 and over						-0.005
						(-1.08)
$\hat{\sigma}_{\varepsilon}$	0.042	0.038	0.037	0.040	0.037	0.047
Nº of observ.	22	20	19	19	20	22

$\hat{\sigma}_{\varepsilon}$ – Estimated standard deviation of ε.

The *z* statistics are in brackets. *, **, *** - Significant at the 10, 5 and 1 per cent level respectively.

Table 9 – Censored normal Tobit results
(dependent variable: output efficiency scores from Model 2 in Table 5)

	1	2	3	4	5	6	7
Constant	0.590***	0.750***	0.768***	0.775***	0.875***	0.581***	0.986***
	(5.88)	(19.96)	(16.06)	(21.54)	(13.53)	(6.05)	(20.76)
Per-capita GDP	4.95E-06***	3.56E-06***	6.37E-06***	3.49E-06***	4.02E-06**	5.11E-06***	5.13E-06***
	(4.64)	(2.67)	(4.60)	(2.74)	(2.60)	(4.86)	(4.57)
PISA	0.0005***					0.0005***	
	(2.61)					(2.25)	
Public education spending			0.011*	0.005	0.010*	0.008	
			(1.67)	(0.94)	(1.74)	(1.33)	
Competence of civil servants				0.030***			
				(3.11)			
Quality of judiciary		0.024***					
		(3.03)					
Shadow economy					-0.024***		
					(-2.11)		
% of pop. aged 65 and over							-0.009***
							(-3.68)
$\hat{\sigma}_{\varepsilon}$	0.019	0.018	0.020	0.016	0.019	0.018	0.016
Nº of observ.	20	19	19	18	18	19	20

$\hat{\sigma}_{\varepsilon}$ – Estimated standard deviation of ε.

The *z* statistics are in brackets. *, **, *** - Significant at the 10, 5 and 1 per cent level respectively.

Table 10 – Corrected output efficiency scores (for specification 1 in Table 9)

	DEA scores (1)	GDP correction (2)	PISA correction (3)	Corrected scores (4)=(1)+(2) +(3)	Corrected Rank
Australia	0.988	0.003	-0.014	0.978	9
Austria	0.978	-0.007	0.002	0.973	13
Belgium	0.973	0.000	-0.009	0.965	15
Canada	1.000	-0.008	-0.017	0.977	10
Finland	1.000	0.004	-0.025	0.981	7
France	0.980	0.007	-0.004	0.983	6
Germany	0.970	0.006	0.000	0.976	12
Greece	0.910	0.048	0.023	0.979	8
Ireland	1.000	-0.013	-0.002	0.985	4
Italy	0.927	0.009	0.016	0.951	18
Luxembourg	1.000	-0.090	0.037	0.947	19
Netherlands	0.991	-0.004	-0.012	0.976	11
New Zealand	0.985	0.030	-0.013	1.000	1
Norway	0.994	-0.016	0.006	0.984	5
Portugal	0.943	0.045	0.018	1.000	1
Spain	0.922	0.029	0.010	0.961	16
Sweden	0.994	-0.002	-0.004	0.988	3
Switzerland	0.979	-0.015	-0.007	0.957	17
United Kingdom	0.933	0.010	-0.015	0.929	20
United States	1.000	-0.037	0.009	0.972	14
Average	0.973	0.000	0.000	0.973	

Note: the corrected scores do not always add up to the indicated sum since for the cases were the result was above one it was truncated to the unity.

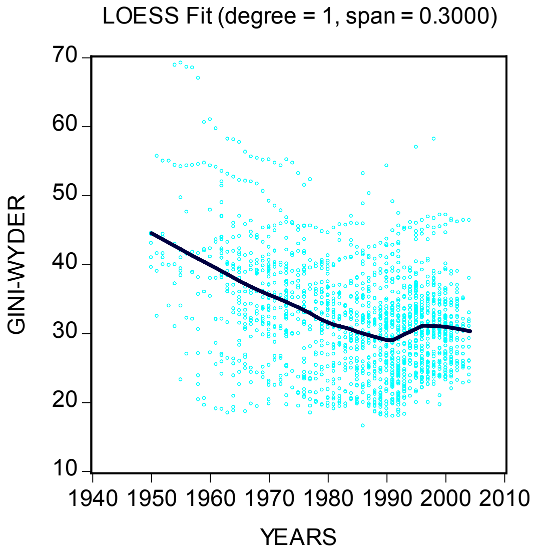
Table 11 – Corrected output efficiency scores (for specification 5 in Table 9)

	DEA scores (1)	GDP correction (2)	Public educ. spending correction (3)	Shadow economy correction (4)	Corrected scores (5)=(1)+(2)+ (3)+(4)	Corrected Rank
Australia	0.988	-0.006	0.006	-0.014	0.973	10
Austria	0.978	-0.010	-0.006	0.000	0.963	13
Belgium	0.973	-0.003	-0.006	0.010	0.973	9
Canada	1.000	-0.012	0.000	-0.012	0.977	7
Finland	1.000	0.001	-0.007	-0.014	0.980	6
France	0.980	0.001	-0.005	-0.005	0.971	11
Germany	0.970	0.000	0.007	-0.002	0.975	8
Greece	0.910	0.031	0.015	0.027	0.982	4
Ireland	1.000	-0.037	0.009	-0.002	0.970	12
Italy	0.927	0.002	0.006	0.012	0.947	16
Netherlands	0.991	-0.007	0.005	-0.007	0.981	5
New Zealand	0.985	0.026	-0.010	-0.012	0.989	3
Portugal	0.943	0.037	-0.005	0.029	1.000	1
Spain	0.922	0.021	-0.009	0.010	0.944	17
Sweden	0.994	0.004	-0.014	0.005	0.989	2
Switzerland	0.979	-0.010	0.003	-0.012	0.960	14
United Kingdom	0.933	0.002	0.008	-0.005	0.939	18
United States	1.000	-0.039	0.004	-0.009	0.955	15
Average	0.971	0.000	0.000	0.000	0.971	

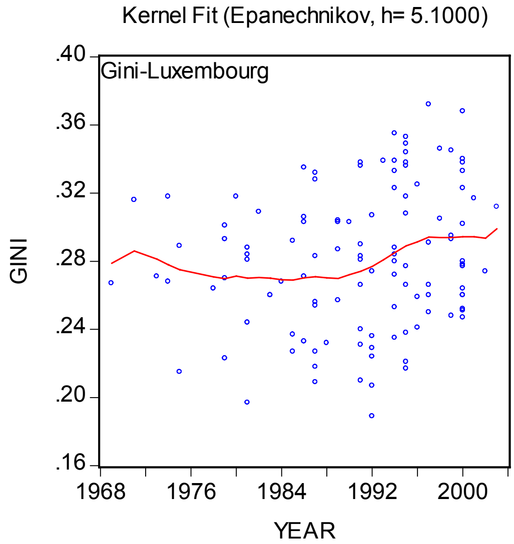
Note: the corrected scores do not always add up to the indicated sum since for the cases were the result was above one it was truncated to the unity.

Chart 1 – Income distribution data: an overview

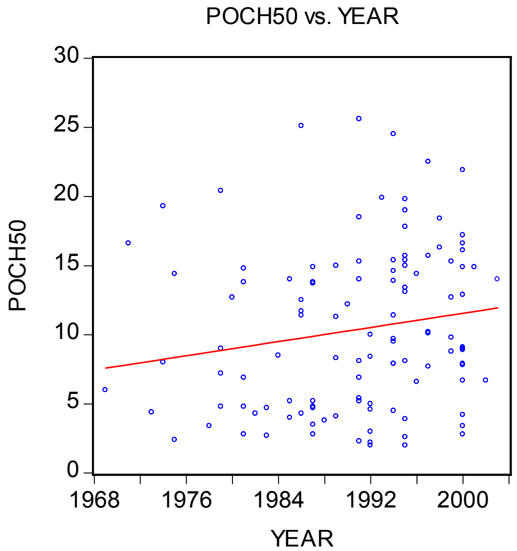
1a



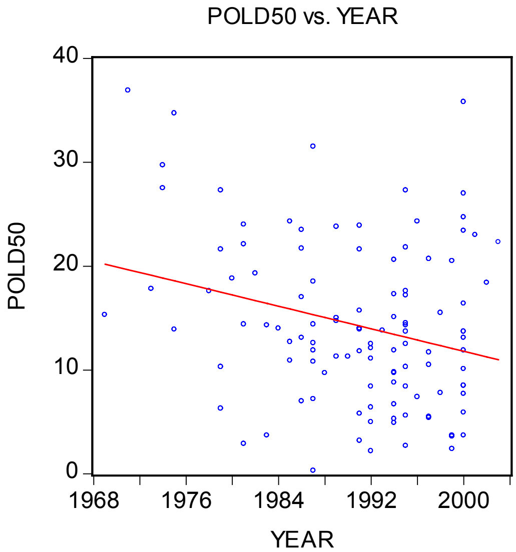
1b



1c

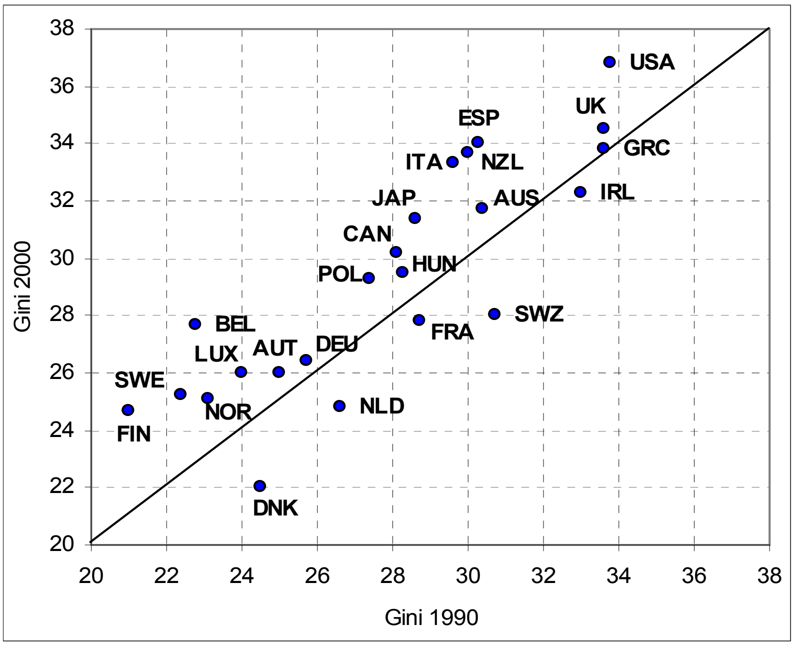


1d



Notes: POCH50 – Child poverty, 2000; POLD50 – old-age poverty, 2000.
Source of the data: Wyder (panel a) and Luxembourg Income Study (b-d)+A104.

Chart 2 – Gini coefficient,
2a - 1990 vis-à-vis 2000



2b - 1980 vis-à-vis 2000

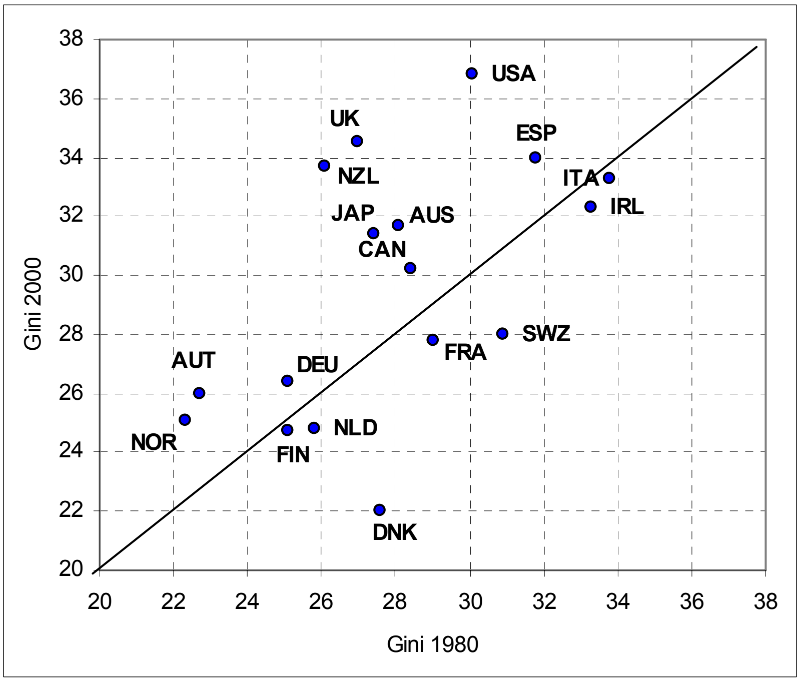


Chart 3a – Social spending and income share of poorest 40% households, 2000

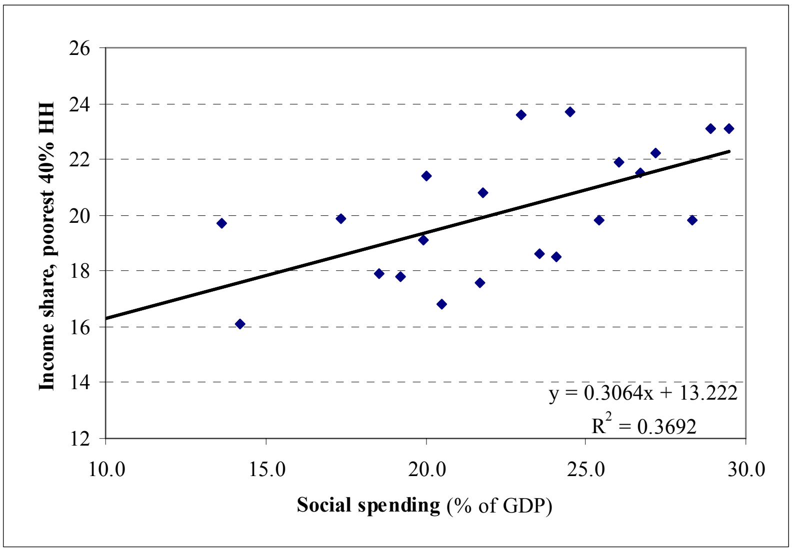


Chart 3b – Social spending & income share, poorest 40% households, change 1960-2000

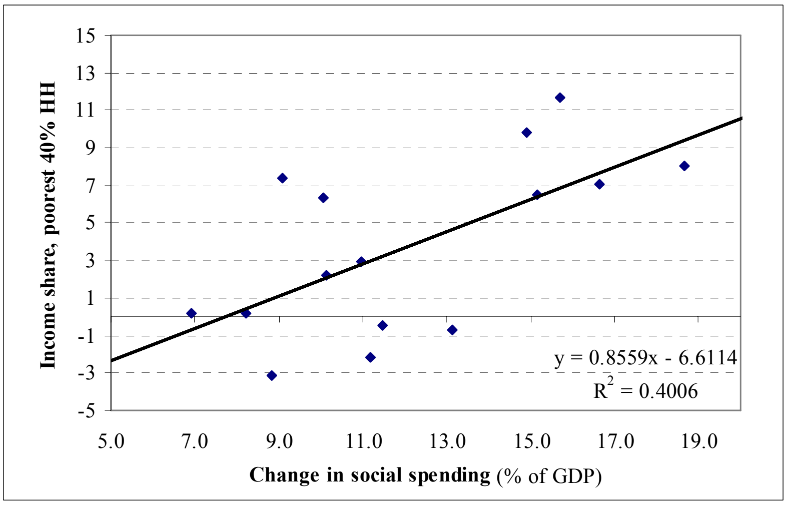
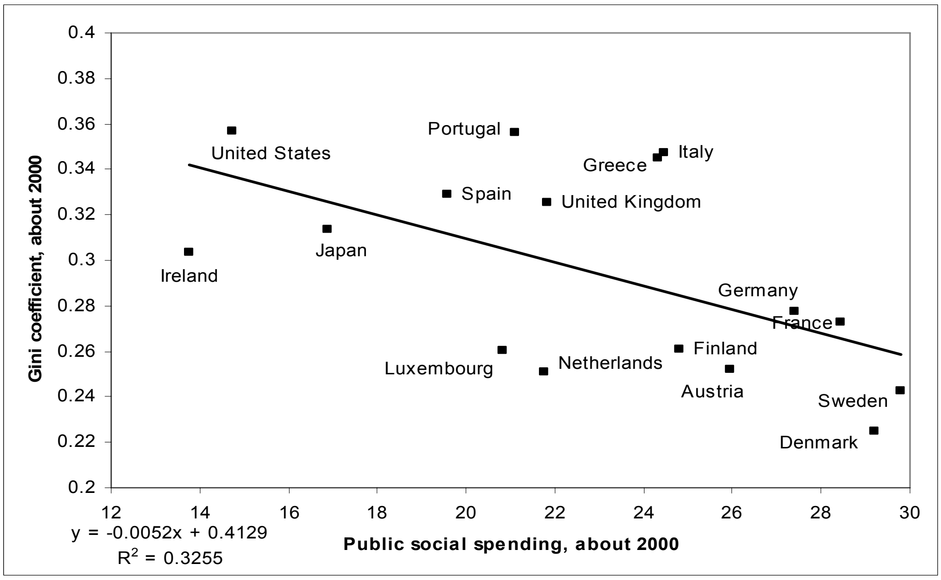
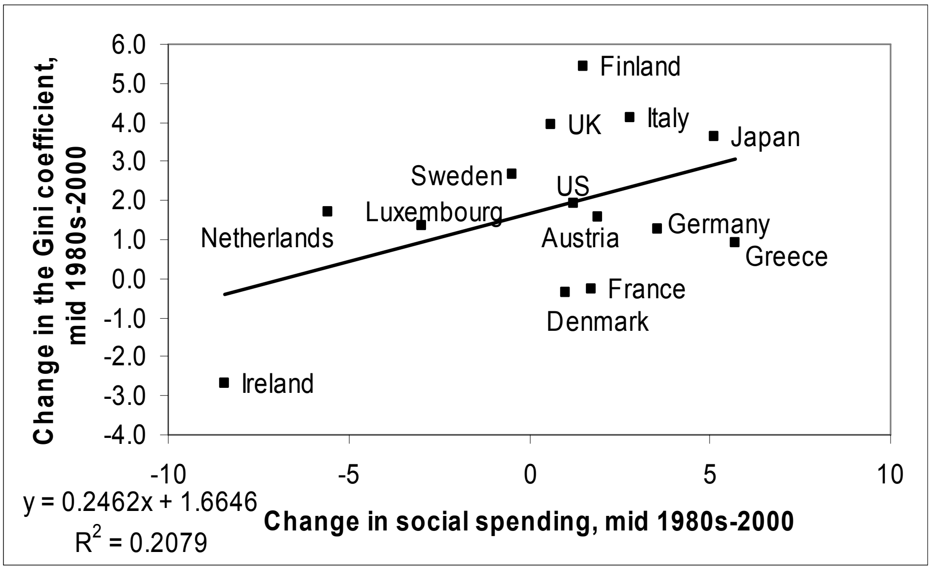


Chart 4 – Income distribution and social spending reform

4a



4b



Source: Heipertz and Ward-Warmedinger, 2007.

Chart 5 – Production possibility frontier: one input, one output

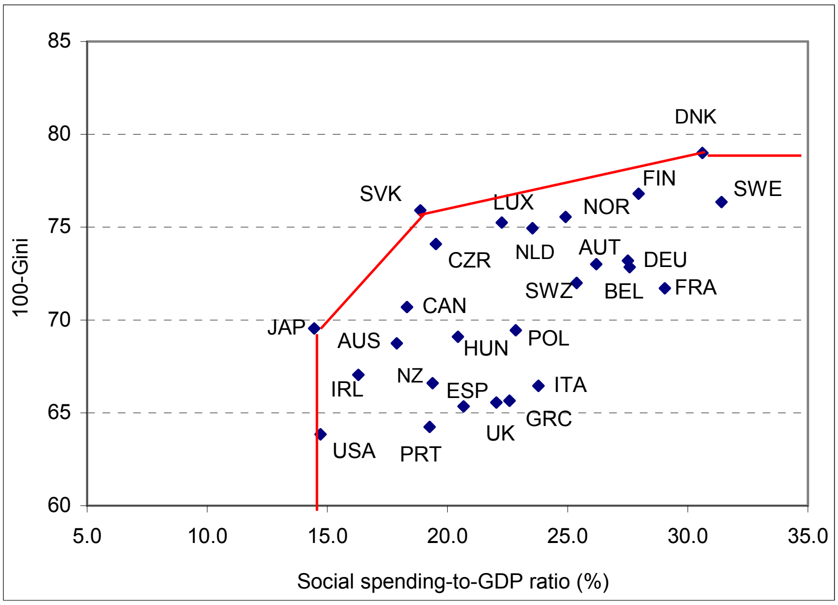


Chart 6 – Production possibility frontier, constant returns to scale, one input (social spending-to-GDP), two outputs (output 1: income share of poorest 40%; output 2: Gini)

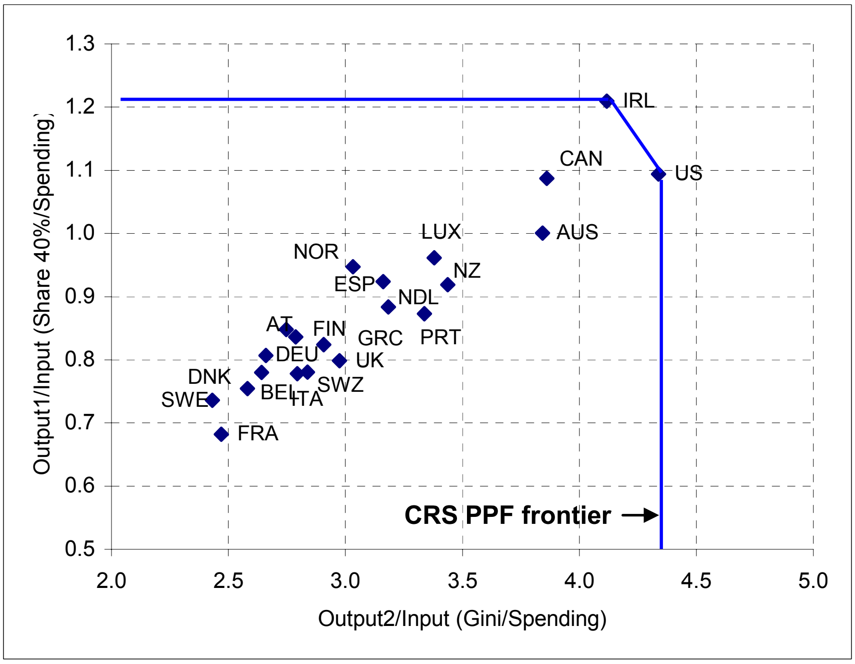
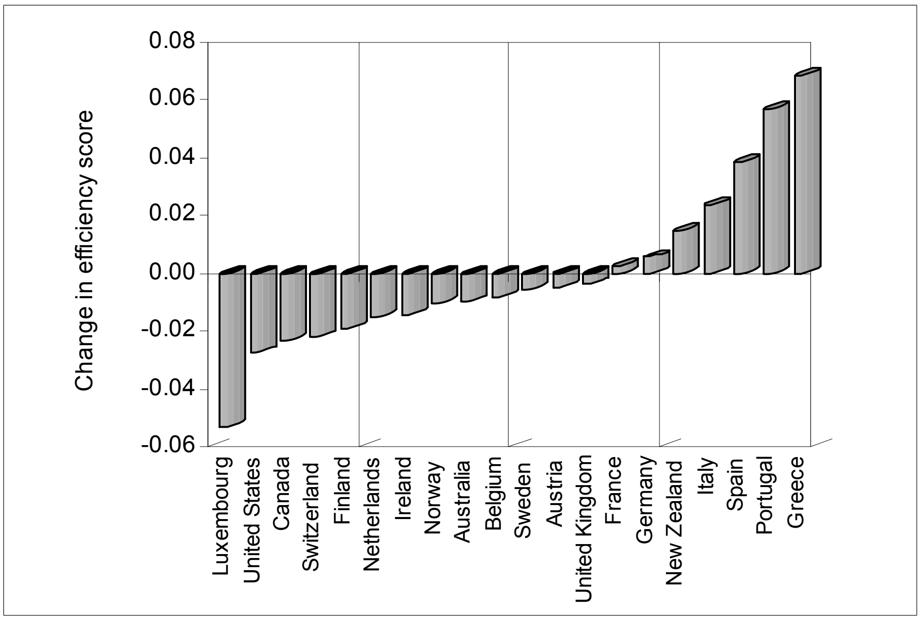
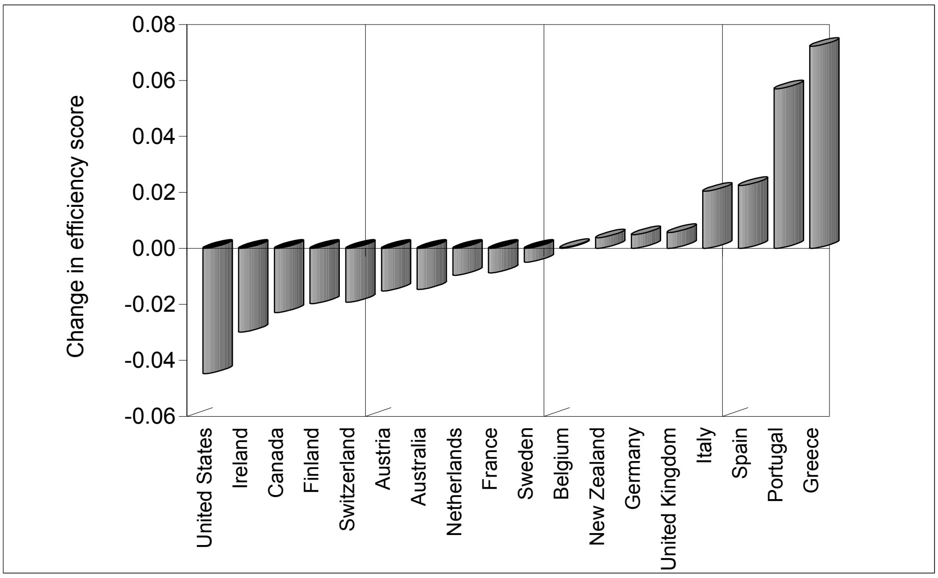


Chart 7 – Change in efficiency scores after correction: +(-), DMU moves closer to (further away from) the production frontier

7a – corrections from Table 10 (GDP, PISA)



7b – corrections from Table 11 (GDP, education spending, shadow economy)



Distribution and growth in Europe – the empirical picture: a long-run view of the distribution of income

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1. Methodological introduction

The literature on income distribution over the past half century has been dominated by the Presidential Address given in 1955 to the American Economic Association by Simon Kuznets. This dominance is both surprising and unsurprising. It is *surprising* since the element for which the Address is best known – the "Kuznets curve" – has proved to have limited empirical relevance. According to the Kuznets curve, as an economy goes through a structural transformation, income inequality follows an inverse U-shape, inequality first rising and then falling as labour is transferred from low-productivity agriculture into high-productivity industry. In fact, as is well known, a period of falling income inequality has been succeeded in recent decades in most industrialised countries by rising income inequality. If there was an inverse U, the pattern has now become a U.

The influence of Kuznets (1955) is *unsurprising* because he seized on a central question concerning the development of the modern capitalist economy – does it lead to rising inequality? The long-run evolution of the distribution of income is a highly salient indicator, and one with which individual citizens and political leaders are much concerned. It is important to understand the past history in order to form a view about where we are headed and about the implications for policy. Is there – in the advanced economies of the twenty-first century - a natural tendency for income differences to increase? `Are the rich securing a disproportionate share of the fruits of growth? Were previous periods of equalisation achieved only by government intervention?

In 1955, the distributional data available to Kuznets were very limited. His inverse-U was based on observations for just three countries (United States, United Kingdom, and Germany); for the United States he only compares 1929 and the "years after World War II (average for 1944, 1946, 1947 and 1950). The longest series is that for the United Kingdom, where he refers to evidence for 1880, 1910, 1913, 1929, 1938 and 1947. The *first aim* of this paper is to describe the long-run evolution of the income distribution using the much richer data now available. The data are richer because we can draw on fifty more years, with differing macro-economic experience. How for instance did inequality evolve during the "Golden Age" of the 1950s and early 1960s? The data are also richer because recent research has provided new evidence concerning the period about which Kuznets was writing. The paper summarises what we know about income inequality over the twentieth century, covering a selection of OECD and EU countries.

The *second aim* of the paper is to bring together different elements in the explanation of income inequality. Much of the recent literature has concentrated on individual earnings, and the rise in wage dispersion, but this is only one ingredient. The account given by Kuznets went much wider than employment in different sectors. He described a variety of mechanisms affecting the distribution of income, including the concentration of capital incomes and the impact of the political and social system. In what follows, I seek to link the explanation of the distribution of income to the mainstream of economics. If the Kuznets curve was an application of a dual economy model of development, then we need to make similar links to growth theory, macro-economics, modern labour economics, and political economy.

Review of empirical evidence

There are three distinctive features of the review of the evidence in sections 2 and 3: emphasis on high-frequency (annual) data, explicit recognition that data quality varies, and use of different sources. Examination of a full run of years is important in understanding the *kind* of explanation that we should be seeking. Not only has the Kuznets curve been confounded by more recent events, but it has become clear that it is misleading to talk of "trends" when describing the evolution of income inequality. As argued in Atkinson (1997), it is better to think in terms of "episodes" when inequality rose or fell. To distinguish such episodes, we need data covering more than a few years. Indeed, there are considerable dangers in relying on a small number of isolated observations. For example, stability has been regarded as a long-standing feature of the British earnings distribution: "thus in a period [1886 to 1966] when the level of earnings of adult male manual workers increased by a factor of nearly 16, it appears that their dispersion (measured in percentage terms) changed very little" (Thatcher, 1968, page 163). But this was based on simply five observations, separated in all cases except the last by more than 20 years. Here, I attach a high priority to covering as many years as possible and to extending the coverage back in time.

In seeking to extend the data coverage, the second consideration becomes important: adopting a graded approach to data quality. Economists tend to swing between two extreme positions with regard to data quality. They either use any data that can be downloaded, without any consideration of their quality, or they reject any data that depart in any respect from their ideal. In my view, we need to adopt an intermediate position, classifying data according to their suitability for the purpose in hand, in the present case the measurement of changes over time in the distribution of income. As a first step in this direction, I have applied a three-fold classification, parallel to that used in some areas of the national accounts: A denotes data that are most appropriate, B denotes acceptable, if not ideal, data that may be applied faute de mieux, and C denotes data that should not be used. In effect, this divides the useable data into two classes, not perhaps a radical step, but one that serves to extend the period covered, while not losing sight of the data quality issue.

The adoption of this grading reflects the third distinctive feature of the approach followed here: the use of a variety of sources. Over the past 30 years, there has been an explosion of research in economics based on household surveys. The exploitation of household micro-data has been very fruitful, but we should not lose sight of other data sources. In what follows, I make particular use of data from income tax records in section 3 on top incomes, of data from employer surveys in section 4, and wealth tax and estate tax data in section 5.

Theoretical framework

My central concern is with the distribution of family or household income, after transfers and direct taxes (i.e. disposable income), taking account of differences in family or household size and structure (i.e. adjusted by an equivalence scale). In seeking to explain this distribution, we have to consider several ingredients. Total household income depends on the earnings of individual members, which are the subject of section 4; indeed these are the single most important element for most households. But the distributional consequences of earnings depend on household composition: the number of earners in the household, and the correlation of their earnings. Household incomes have been affected by the increased labour force participation of married women, and by the reduced participation of younger workers, quite independently of any changes on the dispersion of individual earnings. Conversely, an increase in the skilled earnings differential may lead to greater household income inequality, but it may be moderated where skilled workers are married to unskilled. Educated workers may have seen an increased premium, but their children may be those who are remaining longer in education rather than entering the labour force. We cannot therefore read directly from the distribution of individual earnings to the distribution of household incomes.

To earned incomes are added incomes from capital, examined in section 5. In classical analyses of distribution, the factor incomes were also functional incomes, with workers receiving wages, capitalists receiving profits, and landlords receiving rents. But while such a strict class division may have been appropriate in nineteenth century England, it has clearly ceased to be a realistic assumption. As developed, by Meade (1964), we need a theory of individual income distribution, where individuals both work and receive capital income, in differing proportions. The distribution of income depends on the correlation between the two sources. The class model assumed a correlation of minus 1. At the opposite extreme is a situation where all saving stems from earned income, as in a life-cycle savings model, and the distribution of wealth simply mirrors the distribution of earnings. At this point, I should note that the life-cycle perspective also draws our attention to the fact that the distribution of annual income may be influenced by changes in the time profile of accumulation or in demographic structure. Increased dispersion of incomes may reflect the presence of more elderly persons, with reduced incomes, and should not be regarded as an increase in inequality. In the case of inheritance, another important source of wealth, the timing of transmission will also affect the annual distribution. Where parents pass on wealth before death, there may be an apparent reduction in the concentration of wealth.

The impact of earnings and of wealth depends on the relative magnitudes of earned and capital incomes. This brings us to the factor shares considered in section 6. There is however a crucial difference between the shares that feature in the national accounts (the returns to factors of production) and the shares recorded in the personal distribution of income. To begin with, the aggregate share of employee remuneration (wages and salaries, plus employer contributions to social security and private welfare) is more extensive than the total wages and salaries that typically appears in the personal distribution. Employer contributions and welfare payments are usually not recorded, and their significance has been growing over time, particularly in the US. Profits and property income involve key intervening institutions, notably the company sector, pension funds, and the state. Moreover, the state creates classes of personal income – transfer payments and interest on the national debt – that have no counterpart in national income. These mean that the share of wages differ, since they are expressed as a proportion of a different total. As considered further in section 6, we need to track the relationship between the components of total personal income and the macro-economic aggregates.

Transfer payments and the national debt remind us that on seeking to explain the distribution of income we need to consider issues of political economy. The recent emphasis on global trade and new technology as causes of higher earnings dispersion has tended to create the impression that rising inequality is outside the control of governments, at least of national governments. But such external forces can be moderated or offset through the use of tax and transfer policy. The state can affect market returns through its macro-economic policy, and through its role as an employer and purchaser. Government intervention may shift the distribution of rewards.

As should be clear from this account, there are a number of branches of economics that are highly relevant to the explanation of the distribution of earnings, and we need to build bridges in several directions. Earnings remain the single most important determinant of incomes, and we need to draw on labour economics. But we need also to relate the evolution of capital to theories of economic growth and to take account of recent developments in political economy.

2. The evolution of the overall distribution

The empirical evidence is summarised in this section in terms of the Gini coefficient. A single summary measure is clearly inadequate and may miss the differing experience of different income groups, but in the next section I look specifically at the top of the distribution. In assembling the data, I have tried to make them as comparable as possible, but this has not always been possible. Breaks in continuity are signalled, and differences are noted where this affects the examination of changes over time, but I have not commented on the comparability across countries. The reader should not therefore use the graphs to draw conclusions about the relative degrees of inequality on different countries. The fact that the Gini coefficient for country X lies below that for country Y may reflect a systematic difference in the data source or in the definition of either income or income unit.

I begin with the experience of the three Nordic countries shown in Figure 1. I start with this group because they illustrate very clearly the U-shape that has come now to be the conventional wisdom. Cornia and Court have described how "the Golden Age, a period of stable global economic growth between the 1950s and early-mid 1970s, witnessed declines in income inequality in a number of countries (with some exceptions). This trend was reversed over the last two decades as country after country has experienced an upsurge in income inequality" (2001, page 7). In Finland and Sweden, the Gini coefficient for disposable income fell by more than 10 percentage points between the mis-1960s and 1980. To attach some significance to this change, suppose that the tax and transfer system were approximately linear, as with a uniform tax credit and a constant tax rate. Then, if government spending on goods and services absorbs 20 percent of tax revenue, a redistributive tax of 16 percentage points would reduce a market Gini of 50 percent by 10 percentage points.[1] Raising the tax rate from 20 percent to 36 percent would be a major political shift. After a period when the Gini remained more or less stable, inequality began to rise in the 1990s. The increase was some 6 percentage points on all three countries, more than half reversing the previous fall. (It should be noted that there have been breaks in the series for Norway and Sweden, as definitions were changed, which have to be taken into account.)

The Nordics appear therefore to provide evidence for a "great U-turn", as it was described by Harrison and Bluestone (1988). But a note of caution should be sounded. As far as the downward arm is concerned, there is no clear evidence for Norway,[2] and in the case of Sweden a lot rests on the observation for 1967. Gustafsson and Uusitalo say that "because of some differences between the two data sets the comparability is less satisfactory" (1990, page 84), and the official Statistics Sweden series only starts in 1975. Gustafsson and Johansson (1999) exclude the 1967 observation from their analysis of changes in inequality over time; here I have adopted the alternative procedure of grading it B, and for this reason the section from 1967 to 1975 is shown by a dashed line. From 1975 to 1981 the fall was less than 2 percentage points. In the case of the upward arm, it is not clear that there is a continuing trend; in the cases of Finland and Sweden, the rise seems to have been concentrated in the 1990s.

The U-turn is more usually associated with the Anglo-Saxon countries. Figure 2 shows the Gini coefficients for the United States and the United Kingdom. Here the series go back further – before the Second World War – but the data are even more of a patchwork rather than a single series, reflecting in this case differences in the underlying data sources as well as different definitions. It should also be noted that the US estimates relate to income before direct taxation. The US Gini fell by more than 10 percentage points between 1929 and 1944, was broadly level until the late 1970s, and then rose by some 6 percentage points (taking half of the increase in 1993

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[1] A gross income of Y becomes a net income of (1-t)Y+A, where A is the value of the tax credit. Since A is the same for everyone (with appropriate equivalisation), the Gini is (1-t) times the value for gross income divided by the mean net income relative to the mean gross income, which is assumed to be 0.8.

[2] Those commentating on the Norwegian experience have reached different conclusions. According to Bojer, the period 1970-1984 in Norway showed "great stability in the distribution of personal income" (1987, page 257). According to Ringen, the distribution from 1970-1986 "has not been stable" with first a rise and then a fall in inequality (1991, pages 6 and 7).

as being a genuine increase – see Weinberg, 1996, footnote 3). Again, we should note that the period of the large decline is covered only by a small number of data points.

For the earlier years in the UK, we have a synthetic series, based on income tax and other data, which suggests a fall in the Gini coefficient up to the end of the 1940s parallel to that in the US. The pattern later departs from that in the US in that there appears in the UK to have been a fall of some 5 percentage points between the mid-1960s and the mid-1970s. This fall was more than reversed in the 1980s: between 1980 and 1992 the Gini coefficient in the UK rose by 10 percentage points. If, in terms of percentage points of the Gini, the story of the Nordic countries and the US was -10, followed by +6, that in the UK was -10, followed by -5, followed by +10. Moreover, in contrast to the US, the Gini coefficient for the UK has levelled of in the past 15 years: the figure for 2005 is below that for 1990. Any theory must explain why the evolution of income inequality in the UK was twice as severely affected as the US, and the episodic nature of the rise. A clue is provided by the difference between the two UK series for the latter part of the period, which distinguish between disposable income (bottom line) and market income (top line). The difference between them is, in arithmetic terms, the impact of transfers and direct taxes. Inequality in market income began to rise steadily in the UK in the 1970s, reflecting the decline in employment rates and the ageing of the population. Taxes and transfers held this in check until the mid-1980s: the Gini for net income in 1986 was effectively no higher than 10 years previously. But the mid-1980s saw major changes in tax and transfer policy, and the Gini for net incomes rose by 7 percentage points in four years. Public policy must be part of the explanation.

In Continental Europe (Figures 3 and 4), we find a marked decline from 1959 to 1977 in the Netherlands: "the CBS [Central Bureau of Statistics] figures show quite a marked fall in inequality from 1962 onwards, a fall which continues into the first half of the seventies. About ten years of stability followed, after which a slight increase in inequality can be registered, starting in 1983. ... Thus the long-term fall in income inequality which had run through the 20th century seems to have come to an end half way through the 1980s" (van Zanden, 1998, page 177). The rise from 1983 to 1990 was 3 percentage points, but the 1990s indicate no continuation of the rise: the Gini coefficients for 1991 and 1999 are identical. As in the UK, there was an episode of rising inequality in the 1980s, not continued into the 1990s. In West Germany, the earlier period is surrounded by uncertainty. Both the budget survey (EVS) based estimates and the DIW synthetic estimates show falls in the Gini coefficient of more than 3 percentage points, but the timing is quite different. The EVS estimates show a fall from 1962 to 1973, but this is not mirrored in the DIW synthetic estimates, which show a rise. The preference today is to use household survey data, but it is not evident that we should simply believe one series and not the other. The EVS is based on a quota sample, and a lot of weight attaches to the first observation in reaching the conclusion that inequality fell significantly. The DIW estimates incorporate information from other sources, notably the tax returns. In the more recent period, the EVS and the German Socio-Economic Panel survey show a similar upward trend. The increase in the Gini coefficient indicated by the GSOEP data should be noted: even allowing for some year-to-year variation, the overall rise from 1990 has been some 5 percentage points. A U-shape in Germany is now beginning to be more apparent.

The graphs for France and Italy (Figure 4) show declines in the 1960s (France) and 1970s (both countries). (It should be noted that the Italian estimates are compiled from the same source – the Bank of Italy household survey – but different series, with different income definitions, reflecting changes in the underlying survey; the French data are drawn from the fiscal records (ERF).) In France, the Gini fell by 5 percentage points between 1970 and 1984; in Italy, there was a fall of more than 10 percentage points between 1973 and 1982. Subsequently, the pattern in Italy was variable. As summarised by Brandolini, “from the early 1970s until 1982 ... the inequality of household incomes fell dramatically. In the mid-1980s, it showed some tendency to grow; a further decline in 1989-91 was soon reversed, and in 1995 the Gini coefficient was back to the value of 1980” (1999, page 222). The Gini coefficient in 2004 was essentially the same as in 1993. Similarly, in France there is little sign of an upward trend over the period from 1996 to 2005. This may change if President Sarkozy achieves a “rupture” with the past.

The final graph (Figure 5) shows the changes in income inequality in three Eastern European countries that joined the European Union in 2004. There is again a U-shape, but the underlying causes are likely to be different. It was under a Communist government that the Gini coefficients in Czechoslovakia and Hungary fell by some 5 percentage points from the 1950s to 1980. The upward arm of the U was associated with the transition to a market economy. The reader may note that only one of the series is graded as B: the early part of the series for Poland, which is down-graded because it is limited to worker households. The quality of the data for Eastern Europe is examined at length by Atkinson and Micklewright (1992), where we conclude that the data for the three countries shown (although not the Soviet Union) were of comparable quality with those for the United Kingdom. The Eastern European sources had significant deficiencies, and there were undoubtedly aspects not adequately covered such as private incomes that were of increasing magnitude over time, but there were also respects in which they were superior. As was noted by Večernik, the Communist governments commissioned large surveys and response rates were high, and the “income surveys were highly reliable – at least with regard to the formal economy” (2001, page 193).

Conclusion

The popular view of a U-turn in income inequality finds some foundation in the evidence for 12 OECD countries presented above. The recent upturn is evident in the Nordic and Anglo-Saxon countries, and, now, in Germany. But the conclusion has to be qualified. In the case of the UK, the Netherlands, Italy and possibly the Nordic countries, the increase in the Gini looks more like an episode than a continuing upward trend. In the Eastern European countries, the increase was associated with the transition to a market economy. Moreover, the timing of the downward arm of the U differed across countries, and in some cases was based on one or two influential observations.

3. Top incomes over the long-run: Evidence from income tax data

The review of evidence about overall income inequality in the previous section has shown the importance of viewing recent changes in historical perspective; it has also shown how our view of earlier decades is based in some cases on a small number of isolated observations. In this section, I consider how we can flesh out the picture, and go back further in time, using data from income tax administrative statistics. The fact that they cover, particularly in the early years of the last century, only a small fraction of the population (here I focus on the top 1%), limits their usefulness. The UK super-tax provides an extreme example. When the tax was introduced, super-tax payers were a small minority of the population: 11,328 tax units, or broadly the top 0.05 % of the total. But, although small as a percentage of the total population, this group typically receives a significant fraction of total income – between 5 and 20 per cent – and this can materially affect the overall Gini coefficient. As an approximation, a difference of 10 per cent in the share of the top 1 per cent adds $(1-G_{-})10$ to the Gini coefficient, where G_{-} is the Gini coefficient among the remaining 99 per cent of the population. So that where G_{-} is, say, 30 per cent, the difference in the Gini is 7 percentage points.

The use of income tax data is often regarded with considerable disbelief. The index to Morgenstern's book *On the Accuracy of Economic Observations* (1963) contains the entry "income tax, as reason for lying", and this summarizes well his general – if not very specific - skepticism. Richard Titmuss wrote a book-length critique of the income tax-based statistics on distribution, concluding, "we are expecting too much from the crumbs that fall from the conventional tables" (1962, page 191). These doubts are well justified for at least two reasons. The first is that income tax data are collected as part of an administrative process, which is not tailored to our needs, so that the definition of income, of income unit, etc are not necessarily those that we would have chosen. This causes particular difficulties for comparisons across countries, but also for time-series analysis where there have been substantial changes in the tax system, such as the move from joint taxation of couples to individual taxation in the UK in 1990. Secondly, it is obvious that those paying tax have a financial incentive to present their affairs in such a way that reduces tax liabilities. There is tax avoidance and tax evasion. But these do not mean that the data are worthless. Like all economic data they measure with error the "true" variable in which we are interested. Moreover, we can compensate for some of the shortcomings of the income tax data. In particular, we can set the tax data in context by making use of independent estimates of the total population and the total income. These control totals are typically based on Censuses of Population and on national accounts estimates of the total income of persons. The control totals require a number of adjustments and are surrounded by a margin of error, but the important point is that when I refer to the top 1% having x% of income, this means the top 1% of the total population (aged 15 and over) and x% of the total income of all these individuals, whether or not they are taxpayers. It is *not* the top 1% of taxpayers.

The attraction of income tax evidence is that it is available for long runs of years, typically on an annual basis, *and* that it is available for wide variety of countries. For example, Banerjee and Piketty (2005) have made use of Indian income tax data from the days when the British King was Emperor of India. It is however with OECD countries that these top income studies started. In 1914, Bowley used the

British super-tax data to publish estimates in the *Quarterly Journal of Economics.* Kuznets pioneered the use of control totals in his 1953 study for the US, *Shares of Upper Income Groups in Income and Savings*. The recent revival of interest in income tax data is due to Piketty (2001) when he published a 800 page study for France, covering the period since 1915. When I saw his results, I immediately set to work to make use of the super-tax data for the UK that I had been collecting, and produced estimates starting in 1908 (published in Atkinson, 2005). Piketty and Saez (2003) then developed the analysis for the US, starting in 1913. The interest in making cross country comparisons led to a project to cover a wide range of countries (Atkinson and Piketty, 2007).[3]

English-speaking and Continental European countries compared

The evolution of the share of the top 1 per cent in five English-speaking and five Continental European countries is demonstrated in Figures 6 and 7. The data allow us to go back in all cases before the Second World War and, in 8 cases, to the the First World War or earlier. The graphs show the share of the top 1% in total gross income: i.e. income before tax but including taxable transfers.

Starting with the English-speaking countries, we may note the high initial values: approaching 20% in the UK and the US, and being above 15% in Canada. Even in the more egalitarian Australia, the share in 1921 was around 10%, so that this top group of 1% received ten times their proportionate share of total gross income. This was to change. Over the next 50 years, from 1920 to the late 1970s, top income shares fell sharply in all five English-speaking countries. They differ in the timing of the fall. In the case of the US, the annual income tax data allow us to learn much more about the timing of the pre-war fall (1936 – the year in Figure 2 – does indeed appear to be out of line). Between a peak in 1928 and 1940, the share of the top 1% fell from around 20 per cent to around 15 per cent. But there was no comparable fall in Canada or Australia (although there was in New Zealand). In the US, from 1940 to 1945 there was a further fall of 4 percentage points, and there were falls during the Second World War on Canada and the UK, but not in Australia and New Zealand, which also saw a post-war spike associated with the Korean War boom in wool prices. In Canada and the US, there was limited change in the period 1955 to 1975, whereas Australia, New Zealand, and the UK all exhibited significant peacetime falls in the share of the top 1%. At the end of the 1970s, in North America, the share of the top 1% was around 8%, whereas in the other countries it was some 5-6%. But all of the countries saw a reversal of this decline in the 1980s and 1990s. Here we have a very clear U-turn. Between 1980 and 2000, the share of the top 1% doubled in the US and the UK, and rose by between a half and three-quarters in the other countries. In all cases, we ended up broadly in the position immediately after the Second World War – and in some cases similar to the position at the end of the 1930s.

Figure 7 shows, in contrast, the shares of the top 1% for the five Continental European countries. We may note first the high initial values: the shares are around 20% for France or higher for the Netherlands and Sweden. (The vertical scale is

[3] At this point I should like to acknowledge how much I am drawing on the work of the team. The figures used here in Figures 6 and 7 is based on the research of Thomas Piketty, Emmanuel Saez, Michael Veall, Fabien Dell, Andrew Leigh, Wiemer Salverda, Jesper Roine and Daniel Waldenström.

smaller than in the previous Figure.) As Piketty has noted in the case of France, this is surprising. Some 125 years after the French Revolution, France had much the same inequality at the top as the UK that had no such overthrow of the aristocracy. The shares then fell, as in Anglo-Saxon countries. But the time paths are different. In France, the falls were largely concentrated in the war periods and the depression. In the Netherlands and Sweden, there were falls of some 6-7 percentage points between 1945 and 1980, whereas in Germany the share in 1980 was within 1 percentage point of that in 1950. For four of the five countries, there has not been a U-shaped pattern over the twentieth century. The shares in France and Germany are virtually the same at the end of the period as in 1980, and those in the Netherlands and Switzerland are lower. In Sweden, the share of the top 1 per cent has risen – from around 3½ per cent to 6 per cent – but the rise appears more as a jump in 1991. The series shown for Sweden in Figure 7, like those for other countries, does not include capital gains. Roine and Waldenström show that there is a clearer upward trend over time in the data including capital gains, Sweden resembling more closely the Anglo-Saxon countries

Conclusion

The income tax data provide only a restricted view of the distribution of income, but they allow the changes over time, at least at the top, to be tracked more closely. These reveal a broad commonality over the first three-quarters of the twentieth century, although differences in timing that reflect national specificities. Over the last quarter of the century, however, there were marked differences between the Anglo-Saxon countries and Continental Europe, with Sweden closer to the former.

4. Earnings: Episodes of change?

I turn now to the components of total income. At the top of the distribution, capital income plays an important role, but for the mass of the population earned income is the single most important component. As observed in *Employment in Europe 2005,* "earnings inequalities are one of the most tangible subjects … with real implications for each and every individual" (European Commission, 2005, page 164). It is also a subject about which there are many myths. It has been suggested, for example, that the recent rise in dispersion is noteworthy because it comes after a long period of "remarkable stability" in the earnings distribution. On this basis, the downward arm of the U was due, not to earnings equalization in the fashion of Kuznets, but to the reduction in the inequality of capital income and the growth of the welfare state financed by progressive taxation. In the US, Jones and Weinberg noted that "the earnings distribution for men remained stable, with a few exceptions, between 1967 and 1980" (2000, page 3). Writing about the U.K., Machin says "after showing relative stability for many decades (and a small compression in the 1970s) there has been [since the late 1970s] an inexorable upward trend in the gap between the highest and lowest earners in the labour market." (Machin, 1996, page 62). Writing about the US, Morris and Western in their survey article for the *Annual Review of Sociology* state that "the postwar years of prosperity were marked by … relative stability in earnings inequality. The benefits of economic growth were large and widely distributed" (Morris and Western, 1999, page 625). This characterization in terms of "relative stability" is in fact a long-standing one, at least in the U.K. Commenting on the data for 1886 and 1978, Phelps Brown notes how "the average wage in money … has been multiplied by a factor of 64. Differentials between occupations and grades and regions have changed – mostly they have contracted. The distribution of manpower between different jobs and different places has altered radically. Trade unionism has greatly extended its power. … Yet, after 91 years of these changes … the dispersion of individual earnings remains very closely the same" (1979, p. 4).

The "stability" view has been challenged by other researchers, particularly in the US have emphasized the degree of change in earnings dispersion. "Great Compression" is the term used by Goldin and Margo to describe the narrowing in the US wage structure in the 1940s: "when the United States emerged from war and depression, it had not only a considerably lower rate of unemployment, it also had a wage structure more egalitarian than at any time since. Further, the new wage structure remained somewhat intact for several decades" (1992, page 2). On this basis, there was an episode of equalization in the 1940s followed by a period of stability in the 1950s and 1960s, before a widening of the earnings distribution starting in the 1970s. Lydall, after recording "the substantial fall in dispersion of employee earnings in the United States from 1939 to 1949" (1968, page 177), went on to note that "when we turn to the period 1949 to 1959 we find a quite different picture. The general picture is one of stability, with a slight tendency to widening dispersion" (1968, page 178).

Evidence about the changes in the distribution of earnings in the US since 1939 is brought together in Figure 8. In each of Figures 8 to 11, the solid symbols denote the upper percentiles, shown on the left hand axis, and the hollow symbols show the lower percentiles, shown on the right hand axis. The symbols get larger as one moves away from the median, so that the top decile is larger than the upper quartile. Where the data are graded B in terms of quality, rather than A, they are shown by dashed lines. In the case of Germany, for example, I have classified the wage tax series prior to 1939 as B, on the grounds that the median has to be obtained from another source.

The Great Compression and the Golden Age

The points marked "Goldin and Margo" in Figure 8 show their results from the Census of Population, which began collecting earnings information for 1939. The top decile fell from 195 per cent of the median in 1939 to 166 per cent in 1949. This compression was however in part reversed from 1949 to 1959, when the top decile rose to 176 per cent of the median. In fact, from the annual data provided by the CPS tabulations, we can see the time path more clearly. The top decile began to rise immediately in 1952 and the rise continued unchecked until 1964. The path initiated by the great compression in the United States was not a flat-bottomed U but a V. This puts a different complexion on the 1950s and early 1960s, often regarded as a "Golden Age". At the same time, these findings for the distribution of earnings in the Golden Age need to be reconciled with the observed changes in the distribution of the total income of households shown in Figure 2 earlier. For more recent years, Gottschalk and Danziger found that the distribution of hourly wages of men and the distribution of adjusted family incomes for the period 1975 to 2002 "follow remarkably similar patterns" (2005, page 232). But this need not happen. In his 1972 study, Henle (1972) addressed the divergent movement of the distributions of individual earnings and of total income by families. He concluded that these different trends could largely be accounted for by changes in other sources of income, notably increased transfer payments, and by the increasing proportion of families with two or more earners.

Was a similar pattern found in Europe? In France, the period 1946-1975 was described by Fourastié (1979) as *Les Trentes Glorieuses,* thirty years of growth and redistribution. Figure 9 shows that the upper percentiles were indeed increasing. The top decile rose from 186 per cent of the median in 1950 to 205 per cent in 1962. In the UK (Figure 10), we see both a rise in the top decile and a fall in the lower percentiles from 1954 to the mid-1960s. In the UK case, the data are drawn from different sources. The employer survey (the New Earnings Survey) began in 1968; for earlier years the data are based on income tax records, which differ in relating to annual incomes and including part-year workers, which is why the bottom decile is lower. With the annual observations provided by these two sources, we can see that "stability" is a poor description of the UK earnings distribution before 1979. Between 1954 and 1965, the top decile rose from 171 per cent of the median to 185 per cent. Between 1968 and 197, the bottom decile rose from 48 per cent of the median to 58 per cent, a rise more than twice as large as the subsequent fall up to 1989. The German data in Figure 11 draw on wage tax, employer survey and household survey data. (They also cover the period when the Nazi party came to power.) The different sources differ in level and (on occasion) in direction of change - see the series marked by arrows. They are however agreed in *not* showing a widening of earnings dispersion during the Golden Age. Germany appears to have followed a different path.

Is there evidence for other countries? For Australia, Lydall, using income tax data, had found that the "dispersion [of earnings] of both males and females was growing steadily from 1952-3 to 1962-3" (1968, page 190). In the case of Ireland, there was a fall in the top decile from the 1930s that was reversed in the latter part of the 1950s; although, there is no corresponding fall in the bottom decile. For New Zealand, there is evidence that the top decile rose relative to the median between 1958 and 1973.

1968 and the 1970s

Moving on in time, we can see from the graphs that Germany also appears to have differed from France and the UK in the later 1960s and 1970s. The evolution of earnings dispersion in France up to the late 1980s was summarized by CERC in terms of three phases: "from 1950 to 1966 one sees, despite certain irregularities, a tendency for dispersion to increase. [The period 1966-1985] saw, on the contrary, a significant and regular reduction in inequality, at a stronger rate than the previous rise. Finally, since 1985, one sees a return to widening" (1990, page 1, my translation). The jump in the bottom decile in 1969 stands out in Figure 9. According to Piketty, "the rupture ... arises from the "events" of May 1968 and the resulting social measures" (2001, page 165, my translation). He goes on to say that this break was "the result of breaks in the wages policy of the state, and notably in policy towards the minimum wage"

(2001, page 165, my translation). The bottom decile fell back after 1969 but after 1972 continued an upward climb that was reinforced by the Mitterrand election in 1981.

The May 1968 effect was not limited to France. According to Erickson and Ichino, “during the 1970s, Italy experienced an impressive compression of wage differentials” (1995, page 265). This is borne out by the evidence in Figure 13 from the Bank of Italy household survey for the upper quartile and top decile (data for Italy are shown by squares). The top decile fell from 177 per cent of the median in 1973 to 143 per cent in 1981, a fall of a fifth. A major element in this compression was the *Scala Mobile (SM)*, a negotiated wage indexation “escalator”, notably following the agreement between workers and employers in 1975. According to Manacorda, “the SM had a considerable equalizing effect and that it was largely responsible for the fall in inequality between the late 1970s and the mid-1980s” (2004, page 609). From the UK series in Figure 10 we can see that between 1970 and 1977, the bottom decile rose by 18 per cent, reflecting, among other elements, the impact of redistributive incomes policies and of Equal Pay legislation. The top decile fell over that period by 5 per cent.

The same was true in Nordic countries. The data assembled for Sweden by Gustavsson (2004) show the quintile ratio for men as falling from 1.86 in 1968 to 1.7 in 1976. As he notes, the period coincided with the heyday of the “solidarity wage policy” followed by the major trade union confederation, Landsorganisationen (LO). In their study of the earnings distribution, Eriksson and Jäntti describe how in Finland “earnings inequality dropped dramatically between 1971 and 1975, and continued to decrease until 1985 (Eriksson and, 1997, page 1763).

Fanning out post-1980

The rise in earnings dispersion in recent decades has been widely documented. As has been increasingly recognized (Atkinson, 1999), this has been particularly associated with the upper part of the distribution. Indeed a feature exhibited in the graphs – apart from France - is the “fanning out” of the upper part of the earnings distribution. The top vintile (P95) has increased more than the top decile and the top decile in turn has increased more than the upper quartile. This is shown clearly for the United States in Figure 8, and rather less clearly for Germany in Figure 11. In the case of the UK, the deciles have been increasing progressively more, the higher up the distribution one looks. Between 1977 and 2001, the lower quartile rose by 8 per cent, the top decile by 17 per cent, and P95 by 33 per cent.

This feature is illustrated for a range of countries in Figure 12. These include, in addition to the three just discussed, Australia, Italy, Switzerland and Portugal, and two Eastern European countries: Hungary and Poland.

Conclusions

If one is seeking a single-letter summary of the changes in the earnings distribution over the period examined here, then a “W” seems more appropriate than a

"U". The 1930s and 1940s experienced a reduction in wage differentials – called the Great Compression in the US. This was reversed in the 1950s and early 1960s: with the exception of Germany, this "Golden Age" saw a rise in earnings dispersion. The later 1960s, following the events of May 1968, in France and other countries governments and unions achieved a narrowing of the earnings distribution. The rise in dispersion in recent decades has to be seen in this context.

These observations raise immediate questions for the possible explanatory hypotheses. If rising earnings dispersion was a feature of the 1950s, as well as of the 1980s, then we may have to consider other explanations than those currently in favour, which emphasise the advent of Information and Communication Technologies and the impact of globalization. The reversal in the late 1960s and 1970s means that we have to reconsider the role of government intervention including incomes policies.

5. Wealth: A return of the rich?

The second part of the decomposition is that for capital income, where I examine the underlying distribution of wealth. As is well known, wealth is more concentrated than income, In Figure 13, I have drawn on data from a study by Ohlsson, Roine and Waldenström (2006), covering the France, the UK and US, and the Nordic countries. The graph shows the share of the top 1 per cent in total personal wealth. Interestingly, this shows, at the beginning of the last century, higher wealth concentration in all the "old" countries than in the US. The share of the top 1 per cent in the US before the First World War was under 40 per cent, whereas it was above 50 per cent in France and Sweden (and almost certainly in the UK). But in considering this, we need to bear in mind that the share of the top 1% depends on what is happening both to the distribution *between rich and poor* and to the distribution *among the rich*. The share of the top 1% may be lower because the bottom 99%, in the richer US, had acquired more wealth by that time. In the UK the historian Richard Tawney once remarked of the soldiers of the First World War that most of them went off to war with their possessions on their back. Fewer than 1 person in 5 owned their homes. The share of the top 10% in total recorded wealth in 1923 was 89%. Since then, we have seen a great expansion in "popular wealth": housing, consumer durables, cars, and small savings. In a time series analysis of the share of the top 1%, a popular wealth variable is highly significant (Atkinson and Harrison, 1978). In the US, the average wealth of the bottom 99 per cent rose by a factor of some 2½ between 1916 and 1982, whereas the average wealth of the top 1 per cent was little higher in 1982 than in 1916 (Kopczuk and Saez, 2004, Figure 3).

Declining concentration

Rising "popular" wealth may be one of the causes of the fall in the share of the top 1 per cent over the first three-quarters of the twentieth century shown in Figure 13. In broad terms, shares that had been 40 per cent to 50+ per cent fell to 15 to 20 per cent. Reduction to around a third of their initial value still left the top 1 per cent with a disproportionate share. With the approximate formula used earlier, and assuming a Gini of 40 per cent for the rest of the population, a fall of 25 percentage points in the share of the top 1 per cent would reduce the overall Gini coefficient for wealth by 15 percentage points. The fall appears to have been common across countries, but the timing differs. The fall in the US was sharper following the Great Crash in 1929 and during the 1930s; in France and Denmark the decline is marked during the World Wars. In the UK, the decline continues during the 1950s.

The expansion of popular wealth reduced the relative share of the top 1 per cent, but does not explain reductions in real wealth levels. In the case of France, Piketty shows that the average estate left by the top 0.01 per cent in 1992 was in real terms only a quarter of that left by the top 0.01 per cent before the First World War. He argues that the wealthy incurred severe shocks to their capital during the period 1914-1945: two World Wars, inflation, and destruction of physical capital. These shocks had a permanent effect because progressive taxation prevented wealth-holders from restoring their capital. To quote Piketty, "the introduction of high income and estate tax progressivity [between 1914 and 1945] made it impossible for top capital holders to fully recover" (2007, page 10). The division of estates is also a factor. In the accumulation model described by Meade (1964), where there is equal division of an estate between the children, individual wealth accumulation depends on whether the internal rate of return exceeds the rate of demographic increase. The internal rate of return is governed by the saving rate and by the rate of return net of tax. The cumulative effect of high progressive rates of taxation could account for the continuing fall in top wealth shares in Denmark, Sweden and the UK: between 1945 and 1979 the share was halved in the latter two countries.

Recent changes

The recent reductions in top tax rates could have led to a reversal of this process. Inspection of Figure 13 shows that there was an increase, of 7 percentage points, in Norway, but that in the other countries the increase was less than 2 percentage points. This finding has caused some surprise in the US, given that the top income shares have risen, and the widely-held perception that there are more wealthy people (as indicated by the *Forbes* List of Billionaires and other journalist srudies). This has led to some questioning as to whether the estate method fully captures recent increases in wealth holding (although, as stressed by Kopczuk and Saez, 2003, the estate-based estimates are not in this respect out of line with the Survey of Consumer Finances). It is possible that the increased top income shares arising from remuneration have not yet fed through into corresponding increases in wealth. But we have also to allow for the overall increase in wealth. As Kopczuk and Saez show, the average wealth of both the top 1 per cent and the bottom 99 per cent have risen by some two-thirds in real terms between 1982 and 2000. Over the same period, the average real income per tax unit rose by 28 per cent (Piketty and Saez, 2007, Table 5A.0).

The wealth income ratio has risen. In view of this, we can perhaps square the popular perceptions with the wealth distribution data by defining the "rich" as those who have wealth in excess of a threshold defined as *a multiple of mean income* per person (or per tax unit). (There is an evident analogy with the definition of a relative poverty line.) In Atkinson (2007a), I treated as rich those individuals whose wealth exceeds 30 times mean income. In the year 2000, in the US, on which I concentrate here, the mean income per tax unit was $42,500. In what follows, I apply a simple adjustment of 1.5 to convert tax units to adult population, which implies a cut-off for the US in 2000 of some $850,000 per person. The choice of a multiplier of 30 is based on the fact that at a real yield of 3⅓ per annum this level of wealth generates an amount equal to mean income per person. A person with W* could live off the interest at an average standard of living. An assumed return of 3⅓% does not seem unreasonable as a measure of the long-run real return. A higher rate of 4% is used by some institutions as a measure of the long-run sustainable expenditure while maintaining the real value of their endowment (US charitable foundations are required to take the still higher rate of 5%), but I have applied a lower figure to take account of the importance of owner-occupied housing and its incomplete representation in personal income. The cut-off is not dissimilar to the Cap Gemini definition of High Net Worth Individuals, which in 2006 is $1 million excluding home real estate (website of Capgemini, 21 February 2006).[4]

In Figure 14 is shown the estimated number of rich people, on this definition, as well as the "super-rich", defined as having wealth in excess of 30 x 30 x mean income, or some $25 million in 2000. The scale for the proportion of super-rich is 100 times that for the rich, and the position of the graphs indicates that the super-rich were about 1 in 200 of the rich. If all wealth holdings are increasing faster than income, then the shares may remain constant, while the proportion of rich, and super-rich, is increasing. As may be seen from the graph, this is what appears to be happening. In 1982, some 1.25% of US adults are classified as rich according to the criterion adopted here; by 2000, this had risen to close to 1.75%. At the beginning of the 1980s, the super-rich were 1 in 25,000; at the end of the century, they were 1 in 11,000.

Judged in relation to the aggregate economy, top wealth holdings have been becoming more dominant in the US. Moreover, as noted by Kopczuk and Saez (2004), among the rich wealth is becoming more concentrated. Figure 14 shows on the right hand axis the percentage of the wealth of the rich owned by the top quarter. This began around 60%, and rose from 1950 up to the mid-1960s; there was then a fall in concentration, reversed from 1982 (although with a pause in the 1990s). The Gini coefficient among the rich shows a similar pattern. In 1965, the Gini was 48.6%; it fell to 40.4% in 1976, and then rose, reaching 46.9% in 2000.

Conclusion

Over the first three-quarters of the twentieth century, the reduction in wealth concentration followed a similar path to that of overall income inequality, and specifically the top income shares. The fall in concentration reflected the positive force of the acquisition of popular wealth by the bottom 99 per cent, and the negative incidence of progressive income and estate taxation. In recent decades in Anglo-Saxon countries there has been a rise in the proportion of rich, but that has taken place against a background of a general rise in the wealth-income ratio, so that the impact on wealth shares is less marked.

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[4] On the other hand, it is considerably higher than the level taken for the US by Danziger, Gottschalk and Smolensky (1989) to define "rich" in their article "How the Rich Have Fared, 1973-87", where the cut-off was 9 times the poverty line, or $95,000 for a family of four in 1987 dollars (my definition would have yielded a figure around $475,000).

6. Factor shares and the macro-economy

Does the rise in the wealth-income ratio correspond to a rise in the capital-labour ratio? Or does it simply reflect a revaluation of unchanged income streams? In considering the link with the macro-economy, as recorded in the national accounts, we have to bear in mind several crucial measurement issues.

The income from capital recorded in the distributional statistics used in earlier sections of this paper suffers from two major shortcomings. The first is that, with a few exceptions, capital gains and losses are not covered. If we adopt a Haig-Simons comprehensive definition of income, then accrued gains and losses should enter total income. In practice, gains are measured only when realised and in most distributions they are omitted altogether.[5] Of course, capital gains do not appear in the national accounts, but for the personal sector they are the counterpart of retained earnings not distributed by the company sector. At the same time, the Haig-Simons definition only points to the inclusion of *real* capital gains; we would not want to include the purely inflationary element. This brings me to the second shortcoming. As recorded in distributional statistics, capital income is *money* income, not adjusted for inflation. To this extent, capital income has been overstated in an inflationary age; and this over-statement applies to all capital incomes, including fixed price assets such as savings bank accounts. To my mind, insufficient attention has been paid to the implications for the measurement of income inequality of the fall in inflation (and in expected inflation). It could well be that income from capital was over-stated in the 1970s, when inflation was high and real gains smaller, and is under-stated today when inflation is low and real gains, averaged over recent years, are substantial. If this is the case, then the role of capital income in the growth of inequality, and indeed the growth of inequality itself, may be under-stated.

The complement of capital income is the remuneration of workers. Here too the picture is incomplete. The standard distributional analysis is based on total wages and salaries but does not include employer contributions to social security or to private welfare. As has been emphasised by Burtless (2007), in the United States in recent years money wages have increased less rapidly than total compensation. Between 2000 and 2005, total compensation per worker rose by 5.6 per cent, but only 29 per cent of the increase in took the form of higher money wages. Increased payments into employer health insurance (35 per cent), increased pension contributions (24 per cent), and social insurance (10 per cent) accounted for almost all of the rest. Over the long-run there has been a general tendency for total compensation to rise faster. In the estimates of Feinstein (1972) for the UK, in 1920 wages plus salaries plus Forces' pay accounted for 98 per cent of the total remuneration; by 1965 this had fallen to 92 per cent.

[5] A number of studies of top incomes show series with and without capital gains: see the chapters on the US, Canada and Germany in Atkinson and Piketty (2007).

If, therefore, we wish to relate the shares of personal income, as recorded in the income distribution statistics, to factor shares in national income, we need to decompose the changes:

Share of Earnings in Total personal income

= Earnings /Total compensation x National income /Total personal income

x Total compensation/National income

The different versions of the wage share are shown for the UK in Figure 15. The left hand side (personal income share) is shown by the hollow diamonds; the factor share is shown by the larger squares. The century, leaving aside the world wars, may be divided into three periods: before the Second World War, 1945 to 1980, and after 1980. In the first period, both shares rose. At the outbreak of the Second World War, the labour share was some 10 percentage points higher than at the outbreak of the First World War. From 1945 to 1980 there was a further 10 percentage point increase in the factor share, but there was no corresponding rise in the share of earnings in total personal income. The rise was in employer contributions: wages fell as a percentage of total compensation (see the solid line). Indeed, the ratio of wages to national income was broadly stable in this period (see the line marked by crosses). In the final period, from 1980 to the present, there was a fall in the share of total compensation of some 10 percentage points. By 2006 the share had fallen back to its 1950 level. Self-employment income has risen as a percentage, but even the allocation of the greater part of self employment income to labour would not make more than a couple of percentage points difference to the downward movement. There is a contrast in this respect with the situation in the US, where Dew-Becker and Gordon conclude that "there were substantial fluctuations in labor's share prior to 1984 but little movement since then" (2005, page 7).

The UK experience shows that the share of earnings in total household income may move together with the share of labour in national income (as since 1980) or may move differently (as in the period from 1945 to 1980). We cannot read directly across from one wage share to another. In the case of the US, the estimates of Piketty and Saez show the stability of the factor shares (in the corporate sector) noted above, but that the share of earnings in total personal income fell between 1979 and 1989 by some 5 percentage points, and that about half of that gain had been lost by 2003 (2007, Figure 5.6). In the case of France, Piketty (2007, Figure 3.4) shows that the labour share in corporate value added rose in the 1970s but then fell in the 1980s. Over the same period, the earnings share in household income fell steadily by some 7 percentage points.

Conclusion

The macro-economic theory of distribution has been little discussed in recent years, but should be revived. At the same time, once cannot read across directly from factor shares to the personal distribution. The experience of the UK, US and France suggests that the relation is one of some complexity.

7. Conclusions

In this paper, I have shown evidence about the evolution of the distribution of income in a selection of countries, focusing on the comparison of time paths, not on comparisons across countries. The evidence has highlighted the *variety* of these historical experiences. Indeed the first conclusion is that to any conclusion (including this one) there is always at least one exception.

- There has indeed been a U-turn in overall income inequality, which is evident in Anglo-Saxon countries, Finland, Sweden, Germany and Netherlands, but in a number of cases, the recent increase in inequality looks more like a limited episode rather than a continuing upward trend.
- Top income shares show a marked U over the twentieth century in Anglo-Saxon countries and Sweden, with top shares rising over the last quarter of the century (although not in Continental Europe).
- For individual earnings, if one is seeking a single-letter summary of the changes in the earnings distribution over the period examined here, then a "W" seems more appropriate than a "U".
- The 1930s and 1940s experienced a reduction in wage differentials – called the Great Compression in the US. This was reversed in the 1950s and early 1960s: with the exception of Germany, this "Golden Age" saw a rise in earnings dispersion. The later 1960s, following the events of May 1968, saw governments and unions achieving a narrowing of the earnings distribution. The rise in dispersion in recent decades has to be seen in this context.
- Over the first three-quarters of the twentieth century, the reduction in wealth concentration followed a similar path to that of overall income inequality, and specifically the top income shares. The fall in concentration reflected the positive force of the acquisition of popular wealth by the bottom 99 per cent, and the negative incidence of progressive income and estate taxation.
- In recent decades in Anglo-Saxon countries there has been a rise in the proportion of rich, but that has taken place against a background of a general rise in the wealth-income ratio, so that the impact on wealth shares is less marked.
- The macro-economic theory of distribution has been little discussed in recent years, but should be revived. At the same time, once cannot read across directly from factor shares to the personal distribution. The experience of the UK, US and France suggests that the relation is one of some complexity.

The variety of experience points to the need for a variety of explanations. The distribution of personal income is a subtle combination of different mechanisms, each subject to exogenous and endogenous forces.

Data Sources:

Note: where no other reference is made, the series refer to the total disposable income of the household (or tax unit) adjusted by an equivalence scale and cover the entire population.

Figure 1:
SWE 1967 and SWE3 Gustafsson and Uusitalo, 1990, page 85.
SWE 1 and 2 Statistics Sweden website, 21 August 2007, "The distribution of income 1975-2005".
FI Uusitalo, 2001, page 4; 1987 onwards from Statistics Finland website: http://tilastokeskus.fi/tk/el/tulo/gini.html.
NO 1 Bojer, 1987, page 251; 1973, 1976 and 1979 from Bye and Høyland, 1981, not equivalised.
NO 2 WIID database (website of UN-WIDER), supplied by Statistics Norway
NO 3 and 4 Statistics Norway website, 22 August 2007

Figure 2:
US BEA Brandolini, 2002, Table A1, col 1A.
US CPS U.S. Census Bureau, 2007, Table A-3.
UK Blue Book Atkinson and Micklewright, 1992, Table BI.1.
UK Economic Trends 1979-2005 from Jones, 2007, Table 27; 1977 and 1978 from Brandolini, 2002, Table A.3, col (3c), linked at 1977 to IFS series, from same source, col (4).

Figure 3:
NL1 Brandolini, 2002, Table A9, col 1.
NL2 Trimp, 1996, page 32.
NL3 Income Panel Survey (IPO), see Atkinson and Salverda, 2005.

DE DIW 1950-1968 from DIW, 1973, page 224; 1970-3 from DIW, 1974, page 312; 1975 onwards from Guger, 1989, Chart 1.
DE survey Hauser and Becker, 2001, page 89, and Hauser and Becker, 2004, page 112.
DE panel SOEP results from website of DIW, 11 December 2007.

Figure 4:
FR 1 Brandolini, 2002, Table A11, col 1.
FR 2 Hourriez and Roux, 2001, page 281.
FR 3 *France, Portrait Social*, 2007, page 72.
IT 1 Brandolini, 2002, Table A1, col 7a.
IT 2 Brandolini, 2002, Table A1, col 7b.
IT 3 supplied by Bank of Italy.

Figure 5:
CZ per capita 1 Atkinson and Micklewright, 1992, Table CSI1.
CZ per capita 2 Večernik, 2001, page 199.
HU per capita Atkinson and Micklewright, 1992, Table HI1

HU Tarki Tóth (2004, page 77).
PL per capita WORKER Atkinson and Micklewright, 1992, Table PI4
PL per capita Atkinson and Micklewright, 1992, Table PI1
PL LIS LIS Key Statistics, downloaded 13 August 2007.

Figure 6: Atkinson and Piketty, 2007, Tables 13.2, 13.3, 13.4, 13.5 and 13.6.

Figure 7: Atkinson and Piketty, 2007, Tables 13.1, 13.7, 13.8, and 13.9, and Roine and Waldenström, 2006.

Figures 8-11: See Atkinson, 2007.

Figure 12: See Atkinson, 2008.

Figure 13: Ohlsson, Roine and Waldenström, D, 2006.

Figure 14: Atkinson, 2007a, Figure 6.

Figure 15: Personal income series from Atkinson, 2007, Table 4B.1. Other series from national accounts: 1908 to 1965 from Feinstein, 1972, Tables 1 and 21, 1966 from *National Income and Expenditure* (NIE) 1969, pages 3 and 24, 1967-1971 from NIE 1978, pages 3 and 32, 1972-3 from NIE 1983, pages 3 and 25, 1974-78 from NIE 1985, pages 3 and 37, 1979-85 from NIE 1990, pages 13 and 37, 1986-96 from NIE 1997, pages 27 and 76, 1997-2000 from NIE 2001, pages 33 and 221, 2001-2006 from NIE 2007, pages 33 and 191.

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Figure 1 Three Nordic countries

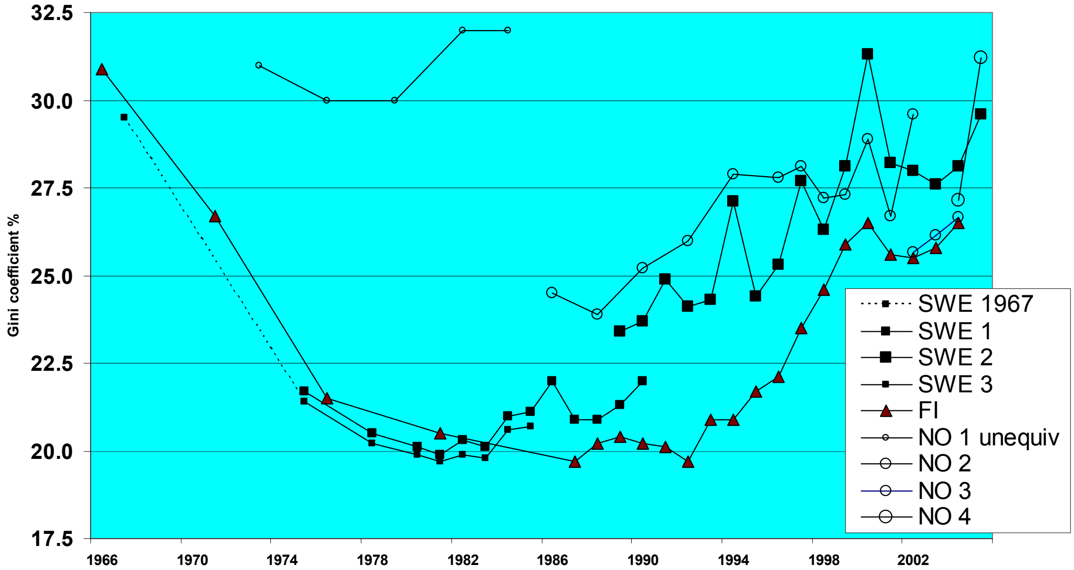


Figure 2 Income inequality in UK and US 1929-2005

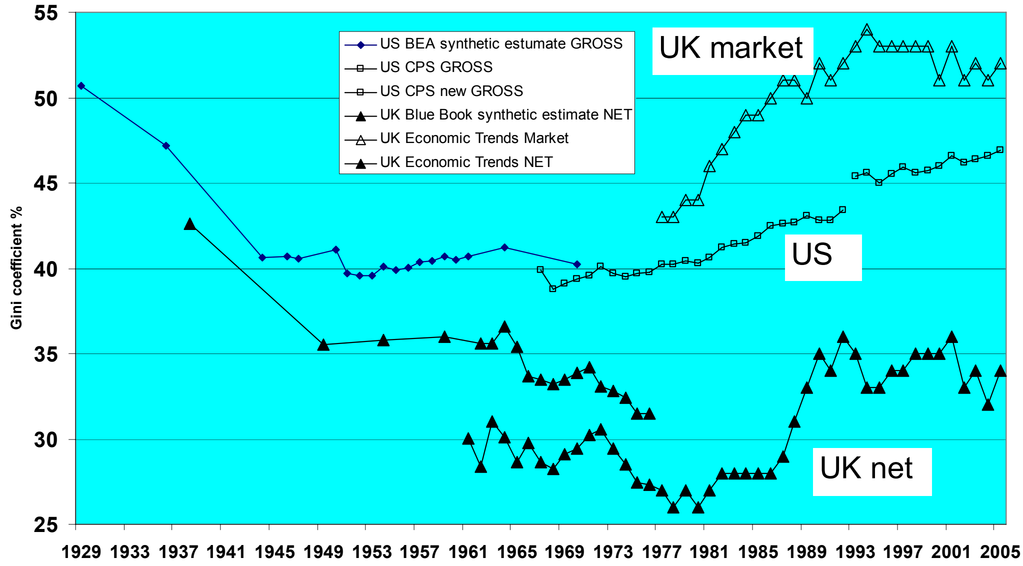


Figure 3 (West) Germany and Netherlands

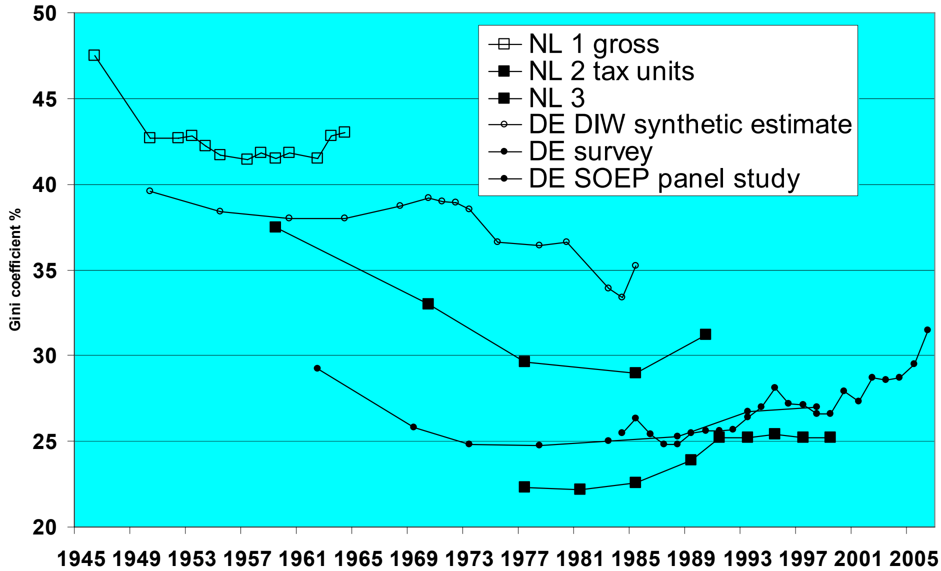


Figure 4 France and Italy

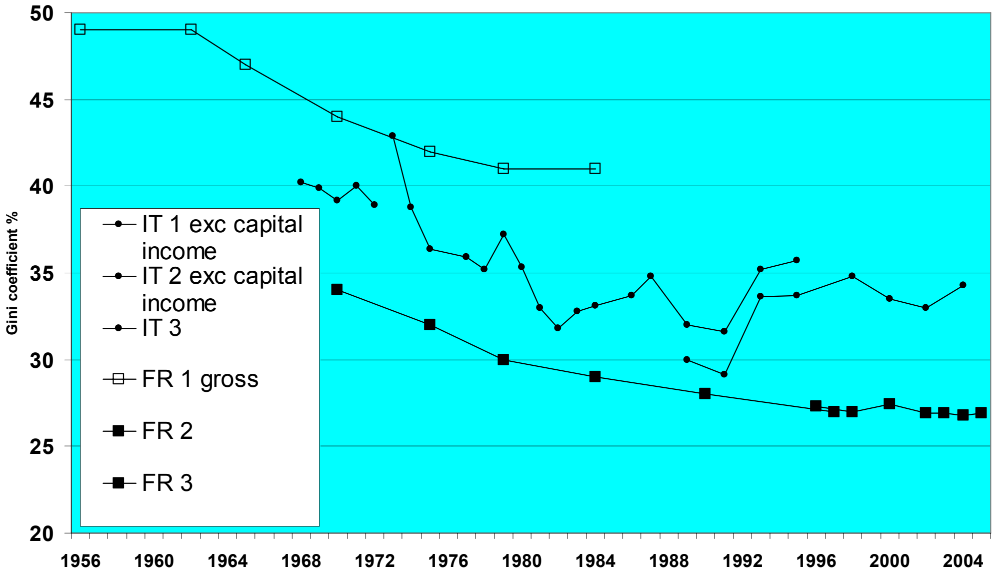


Figure 5 Czech Republic (Czechoslovakia), Hungary and Poland

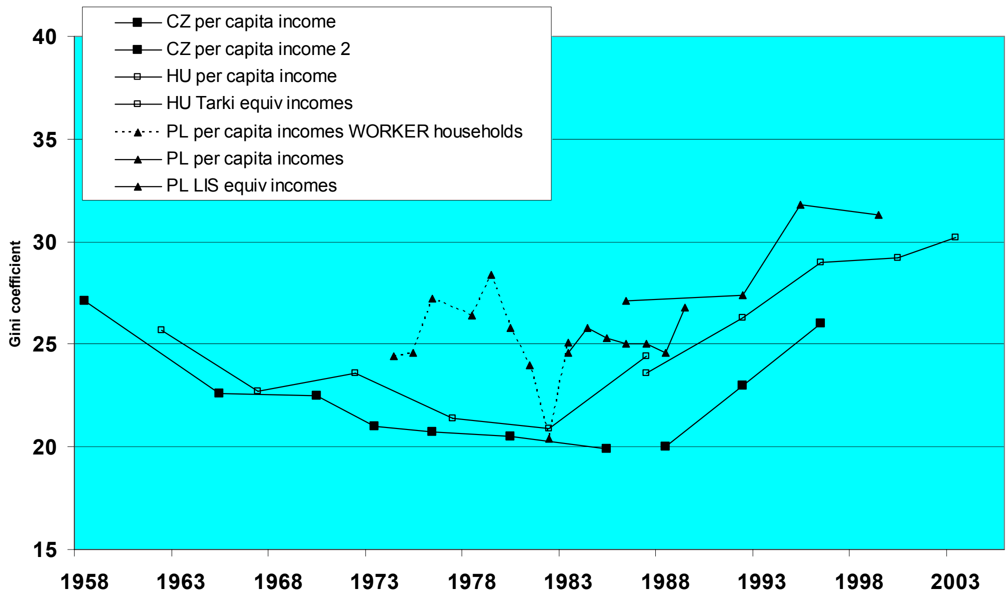


Figure 6 Share of top 1% in English-Speaking countries

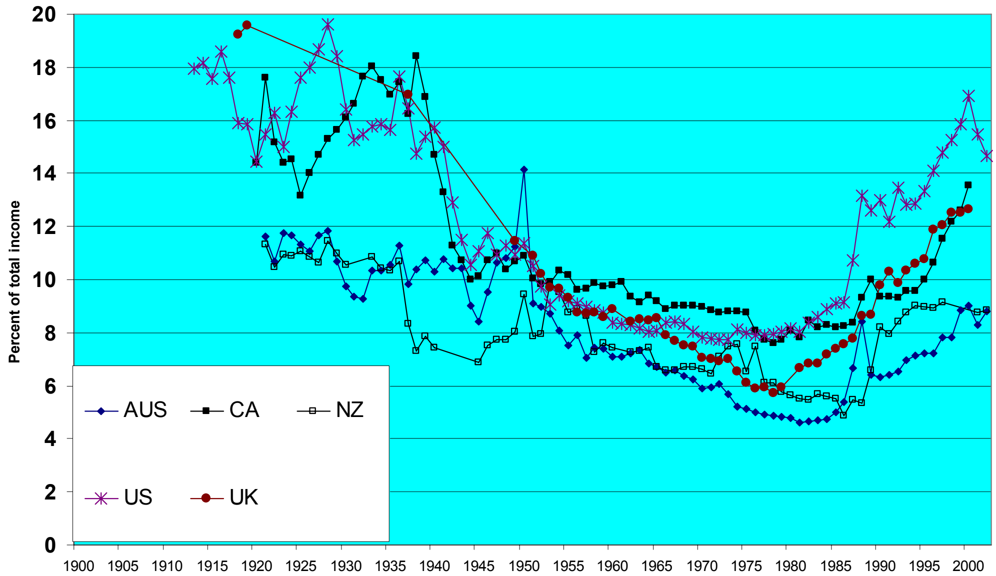


Figure 7 Share of top 1% in Continental Europe

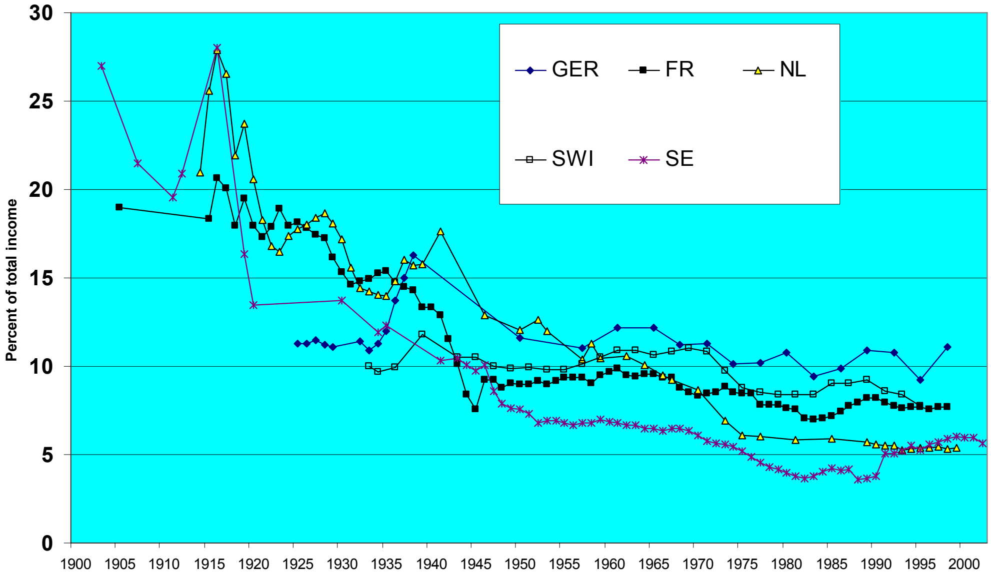


Figure 8 Long run development of earnings distribution in United States 1939-2005

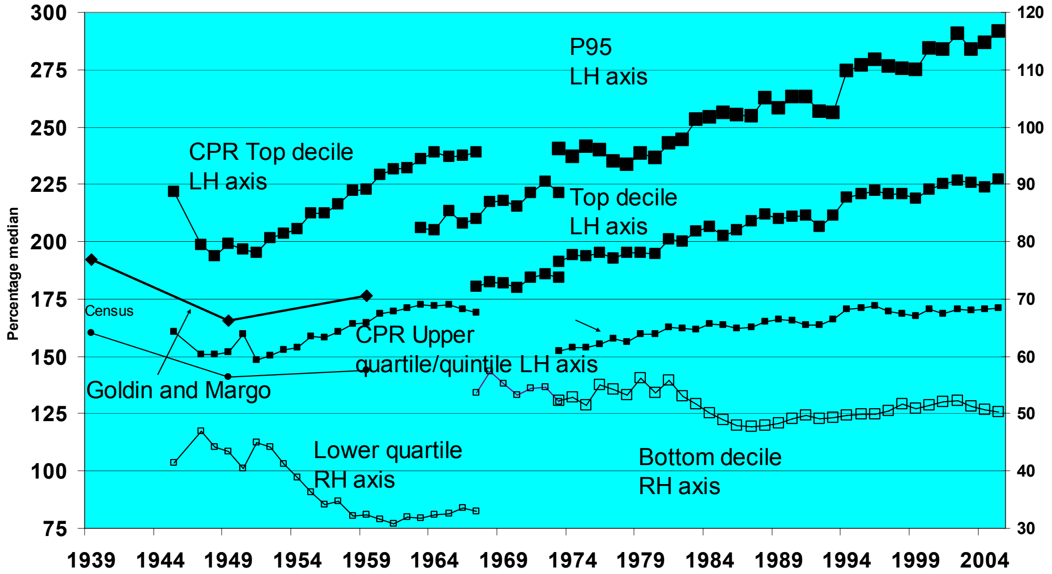


Figure 9 Long run development of earnings dispersion in France 1919-2004

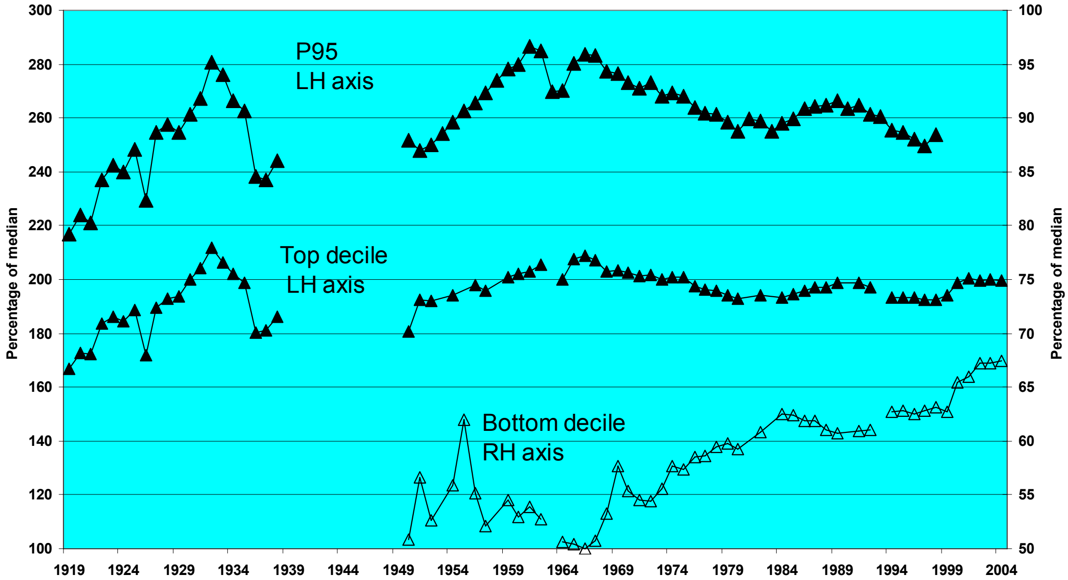


Figure 10 Long run development of earnings dispersion in United Kingdom 1954-2006

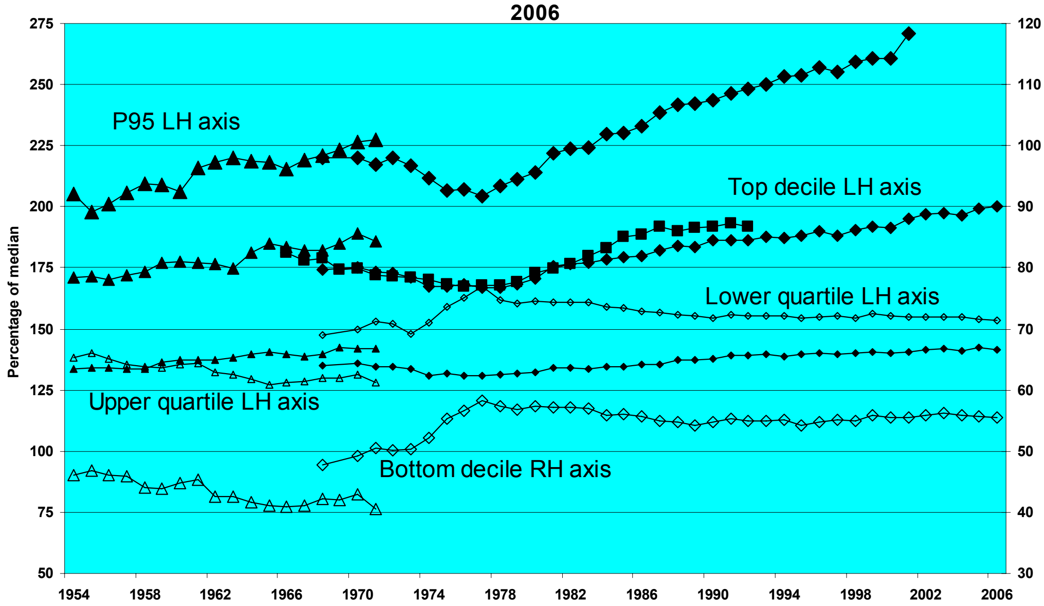


Figure 11 Long run development of earnings dispersion in West Germany 1929-2002

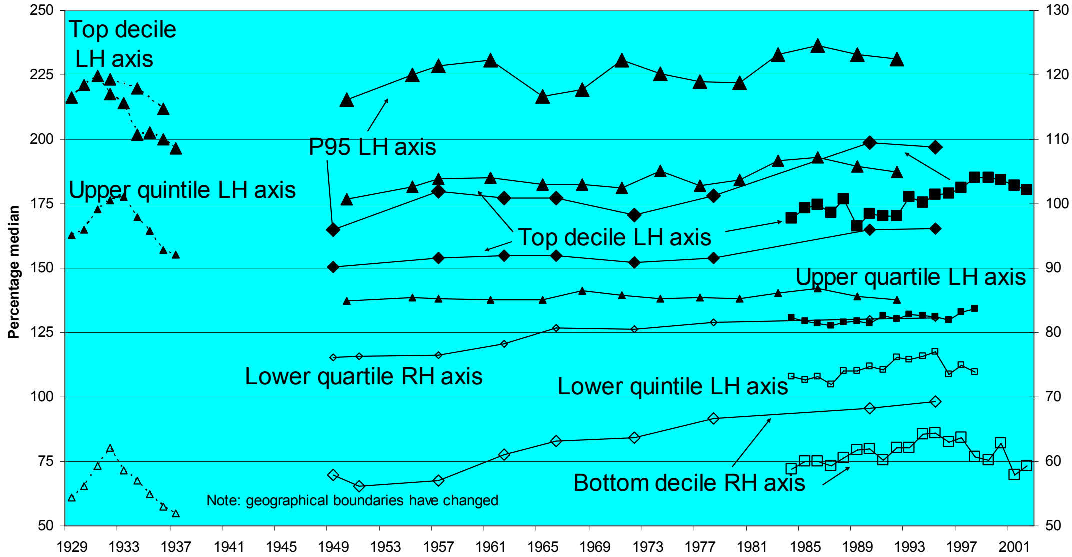
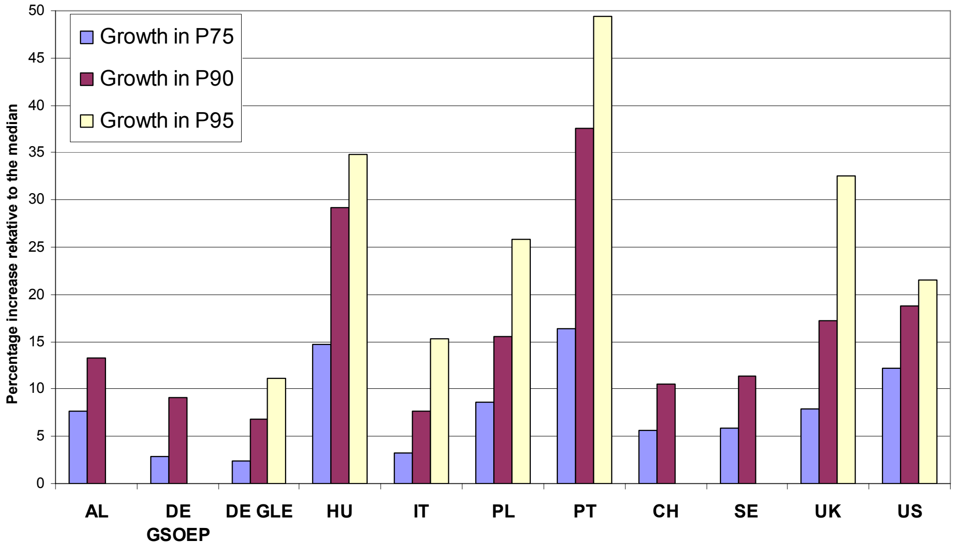


Figure 12 Fanning out in the upper part of the distribution



Note: AL 1975-2006; DE GSOEP 1984-1998; DE GLE 1962-1995; HU 1994-2003; IT 1977-2004; PL 1992-2004; PT 1982-2002; CH 1996-2004; SE 1983-2004; UK 1977-2001; US 1973-2005

Figure 13 Top 1% of wealth distribution in six countries

from Ohlsson, Roine and Waldenstrom (2006)

UK data adjusted for break in 1960

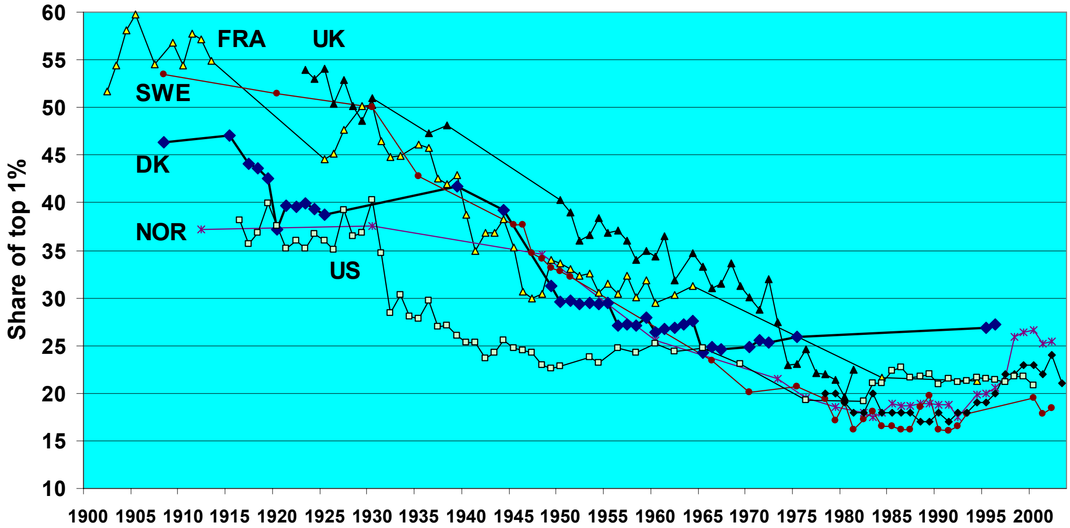


Figure 14 Wealth concentration in the US 1946-2000

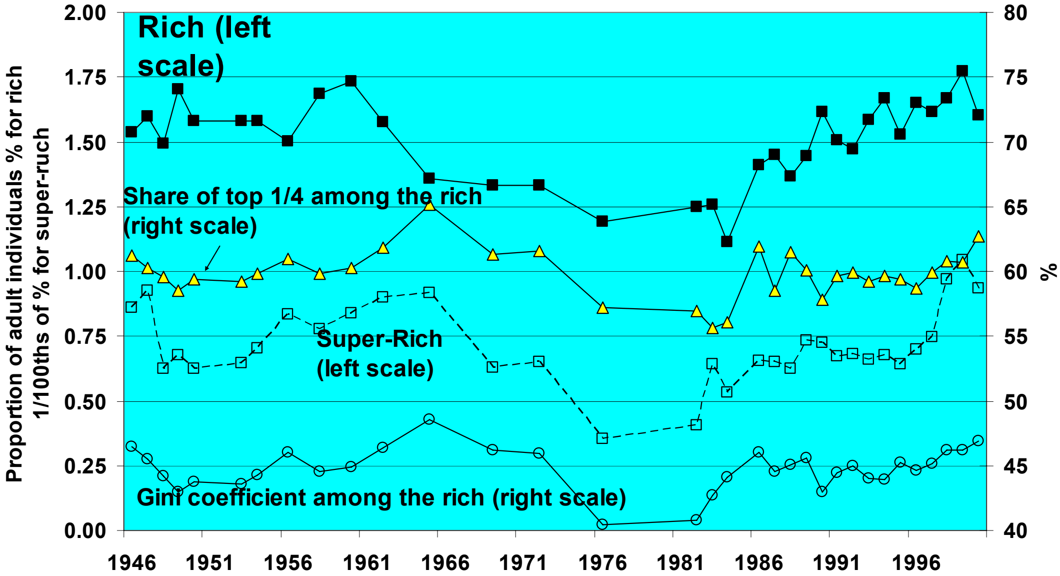
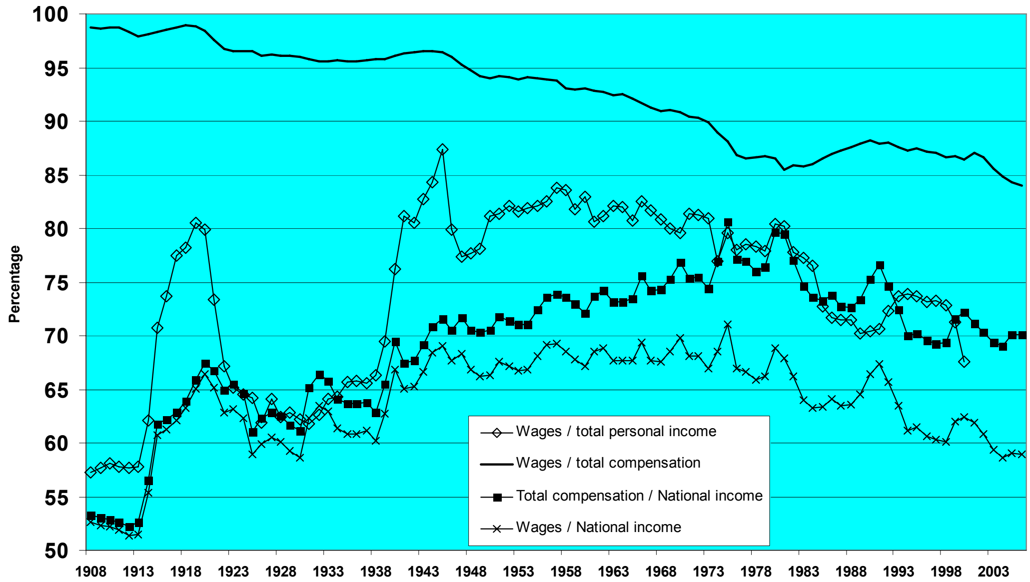


Figure 15 Wage shares in the UK 1908-2006



Inequality and Growth in Advanced Economies: An Empirical Investigation*

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Abstract

This paper investigates empirically the effect of income and human capital inequality on economic growth in different regions of the world. In the estimation of a dynamic panel data model that controls for country specific-effects an takes into account the persistency of the inequality indicators, the results show a different effect of inequality on growth depending on the level of development of the region. Specifically, we find a negative effect of income and human capital inequality on economic growth in the whole sample for which there are available data as well as in the low and middle income economies, an effect that vanishes or becomes positive when it comes to higher income countries. Nevertheless, a more exhaustive analysis of the encouraging influence of inequality on growth in the high income economies suggests that it is not stable over time and is highly affected by atypical observations.

JEL classification: O1, O4.

Key words: Human capital and income inequality, economic growth, dynamic panel data model.

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1 Introduction

Does more inequality encourage or discourage economic growth? A large body of empirical evidence has tried to answer this question over the years, however, the literature so far has not provided a conclusive answer to the query. In the early nineties, the results of the theoretical models that formalized a negative effect of wealth inequality on growth and investment rates gained significant relevance since their conclusions were supported by the empirical evidence that used data on income inequality.[1] In particular, the empirical literature found that, other things equal, those countries with higher inequality in the distribution of income in 1960 experienced, on average, lower per capita income growth rates during the period 1960-1985. With the appearance of Deininger and Squire's (1996) data set, the quantity and quality of income inequality data improved considerably with respect to previous sources. This new data set allowed more recent empirical studies to use the temporal dimension of the data to estimate panel data models. However, the estimation of panel data models have challenged the cross-sectional results. For instance, in a panel of countries Barro (2000) finds little association between income inequality and economic growth for a broad number of countries. Moreover, he finds a negative relationship between both variables in poor countries and a positive association in richer places. The most surprising results are those by Forbes (2000). This study controls for country-specific effects and the findings suggest that in the medium and short term an increase in the level of inequality in the distribution of income in a country has a positive and significant relationship with its subsequent economic growth rates.[2] Some studies have argued that the lack of consistency in the results is due to the fact that empir-

[1] Specifically, part of the literature focused on the political approach in which a median voter chooses the level of redistribution in the economy. Assuming that such redistributive policies are financed by distortionary taxes affecting investment, a more unequal society, in which the median voter favours more redistribution, will experience lower growth rates (Alesina and Rodrik, 1994; Bertola, 1993; Persson and Tabellini 1994). Other studies argued that under the presence of imperfect credit markets poor individuals with no collateral may not undertake a profitable investment project, which implies that the greater the number of restricted individuals, the lower the average investment rate in the society (Galor and Zeira, 1993). See Benabou (1996), Perotti (1996) or Aghion *et. al* (1999) for a comprehensive survey of this literature.

[2] Also estimating a dynamic panel data model but using regional data of the American States, Panizza (2002) finds no evidence of a positive correlation between changes in income inequality and changes in growth. In addition, he finds that the relationship between income inequality and growth is not robust. He shows that the relationship depends on the econometric specification and the method used to measure inequality.

ical studies estimate a linear model whereas the true relationship is not linear (e.g. Banerjee and Duflo, 2003). Other papers object that income inequality data may be a poor proxy for wealth inequality and, in order to palliate this shortcoming, they use the distribution of other assets to analyze the effect of inequality on growth (e.g. Alesina and Rodrik, 1994; Deiniger and Squire, 1998; Castelló and Doménech, 2002). Recently, Voitchosky (2005) has argued that previous studies have used aggregate measures of inequality, such as the Gini coefficient, which mask the different effect that the lower and upper part of the income distribution have on growth. And it is at this stage that the debate in the empirical literature that analyzes the effects of inequality on growth remains.

In this paper we analyze the effect of income and human capital inequality on economic growth in different regions of the world according to their level of development, paying special attention to the Advanced economies or high income OECD countries. This exercise is informative because according to Barro´s (2000) result, the effect of income inequality on economic growth may differ in poor and rich economies. In fact, most of the theoretical channels that predict a negative effect of wealth, income and human capital inequality on growth (e.g. political instability, credit market imperfection, fertility and life expectancy mechanisms) might have a stronger support in developing economies. Therefore, including all countries in the analysis may give misleading conclusions about the real effect of inequality on the per capita income growth rates.

Mainly, we depart from the previous literature in two ways. In the first place, from a methodological point of view, we use the system GMM estimator to control for country specific effects. The reason is that the traditional first difference GMM estimator used by Forbes (2000) may not be appropriate when variables are highly persistent, as it is the case of income and education inequality measures. For example, in a sample that includes all regions in the world more than 90 per cent of the variation in income and human capital inequality measures is cross-sectional, whereas the explanatory power of time dummies in regressions where the dependent variables are the income and human capital Gini coefficients is less than 1 per cent. Thus, by taking first differences most of the variation in the data, which comes from variability across countries, disappears. The benefits of using the system GMM estimator in this context is that, in addition to controlling for unobservable heterogeneity, by estimating an equation in levels, the system GMM estimator keeps the information in the data coming from variability across countries. In fact, in Monte Carlo simulations Blundell and Bond (1998) have shown that under some conditions the system GMM performs better than the first difference when variables are highly persistent. In addition, Hauk and Wacziarg (2006) also show in Monte Carlo simulations that the system GMM estimator has better properties in the estimation of growth equations than the first difference GMM counterpart.

By using the system GMM estimator we find that the influential results of Forbes (2000) are not robust to this econometric technique. In a sample that includes 56 countries for the period 1965-2000 we find a negative coefficient for the income Gini index in the estimation of a conventional growth equation. This result implies that the strong positive effect of income inequality on economic growth, found by Forbes, might not be due to the proper control of country specific effects. Alternatively, the high persistency of the income Gini coefficient and the fact that it is measured with error (see Atkinson and Brandolini, 2001) may rise some doubts whether the first difference GMM is an appropriate estimator in this context.

In the second place, in addition to analyzing the relationship between income inequality and economic growth, we also use human capital inequality measures. In fact, the role played by human capital inequality on economic growth is present in most of the models that analyze the effect of inequality on growth under imperfect credit markets (e.g. Galor and Zeira, 1993; Mookherjee and Ray, 2003). Moreover, the latest advances in the theoretical literature also point out to human capital inequality and its influence on demographic variables as alternative channels that predict a negative relationship between inequality and growth. In particular, Castelló-Climent and Doménech (2007) examine how human capital inequality may discourage growth by reducing life expectancy and investment in education, rather than by increasing fertility, as in De la Croix and Doepke (2003) and Moav (2005). Nevertheless, it is worthy to point out that these mechanisms should have more support in developing countries where differences in fertility and life expectancy among individuals are more pronounced. On the contrary, in rich economies, the role of human capital inequality on growth could be different and might respond to the demand of highly educated individuals in a rapid process of technological change.

Interestingly, the results found in this paper are in accordance with these predictions. Specifically, we find that more human capital inequality discouraged the per capita income growth rates in most parts of the world during the period 1965-2000.

Mainly, in less developing countries where the life expectancy and fertility channels seem that played an outstanding effect. On the contrary, this negative effect vanishes when it comes to higher income economies. In particular, we find that greater human capital inequality encouraged the per capita income growth rates of the European economies during the period 1980-2000. Nevertheless, a robustness check suggests that this result is highly influenced by atypical observations.

Likewise, we also find a different effect of income inequality on the per capita income growth rates depending on the level of development. Using an updated version of the Deiniger and Squire´s (1996) data set, we find that the negative influence of a more unequal distribution of income on growth in developing countries becomes positive in the Advanced and European economies. Moreover, the use of a higher quality data set from the Luxemburg Income Study for the higher income economies displays similar results.

The organization of the paper is as follows. In the next Section we discuss the data and the model. In Section 3 we display the results about the influence of income and human capital inequality on economic growth in several samples that include the total available data, Developing, Advanced and European Economies. In Section 4 we focus on the Advanced economies and use alternative inequality indicators to examine whether the different parts of the distribution have different effects on economic growth. Moreover, we split the whole sample into different sub periods to see if the different effect of inequality on growth found in the European economies is stable over time and if it has been influenced by the European Monetary Union. Section 5 contains the conclusions reached.

2 Econometric Model and Data

2.1 Econometric Model

Most of the empirical studies that have analyzed the relationship between income inequality and economic growth have focused on cross-section growth regressions in which an income inequality variable is added to the set of explanatory variables in a convergence equation. One of the main criticisms of these kind of regressions is that they suffer from two inconsistency sources. On the one hand, cross-section estimations fail to control for specific characteristics of countries, such as differences in technology, tastes, climate or institutions, whose omission may bias the coefficient of the explanatory variables. On the other hand, they do not address properly the treatment of some explanatory variables that, according to the theory, should be considered to be endogenous. Both remarks seem extremely important in the relationship between inequality and growth as suggested by Forbes´s (2000) results. Therefore, we propose to analyze the effect of income and human capital inequality on economic growth by estimating the following standard growth equation:

$$(\ln y_{i,t} - \ln y_{i,t-\tau})/\tau = \beta \ln y_{i,t-\tau} + \gamma Inequality_{i,t-\tau} + X_{i,t-\tau}\delta + \xi_t + \alpha_i + \varepsilon_{it} \quad (1)$$

Reorganizing we can rewrite equation (1) as a dynamic model:

$$\ln y_{i,t} = \widetilde{\beta} \ln y_{i,t-\tau} + \widetilde{\gamma} Inequality_{i,t-\tau} + X_{i,t-\tau}\widetilde{\delta} + \widetilde{\xi}_t + \widetilde{\alpha}_i + \widetilde{\varepsilon}_{i,t} \quad (2)$$

If we consider τ different from one, we have that $\widetilde{\beta} = \tau\beta + 1$, $\widetilde{\gamma} = \tau\gamma$, $\widetilde{\delta} = \tau\delta$, $\widetilde{\xi}_t = \tau\xi_t$, $\widetilde{\alpha}_i = \tau\alpha_i$ and $\widetilde{\varepsilon}_{i,t} = \tau\varepsilon_{i,t}$. The definition of variables is as follows, $y_{i,t}$ is the real GDP per capita in country i measured at year t, τ is a five-year span, $Inequality_{i,t-\tau}$ measures income and human capital inequality in country i at the beginning of the period, β, γ and δ represent the parameters of interest that are estimated, ξ_t is a time specific effect , α_i stands for specific characteristics of every country that are constant over time and ϵ_{it} collects the error term that varies across countries and over time.

In order to reduce any omitted variable bias, matrix $X_{i,t-\tau}$ includes k explanatory variables, suggested in the literature as important determinants of the growth rates (e.g. Barro, 2000). The empirical studies analyzing growth usually estimate a broader version of the neoclassical growth model that includes the convergence property as well as other variables that determine the steady state. In this line, the model to be estimated will control for initial conditions and for some variables, chosen by the government or private agents, which characterize the steady-state conditions. The variables that account for the initial conditions are the level of per capita income (lny) and the initial stock of human capital, proxied by the average years of male secondary and tertiary education of the population aged 25 years and over ($Educ$).[3] The

[3]Evidence suggests that higher male levels of education accounts more for growth than primary

determinants of the steady state include some variables that answer for government policies and others that refer to optimal decisions by private agents. These variables include the government share of real GDP (*G/GDP*); total trade, measured as exports plus imports divided by real GDP (*Trade*) and the inflation rate, measured as the annual growth rate of consumer prices (*Inflation*). Human and physical capital accumulation are ruled out from the set of controls because they are endogenous in the model; most of the mechanisms that predict a negative effect of inequality on growth work through a discouraging effect on the investment rates.

The most common approach to estimate a dynamic panel data model has been the first difference Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991). The idea of this estimator is to take first differences to eliminate the source of inconsistency, that is α_i, and use the levels of the explanatory variables lagged two and further periods as instruments. In order for the first difference GMM estimator to be consistent we need to assume that the errors are not second order serially correlated and that the explanatory variables are weakly exogenous.

However, although the first difference GMM estimator deals properly with the problem of unobservable heterogeneity, it has some shortcomings in the estimation of equation (2). The first has to be with the characteristic of persistency of the variables included in this equation. These variables, particularly income and human capital inequality measures, vary significantly across countries but remain quite stable within a country. For instance, Table 1 shows that more than 90 per cent of the variation in income and human capital inequality measures is cross-sectional, whereas the explanatory power of time dummies in regressions where the dependent variables are the income and human capital Gini coefficients is less than 1 per cent. Thus, by taking first differences most of the variation in the data, which comes from variability across countries, disappears. This fact may indeed increase the measurement error bias by increasing the variance of the measurement error relative to the variance of the true signal (Griliches and Hausman, 1986). Moreover, Blundell and Bond (1998) point out that when explanatory variables are persistent, the lagged levels of the explanatory variables are weak instruments for the variables in differences. They show that in small samples the shortcoming of weak instruments translate into a large finite sample bias.

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and female education (see for example Barro, 2000).

Therefore, an econometric technique that exploits the bulk of the variation in the data would be preferable in order to improve the precision of the estimated coefficients. By adding the original equation in levels to a system of equations that also include equations in first differences, the system GMM estimator is particularly useful in our context since, in addition to controlling for country-specific effects, it preserves the cross-country dimension of the data that is lost when only the first differenced equation is estimated (e.g. Arellano and Bover, 1995; Blundell and Bond, 1998) .

In the system GMM estimator the equations in first differences eliminate the fixed effect in the model. Moreover, the difference equations are combined with equations in levels, which are instrumented with the lagged first differences of the corresponding explanatory variables. In order to use these additional instruments, we need the identifying assumption that the first differences of the explanatory variables are not correlated with the specific effect, that is, although the specific effect may be correlated to the explanatory variables, the correlation is supposed to be constant over time. If the moment conditions are valid, Blundell and Bond (1998) show that in Monte Carlo simulations the system GMM estimator performs better than the first difference GMM estimator. We can test the validity of the moment conditions by using the conventional test of overidentifying restrictions proposed by Sargan (1958) and Hansen (1982) and by testing the null hypothesis that the error term is not second order serially correlated. Furthermore, we will test the validity of the additional moment conditions associated with the level equation with the difference Hansen test.

2.2 Data

The sources of the data used are as follows. The data on real GDP per capita (lny), government spending (G/GDP), measured as government share of real GDP, and total trade (*Trade*), measured as exports plus imports to real GDP, are taken from PWT 6.2 by Heston, Summers and Aten. The latest version of the PWT has updated the measures of per capita income up to 2005, which allows as to use one more period in the sample, 1960-2005. Inflation rate (*Inflation*), measured as the annual growth rate of consumer prices, is taken from the Global Development Growth Data Base compiled by Easterly and Sewadeh (2002).

The income Gini coefficient ($Gini^y$) is from Deininger and Squire's (1996) data set and updated by the World Bank. Under the same premise of including only "high quality" data, we broaden the observations used by Forbes (2000) in two directions. On the one hand, we extend the income inequality data up to 1995. On the other hand, we add a few more countries. The observations used by Forbes (2000) and the new sample used in this study are displayed in Table A. Even though we can include only twelve more countries, Table A shows that most of them are developing countries and six of them are in Africa. This enlargement is one step further in achieving a data set that represents all areas in the world, some of them with no observations in Forbes' sample. On balance, there is a total of 56 countries with at least two observations of the income Gini index.

In the second part of the paper we focus on the effect of inequality on growth in a sample of economically Advanced economies and European countries. Thus, we use the Luxemburg Income Study that provides improved data for income inequality measures with regard to quality and comparability across countries. The main drawback of the LIS data set is that it only contains data for a reduced sample of wealthy economies starting in 1980.

A more comprehensive data set on inequality measures is that for human capital inequality variables ($Gini^h$, $Quintile^h$), which are available for 108 countries during the period 1960-2000. The source of human capital inequality measures is Castello and Domenech (2002) and the education variable (*Educ*) is taken from the latest Barro and Lee' (2001) data set.[4]

3 Empirical Results

The role played by human capital accumulation is present in most of the models that analyze the relationship between inequality and growth. Furthermore, inequality in education is highly related to inequality in opportunities, which can be very acute in the presence of credit market constraints. For instance, under imperfect credit markets and indivisibilities in the accumulation of human capital, Galor and Zeira (1993) find that the greater the share of the population credit constrained, the lower the average human capital in the economy. In this model wealth transmission from

[4] Table A reports data on 12 countries that were not included in Forbes' sample. These countries are Algeria, Iran, Israel, Jordan, Ghana, Mauritaia, Mauritius, South Africa, Uganda, Honduras, Jamaica and Taiwan. However, unlike Forbes´ study, Table A does not report data on Bulgaria because this country is not included in Castello and Domenech's (2002) data set.

parents to children depends on the parents´ human capital. As a result, the initial distribution of wealth is mainly driven by the initial distribution of human capital.

Mechanisms that point out different fertility patterns among individuals with different levels of education also predict that the distribution of education on one side and decisions on human capital investment and fertility on the other are highly related (e.g. De la Croix and Doepke, 2003; Moav, 2005). In these models parents with lower human capital choose to have a higher number of children and less education for them, which hampers the number of skilled individuals in the future and therefore the average level of human capital and growth rates in the economy. Recently, other papers have also pointed out that the initial distribution of education may hamper the human capital investment rates by reducing the average life expectancy. Castello-Climent and Doménech (2007) show that when parents education influences offspring life expectancy, as it is shown by empirical evidence (e.g. Case et al., 2002; Currie and Moretti, 2003), the initial distribution of education, by affecting life expectancy, has outstanding effects on a country´s average rate of investment in human capital.

Therefore, in the fist place we check whether the distribution of education has had any effect on the per capita income growth rates in different regions of the world. In fact, we should expect that the negative effect of human capital inequality on growth, predicted from the theoretical models, should be more acute in developing countries, where the difference between life expectancy and fertility patterns among the strata of the population are more acute. On the contrary, the role that the demographic channels are expected to play in richer economies is likely to be less important.

Using available data for the distribution of education, computed by Castello and Domenech (2002), we examine the effect of human capital inequality on economic growth during the period 1965-2005. The results, displayed in Table 2, show a clear negative and statistically significant effect of the human capital Gini coefficient on the per capita income growth rates in a sample of 102 countries that include all countries in the world for which there are available data. Moreover, this effect is not only statistically significant at the 1 per cent level but it is also considerable in quantitative terms; an increase in 0.1 points in the human capital Gini index reduces the annual growth rate by 0.51 per cent. The results of the other variables are also as expected; a negative coefficient of the initial per capita income, showing conditional convergence, a positive effect of the educational variable and a negative one of the government expenditure. Moreover, we find that more openness, measured through the share of total trade, has had a positive influence on a country´s per capita income growth rate whereas more inflation has had a negative one.

Once we have examined the effect of human capital inequality on the growth rates in the whole sample, we focus on different regions of the world to test whether the influence of human capital inequality on growth differs in countries with different levels of development. The results show that the estimated coefficient in the whole sample practically holds when we reduce the countries to include only developing economies, as displayed in column (2).[5] Likewise, when we restrict the sample to OECD countries the estimated coefficient of the human capital Gini index continues having a negative and statistically significant impact at the 1 per cent level on the per capita income growth rate, though the economic impact is smaller in absolute value. Nevertheless, once we remove the countries that are not classified as high income economies from the OECD sample the negative effect on the growth rates of an increase in human capital inequality is no so evident. The results displayed in column (4) for the Advanced or high income OECD economies show that the estimated coefficient of the human capital Gini index reduces more than half and stops being statistically significant at the standard levels.[6] Moreover, the absence of a negative effect from human capital inequality on growth is even more clear in the European economies. Column (5) displays a positive coefficient of the human capital Gini index, though it is not statistically significant, for a sample of 20 European economies.

According to some theoretical models, human capital inequality could affect economic growth rates through its influence on demographic variables. Thus, in the remaining columns we include the fertility rates and a measure of the life expectancy in the set of controls. In line with the theoretical predictions, columns (6-8) show that once we control for demographic variables the negative and statistically significant coefficient of the human capital Gini index disappears in the World sample as well as in the Developing and OECD economies. In fact, we find that longer life expectancy has had a strong positive influence on the growth rates whereas more fertility rates

[5] Developing countries include low and middle income countries ($11,115 or less) as classified by the World Bank in 2007. Income groups are classified according to 2006 gross national income per capita.

[6] The Advanced economies include the high income OECD economies as classified by the World Bank. OECD cuntries not classified as high income economies in our sample inlcude Hungary, Mexico, Poland and Turkey.

have had a discouraging effect on growth. Moreover, as expected, the non existent influence of human capital distribution on growth in the Advanced and European economies is not affected by controlling for the demographic measures.

Up to now we have examined the effect of human capital inequality on economic growth. However, it may be possible that the human capital inequality measure is picking up an income inequality effect. Therefore, in Table 3 we examine the individual and joint effect of income and human capital inequality on the per capita income growth rates in different regions of the world. Nevertheless, whereas there are data for human capital inequality measures for 108 countries over the period 1960-2000, the availability of data of income inequality measures for a broad number of countries and periods is scarce. Specifically, by controlling for income inequality measures the number of countries halves and in many of these countries there are only data for two periods.

Table 3 displays the results of the effect of human capital and income inequality on economic growth in the reduced sample of 56 countries for which there are available data on income inequality measures. With regard to human capital inequality, the results display a negative coefficient of the human capital Gini index in all samples, though in the Advanced and European economies this coefficient is not statistically significant at the standard levels. Also in line with the previous findings, the lower part of the table shows that the negative coefficient of the human capital Gini index in the World, Developing and OECD samples stops being statistically significant once we control for the life expectancy and the fertility rates, suggesting that some of this negative effect is driven through the demographic variables.

The independent effect of income inequality on growth is displayed in the second column of every group of countries. With regard to the whole sample, column (2) shows that an increment in income inequality has hampered the growth rates in the whole sample that includes all countries for which there are available data. This result is very important because it highlights that the striking findings of Forbes (2000), who finds a strong positive and statistically significant coefficient for the income Gini index by using the first difference GMM estimator, could be driven by the fact that inequality measures are highly persistent and measure with error and not by the omission of country specific effects in the model.

The results also suggest that the influence of income inequality on economic growth in the Advanced and European countries is different from that found in the rest of the world. Specifically, we find a negative coefficient in the sample of Developing and OECD countries, though the coefficient is only statistically significant in the latter. Interestingly, in line with the demographic channels, we also find that the negative effect of income inequality on growth, if any, disappears once the measures of life expectancy and fertility rates are accounted for (see lower part of the Table). On the contrary, the estimated coefficient of the Gini index is positive, though not statistically significant at the standard levels, for the Advanced and European economies.

Finally, we control for both human capital and income inequality to test whether they have any independent effect on growth (results are displayed in the third column of every group of countries). The results can be summarized as follows. Firstly, the coefficient of the human capital and income Gini indexes are negative and statistically significant in the sample that includes all countries, which suggests that income and education inequality have had a negative and independent effect on the per capita income growth rates. Moreover, the fact that these coefficients stop being statistically significant once fertility and life expectancy are included in the set of controls gives support to the predictions of the demographic mechanisms. Secondly, whereas the negative effect of a more unequal distribution of education holds, the coefficient of the income Gini index is close to zero in the sample of Developing countries. Moreover, once the demographic variables are included, the estimated coefficient of income Gini index is even positive and statistically significant at the 5 per cent level. Finally, in the Advanced and European economies we also find a different effect of income and human capital inequality on growth. Specifically, the estimated coefficient of the human capital Gini index continues being negative, though not statistically significant. However, the evidence suggest that a greater inequality in the distribution of income has had a beneficial effect on the per capita income growth rates of the Advanced and European economies; the coefficient of the income Gini index is positive and statistically significant at the 10 and 5 per cent significance level respectively.

To sum up, when we control for both, income and human capital inequality, whereas we find a negative coefficient of the human capital Gini index in all samples the effect of income inequality on growth differs across regions. Specifically, more income inequality seems to be related to higher growth rates in rich economies. The differential effect of human capital and income inequality in the Advanced and European economies is analysed in more detail in the remaining part of the paper.

4 Income and Human Capital Inequality in the Advanced Economies

In this section we examine in more detail the evolution of income and human capital inequality over time and its effect on the per capita income growth rates in the high income OECD economies and in the European countries.

In Figure 1 we plot the income Gini coefficient for the Advanced economies. For the few countries for which there are available data in the seventies, we observe a reduction in the income Gini coefficient over this 10 year span. The reduction in income inequality is found not only in higher inequality countries such as the United States and Canada but also in lower income inequality economies such as Germany or Sweden. However, the behaviour of the income Gini coefficient changes dramatically in the eighties. In particular, from 1980 to 1990 we observe an increase in the income Gini coefficient in most of the Advanced economies. The greater increase is found in the United States, United Kingdom, Australia and Sweden. Moreover, Figure 1 also shows that the tendency of increasing income inequality continues in the nineties as well. Some exceptions are Denmark, the Netherlands, France, Ireland and Greece, which slightly reduced income inequality over this period. However, in spite of the general increment in income inequality in the Advanced economies since 1980, in year 2000 there are noticeable differences among these countries. Specifically, income Gini coefficients above 0.33 can be found in the United States, United Kingdom, Spain and Greece. On the other extreme are Denmark, the Netherlands, Finland, Norway or Sweden, with income Gini coefficients below 0.26.

The pattern of human capital inequality over this period differs from that observed with income inequality. Broadly, human capital inequality has remained constant over the whole period. In fact, Figure 2 shows that from 1990 to 2000 most of the countries have maintained their relative positions, being located very close to the diagonal line. Nevertheless, the variation in human capital inequality across countries is higher than that observed with income inequality. For instance, in year 2000 Portugal and Italy displayed a human capital Gini coefficient close to 0.4 and 0.35, respectively. On the other extreme are Norway, the United States, Canada and New Zealand with a Gini coefficient close to 0.1. As a result, human capital inequality displays a lower average and greater variation than income inequality. In particular, the statistics for the Advanced economies in year 2000 show an average human capital Gini coefficient of 0.20 with a standard deviation equal to 0.07, whereas the average income Gini coefficient is 0.29 with a standard deviation of 0.04.

Next, we examine the effect of human capital and income inequality on the per capita income growth rates in different samples that include higher income countries. In the first place, we will split the whole sample into different subperiods. This will allow us to check if the effect of inequality on growth has been stable over time and if the European Monetary Union has had any influence on the differential effect found in the European countries. In particular, we will compare the effect of inequality on growth in the Euro area with that observed in countries with similar levels of development such as the whole European region and other Advanced or high per capita income economies.[7]

Moreover, we will complement the information provided by the Gini coefficient with additional measures of the different parts of the distribution such as the distribution of education by quintiles or ratios of several income percentiles. The use of these additional measures is helpful because the Gini coefficient is an aggregate measure of inequality and it does not provide any information on whether the lower an upper part of the distribution have different effects on the growth rates. In fact, Voitchosky (2005) states that the use of a unique and aggregate measure of inequality, such as the Gini coefficient, may mask the complex effect that the different parts of the income distribution may have on economic growth. Specifically, using the Luxemburg Income Study data set she finds that inequality at the top end of the income distribution is positively related to economic growth, whereas inequality at the bottom end of the distribution has a negative impact on subsequent growth rates.

Table 4 displays the results for human capital inequality, measured through the Gini coefficient and the distribution of education by quintiles. In these regressions we also control for the standard determinants of growth and for time dummies, in line with the previous tables. However, to save space we only show the estimated coefficients for the inequality variables. The first column shows the results for the human capital Gini coefficient and for the distribution of education by quintiles for the Advanced, European and Euro economies for the whole period, 1965-2005. In the remaining columns we have split the whole period into subperiods of equal length to test whether the effect of human capital inequality differs over time.

[7] The countries that belong to the Euro Area in our sample are: Austria, Belgium, France, Finland, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

The results regarding the Advanced economies show an effect of human capital inequality on economic growth that is not stable over time, in some periods the estimated coefficient of the Gini index is negative whereas at the end of the eighties and nineties it is positive, though in any case it is statistically significant at the standard levels. In fact, the estimated coefficient of the human capital Gini index is only statistically significant in the recent years. In particular, during the period 1995-2005 the results suggest that more human capital inequality discouraged the growth rates of the Advanced economies; the estimated coefficient of the Gini index is -0.157 and it is statistically significant at the 5 per cent level. Likewise at different parts of the distribution, the results with the quintiles show that a greater share of the education attained by the majority of the society had a beneficial effect on the per capita income growth rates, whereas a greater share of education concentrated on the top 20 per cent of the highest educated individuals discouraged growth.

Nevertheless, the results for the European economies are somehow different. Although the estimated coefficient of the human capital Gini index is also negative during the period 1995-2005, it is not statistically significant at the standard levels. Moreover, the Gini coefficient and the quintiles suggest that human capital inequality had a positive instead of a negative effect on the economic growth rates during the period 1980-1995.

A positive effect of a more unequal distribution of education on the growth rates is also found in the Euro Area, mainly from 1980 to 2000. In fact, even for the whole period the estimated coefficient of the 5^{th} Quintile in the distribution of education is positive and statistically significant at the 10 per cent level, which leads to the suggestion that the European Monetary Union is not the cause of such an effect. However, given the high disparities in the inequality measures (e.g. the average human capital Gini index in Portugal (0.474) is almost 3 times higher than that in the Netherlands (0.170)) it is possible that an extreme value is influencing these results. Thus, to check the robustness of the positive effect of human capital inequality on the growth rates we have repeated the previous exercise removing one country at a time. Interestingly, Table 5 shows that the results are quite sensitive to the inclusion of Portugal in the sample. In particular, the positive and statistically significant coefficient of the human capital Gini coefficient and the top quintile for the period 1985-2000 disappears once Portugal is excluded from the sample. For example, once we rule out Portugal the estimated coefficient for the fifth quintile for the period 1990-

2000 found in Table 4 (0.163 (st. dv. 0.064) reverse sign and stops being statistically significant (-0.154 (st. dv. 0.154)), which leads to the suggestion that the positive influence of human capital inequality on economic growth is not robust and is highly influenced by one of the countries with extreme values in the inequality indicator.

As for the effect of income inequality on economic growth, we have analysed the stability over time with different measures from the Luxembourg Income Study data set. Nevertheless, in spite of its improvement in the quality of the data, one of the main drawbacks of the LIS data set is the lack of observations for a broad number of countries during a long time period. For example, there are no data for Portugal or New Zealand and for most countries the first observation starts in 1980. As a result, we are forced to divide the whole period into two subperiods: 1975-1990 and 1990-2005.

The results, displayed in Table 6, show a positive and statistically significant coefficient of the income Gini index in the sample of Advanced economies during the whole period 1975-2005.[8] However, the fact that the estimated coefficient of the income Gini index is negative in the period 1975-1990 suggests that this effect is mainly driven by the positive effect on growth of an increase in income inequality in the latest period of the sample, 1990-2005. Among the percentile ratios, this result is also reflected in a positive an statistically significant coefficient of the ratio between the income reached by the 20 per cent of individuals with the highest income by the 20 per cent of individuals with the lowest income, that is, this ratio accounts for how may times the richest 20 per cent have more income than the poorest 20 per cent.

A similar result is found in the European countries and in the Euro Area during the period 1990-2005.[9] In particular, the estimated coefficient of the Gini index is 0.079 for the Advanced economies, 0.076 for the European countries and 0.071 for the Euro Area. Likewise, the estimated coefficient of the percentile ratio between the richest 20 per cent and the poorest 20 per cent is 0.010 in the sample of the Advanced economies, 0.012 in the European region and 0.015 in the Euro Area.

The fact that the positive effect of income inequality on growth from 1990 onwards is also found in the broader sample of the Advanced economies, which includes countries such as the United States with high income inequality and high per capita

[8]Note that this result differs of that found in Table 3 for the period 1965-2000 for 20 Advanced economies using the World Bank data set.

[9]Due to a lack of sufficient observations we can not report any result for the period 1975-1990 for the Euro Area.

income growth rates, minimizes the possibility that the European Monetary Union has influenced the results. Moreover, we have also tested the robustness of the results to different time periods. We find similar results for the period 1985-2005 and for the period 1980-2005, which suggests that the positive effect was previous to the establishment of the EMU. Nevertheless, in line with the analysis of human capital inequality we have also analysed whether any country belonging to the Euro Area may be the responsible of this positive effect. Results displayed in Table 7 show that when we remove one country at a time the estimated coefficient of the Gini index is always positive and quite stable in the sample of the Advanced economies, though it is sensitive to the countries included in the reduced sample of European and Euro Area countries.

Overall, in view of these results we can not conclude that a more uneven distribution of human capital or income may rise the growth rates of the European economies since the effect has not been stable over time. Moreover, we have found that the positive influence of human capital inequality on the growth rates is driven by atypical observations. Furthermore, the scarcity of available data for income inequality measures make it difficult to carry out a proper empirical test.

5 Conclusions

In this paper we have analysed the effect of income and human capital inequality in different regions of the world that include developing as well as rich economies. The estimation of a dynamic panel data model that controls for country specific characteristics suggests that income and human capital inequality have a different effect on growth in regions with different levels of development.

Using data for human capital Gini coefficients and the distribution of education by quintiles we find that more human capital inequality has discouraged the growth rates in most of the regions in the world. In accordance to some theoretical models, the negative effect is found in less developed countries where the relationship between human capital inequality and demographic variables is stronger. On the contrary, we do not find a clear effect in the sample of higher income economies. In particular, whereas we obtain a positive effect of a more unequal distribution of human capital on the growth rates of the European economies during the period 1980-2000, a simple test of atypical observations shows that this result is not robust.

With regard to the effect of income inequality on growth, we find different effects according to the level of development; a negative effect in the less developed countries and a positive one in the higher income economies. Moreover, the positive effect in the richer countries is found not only with the World Bank income inequality measures but also with the higher quality LIS data set, which shows that a greater share of income accruing to the richest twenty per cent of individuals regarding to the poorest 20 per cent has had a positive and statistically significant influence on the growth rates of the Advanced and European economies in recent years.

Overall, the results suggest that income and education inequality have had a different effect on the growth rates of several economies depending on their level of development. In particular, the results seem to be negative for low and middle income countries and in some cases positive for higher income economies. Nevertheless, the positive effect of inequality on economic growth found in the Advanced and European countries is not robust to atypical observations and is not stable over time, which suggest that a trade-off between equity and efficiency might not be a concern in these economies.

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Figure 1- Income Gini coefficient 1970-2000

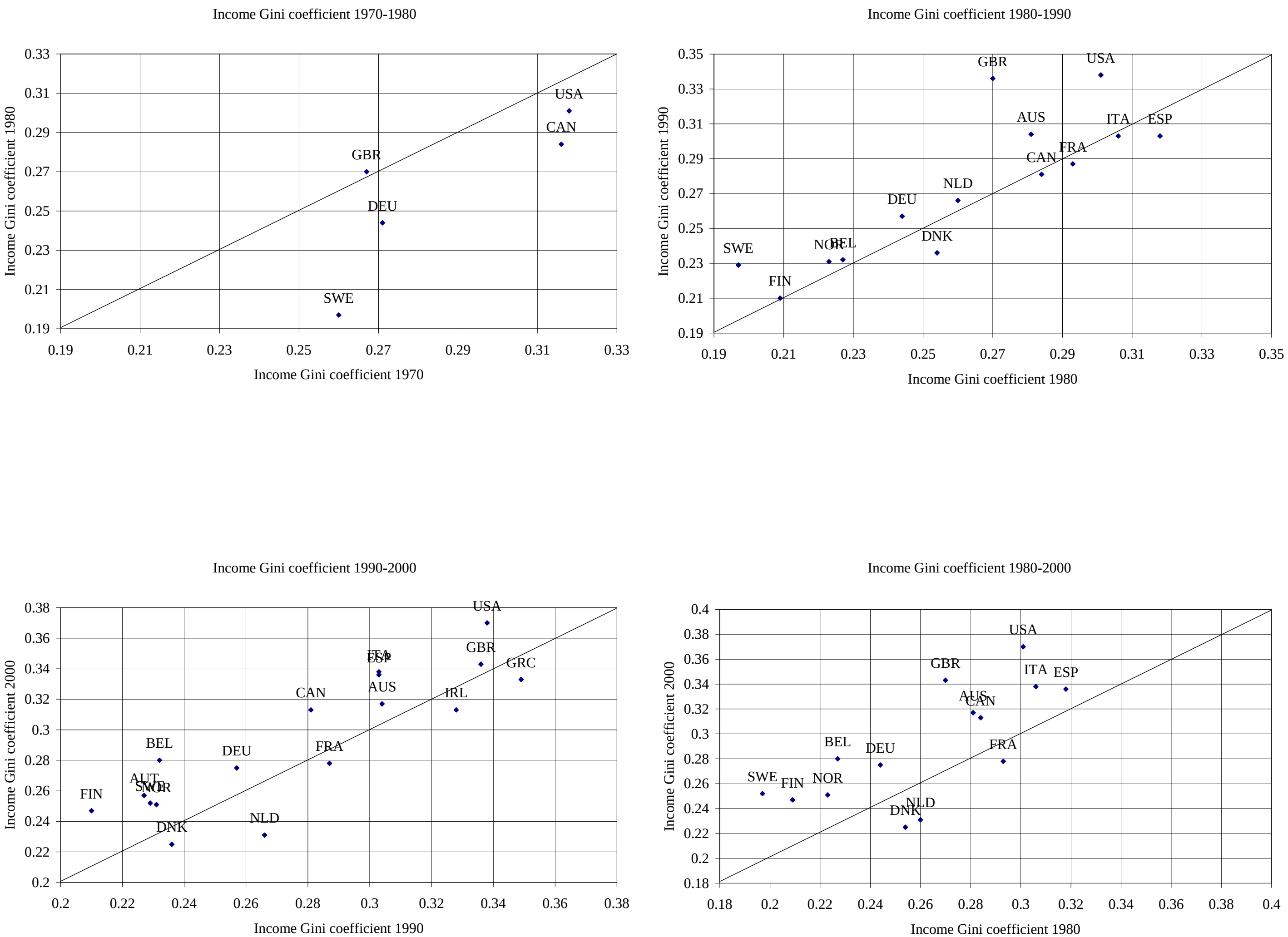

Figure 2- Human Capital Gini coefficient 1960-2000

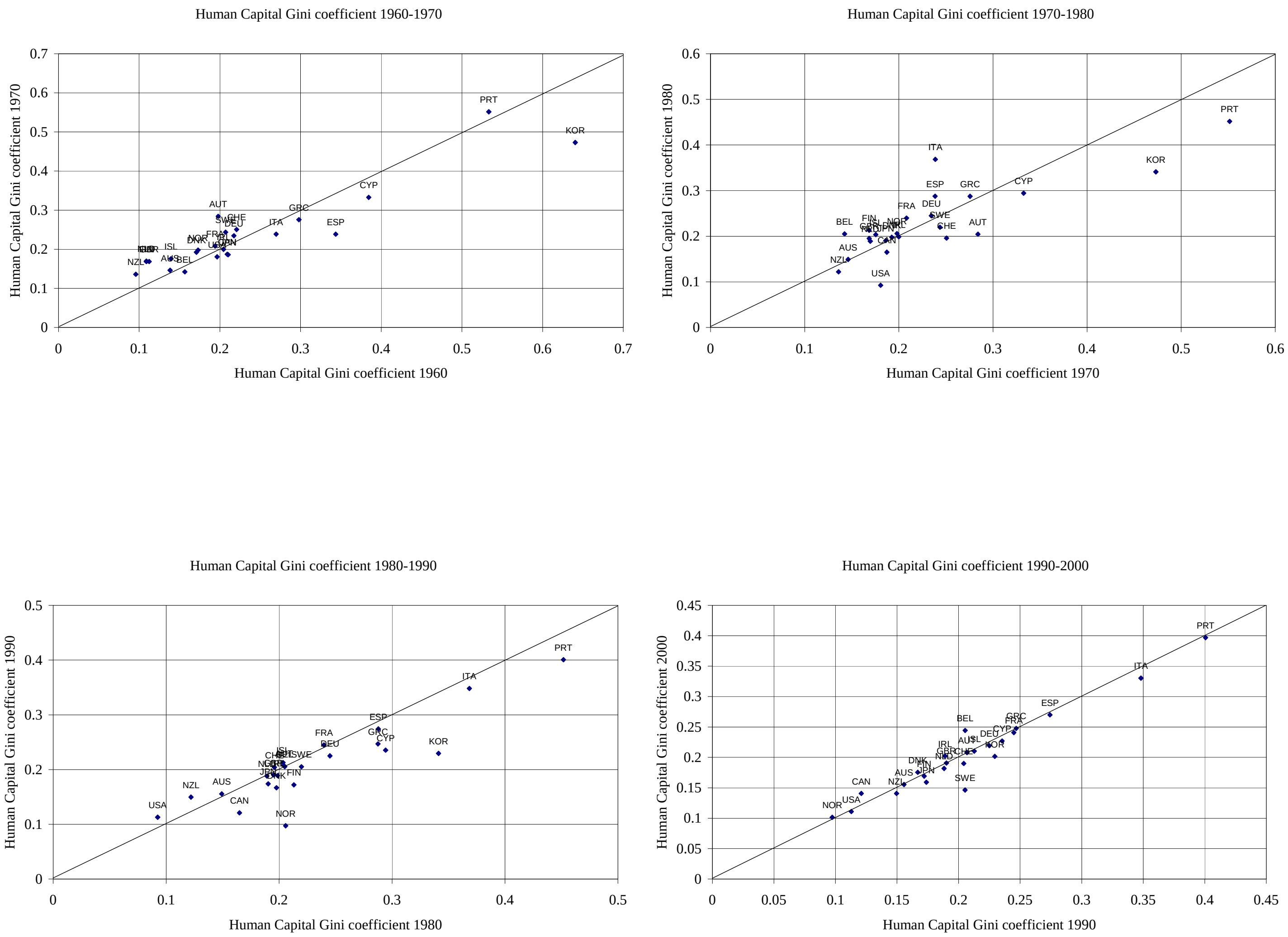

Table 1

Income and Human Capital Inequality

	R^2 from regressions on country and time dummies				
Dependent variable	Country dummies	Time dummies	Country and time dummies	Obs.	Countries
$Gini^y$	0.920	0.019	0.924	256	56
$Gini^h$	0.901	0.042	0.952	919	105

Note: Pooled OLS estimation.

Table 2

Human Capital Inequality and Economic Growth

Whole Sample. System GMM

	World (1)	*Developing* (2)	*OECD* (3)	*Advanced* (4)	*Europe* (5)	*World* (6)	*Developing* (7)	*OECD* (8)	*Advanced* (9)	*Europe* (10)
$Gini^h_{t-\tau}$	-0.050^a	-0.048^a	-0.034^a	-0.015	0.012	0.008	0.010	-0.000	-0.024	0.016
	(0.015)	(0.017)	(0.011)	(0.014)	(0.015)	(0.013)	(0.015)	(0.011)	(0.015)	(0.015)
$lny_{t-\tau}$	-0.006^a	-0.005^a	-0.025^a	-0.034^a	-0.026^a	-0.018^a	-0.011^a	-0.039^a	-0.038^a	-0.033^a
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
$Educ_{t-\tau}$	0.002	-0.000	0.002^c	0.001	0.002	-0.003	-0.006	0.003^a	0.002	0.002^c
	(0.002)	(0.004)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)	(0.001)
$(G/GDP)_{t-\tau}$	-0.037	-0.033	-0.052^b	-0.063^a	-0.046^c	-0.031	-0.040	-0.053^b	-0.060^a	-0.035
	(0.026)	(0.028)	(0.025)	(0.022)	(0.027)	(0.025)	(0.028)	(0.022)	(0.022)	(0.027)
$Trade_{t-\tau}$	0.010^a	0.013^a	0.011^a	0.008^b	0.015^a	0.005^c	0.009^b	0.012^a	0.008^b	0.015^a
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)
$Inflation_{t-\tau}$	-0.002^a	-0.002^a	-0.035^a	-0.026	-0.026^a	-0.002^a	-0.002^a	-0.030^a	-0.012	-0.024^a
	(0.000)	(0.000)	(0.007)	(0.019)	(0.008)	(0.000)	(0.000)	(0.006)	(0.020)	(0.009)
$lnFERT_{t-\tau}$						-0.040^a	-0.043^a	-0.012^a	-0.012^b	-0.002
						(0.007)	(0.009)	(0.004)	(0.006)	(0.007)
$lnLE_{t-\tau}$						0.047^a	0.034^c	0.129^a	0.014	0.121^b
						(0.018)	(0.020)	(0.036)	(0.050)	(0.059)
Constant	0.105^a	0.086^c	0.279^a	0.359^a	0.277^a	0.049	0.052	-0.145	0.347^c	-0.174
	(0.038)	(0.047)	(0.030)	(0.032)	(0.038)	(0.074)	(0.887)	(0.133)	(0.186)	(0.223)
Countries	102	70	27	23	20	101	70	27	23	20
Obs	744	474	236	204	172	732	470	236	204	172
AR (2) test	[0.129]	[0.117]	[0.558]	[0.094]	[0.728]	[0.171]	[0.139]	[0.605]	[0.011]	[0.690]
Hansen J test	[0.001]	[0.001]	[0.209]	[0.444]	[0.839]	[0.001]	[0.005]	[0.782]	[0.981]	[0.995]
Diff Hansen	[0.029]	[0.597]	[1.000]	[0.999]	[1.000]	[0.270]	[0.457]	[1.000]	[0.999]	[1.000]

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively. The set of controls also include period dummies. The period of analysis is 1965-2000. The instruments are the levels of the explanatory variables lagged two periods and further lags until a maximum of 4. In addition to these variables, the system-GMM also uses as instruments for the level equation the explanatory variables in first differences lagged one period. Developing countries include low and middle income countries as classified by World Bank in 2007 and Advanced countries include OECD countries except Hungary, Mexico, Poland and Turkey.

Table 3

Human Capital Inequality, Income Inequality and Economic Growth

Reduced Sample. System GMM

	World			Developing			OECD			Advanced			Europe		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
$Gini^h_{t-\tau}$	-0.028^c		-0.025^c	-0.036^b		-0.036^b	-0.031^b		-0.022	-0.011		-0.011	-0.004		-0.021
	(0.015)		(0.015)	(0.014)		(0.015)	(0.014)		(0.016)	(0.021)		(0.021)	(0.019)		(0.021)
$Gini^y_{t-\tau}$		-0.053^c	-0.061^b		-0.017	0.000		-0.042^b	-0.028		0.038	0.038		0.040	0.054^c
		(0.027)	(0.025)		(0.026)	(0.024)		(0.021)	(0.023)		(0.028)	(0.028)		(0.026)	(0.030)
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$ and time dummies															
Countries	56	56	56	31	31	31	24	24	24	20	20	20	16	16	16
Obs	244	244	244	119	119	119	125	125	125	104	104	104	79	79	79
AR (2) test	[0.076]	[0.079]	[0.064]	[0.046]	[0.042]	[0.098]	[0.912]	[0.992]	[0.968]	[0.954]	[0.979]	[0.954]	[0.960]	[0.964]	[0.934]
Hansen J test	[0.045]	[0.121]	[0.115]	[0.773]	[0.709]	[0.852]	[0.857]	[0.857]	[0.961]	[0.969]	[0.969]	[0.989]	[0.987]	[0.987]	[0.997]
Diff Hansen	[0.879]	[0.977]	[0.967]	[0.986]	[0.948]	[0.998]	[1.000]	[1.000]	[1.000]	[0.999]	[0.999]	[0.999]	[1.000]	[1.000]	[1.000]

Controlling for fertility rates and life expectancy

	World			Developing			OECD			Advanced			Europe		
$Gini^h_{t-\tau}$	-0.002		-0.004	0.009		0.011	-0.009		-0.015	-0.020		-0.027	-0.006		-0.030
	(0.014)		(0.013)	(0.017)		(0.028)	(0.016)		(0.018)	(0.024)		(0.024)	(0.020)		(0.023)
$Gini^y_{t-\tau}$		0.021	0.024		0.066^b	0.068^b		0.011	0.022		0.046	0.051^c		0.043	0.066^b
		(0.022)	(0.021)		(0.028)	(0.028)		(0.025)	(0.028)		(0.030)	(0.030)		(0.028)	(0.033)
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$,$lnFERT_{t-\tau}$, $lnLE_{t-\tau}$ and time dummies															
Countries	55	55	55	31	31	31	24	24	24	20	20	20	16	16	16
Obs	237	237	237	119	119	119	125	125	125	104	104	104	79	79	79
AR (2) test	[0.048]	[0.053]	[0.054]	[0.025]	[0.039]	[0.019]	[0.856]	[0.833]	[0.779]	[0.923]	[0.983]	[0.990]	[0.947]	[0.945]	[0.889]
Hansen J test	[0.300]	[0.333]	[0.444]	[0.933]	[0.933]	[0.975]	[0.988]	[0.988]	[0.996]	[0.977]	[0.997]	[0.999]	[0.999]	[0.999]	[1.000]
Diff Hansen	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[1.000]	[1.000]	[1.000]

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively. The period of analysis is 1970-2000. The instruments are the levels of the explanatory variables lagged two periods and further lags until a maximum of 4. In addition to these variables, the system-GMM also uses as instruments for the level equation the explanatory variables in first differences lagged one period .

Table 4
Human Capital Inequality and Economic Growth
Dependent variable: per capita income growth rate. System GMM

	1965-2005	1965-1975	1970-1980	1975-1985	1980-1990	1985-1995	1990-2000	1995-2005
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Advanced Countries				
$Gini^h$	-0.015	-0.024	0.001	-0.041	-0.001	0.013	0.004	**-0.157**^{b}
	(0.014)	(0.050)	(0.053)	(0.037)	(0.053)	(0.040)	(0.054)	(0.067)
1^{st} $Quintile^h$	0.041	-0.044	0.035	0.201	0.034	0.052	0.004	0.145
	(0.028)	(0.116)	(0.094)	(0.143)	(0.086)	(0.081)	(0.079)	(0.090)
3^{rd} $Quintile^h$	0.015	0.024	-0.041	0.012	-0.037	-0.085	0.054	**0.199**^{b}
	(0.018)	(0.067)	(0.061)	(0.041)	(0.058)	(0.080)	(0.085)	(0.084)
5^{th} $Quintile^h$	-0.016	-0.116	-0.028	-0.024	0.027	0.073	0.071	**-0.270**^{b}
	(0.024)	(0.107)	(0.078)	(0.059)	(0.063)	(0.070)	(0.070)	(0.121)
Obs.	204	66	68	69	69	69	69	69
Countries	23	23	23	23	23	23	23	23
				European countries				
$Gini^h$	0.012	-0.012	-0.030	-0.001	**0.081**^{b}	0.050	0.048	-0.046
	(0.015)	(0.044)	(0.037)	(0.048)	(0.031)	(0.035)	(0.037)	(0.042)
1^{st} $Quintile^h$	-0.009	0.156	0.091	0.039	**-0.149**^{b}	-0.063	-0.067	0.077
	(0.031)	(0.106)	(0.077)	(0.076)	(0.064)	(0.072)	(0.082)	(0.082)
3^{rd} $Quintile^h$	-0.017	-0.006	0.019	0.002	**-0.122**^{b}	-0.044	-0.015	0.102
	(0.021)	(0.054)	(0.058)	(0.000)	(0.046)	(0.074)	(0.059)	(0.069)
5^{th} $Quintile^h$	0.026	-0.081	-0.032	0.012	**0.138**^{a}	**0.104**^{c}	0.087	-0.012
	(0.026)	(0.091)	(0.077)	(0.064)	(0.048)	(0.056)	(0.053)	(0.051)
Obs.	172	52	56	60	60	60	60	60
Countries	20	20	20	20	20	20	20	20
				Euro Area				
$Gini^h$	0.019	0.013	0.025	0.017	**0.058**^{b}	**0.106**^{a}	**0.091**^{c}	0.029
	(0.016)	(0.023)	(0.021)	(0.077)	(0.024)	(0.032)	(0.045)	(0.049)
1^{st} $Quintile^h$	-0.042	-0.088	-0.057	-0.034	**-0.085**^{c}	**-0.135**^{b}	-0.124	-0.043
	(0.030)	(0.054)	(0.054)	(0.051)	(0.045)	(0.055)	(0.075)	(0.081)
3^{rd} $Quintile^h$	-0.012	-0.012	-0.038	-0.034	**-0.083**^{b}	**-0.159**^{a}	-0.099	-0.009
	(0.021)	(0.032)	(0.030)	(0.031)	(0.036)	(0.049)	(0.071)	(0.072)
5^{th} $Quintile^h$	**0.054**^{c}	0.003	0.059	0.029	**0.117**^{a}	**0.147**^{a}	**0.163**^{b}	0.058
	(0.028)	(0.046)	(0.039)	(0.040)	(0.035)	(0.047)	(0.064)	(0.070)
Obs.	97	31	32	33	33	33	33	33
Country	11	11	11	11	11	11	11	11
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$ and time dummies								

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively.

Table 5

Human Capital and Growth in the Euro Area

Dependent variable: per capita income growth rate. System GMM

Robustness check: rule out one country at a time

	1980-1990		1985-1995		1990-2000	
	Gini^h	5^{th} Quintile^h	Gini^h	5^{th} Quintile^h	Gini^h	5^{th} Quintile^h
Austria	0.057^b	0.109^a	0.104^a	0.147^b	0.097^c	0.181^b
	(0.025)	(0.038)	(0.035)	(0.053)	(0.050)	(0.072)
Belgium	0.052^c	0.111^b	0.109^a	0.159^a	0.093^b	0.173^a
	(0.026)	(0.039)	(0.034)	(0.050)	(0.042)	(0.059)
Finland	0.060^b	0.124^a	0.095^a	0.127^a	0.105^b	0.182^b
	(0.027)	(0.038)	(0.031)	(0.044)	(0.049)	(0.068)
France	0.059^b	0.122^a	0.124^a	0.177^a	0.108^b	0.200^a
	(0.026)	(0.038)	(0.033)	(0.048)	(0.047)	(0.066)
Germany	0.065^b	0.123^a	0.113^a	0.150^a	0.090^c	0.168^b
	(0.025)	(0.036)	(0.034)	(0.049)	(0.049)	(0.070)
Greece	0.047^c	0.103^b	0.080^c	0.109^c	**-0.009**	**-0.008**
	(0.026)	(0.039)	(0.039)	(0.055)	(0.046)	(0.074)
Ireland	0.056^c	0.181^a	0.102^a	0.180^a	0.072^c	0.132^b
	(0.032)	(0.055)	(0.034)	(0.055)	(0.037)	(0.055)
Italy	0.057^b	0.096^a	0.132^a	0.140^b	0.127^b	0.178^b
	(0.022)	(0.028)	(0.042)	(0.050)	(0.058)	(0.072)
Netherlands	0.058^b	0.117^a	0.106^a	0.144^a	0.094^c	0.170^b
	(0.024)	(0.034)	(0.033)	(0.049)	(0.049)	(0.070)
Portugal	**0.059**	0.250^a	**0.011**	**-0.161**	**-0.154**	**-0.053**
	(0.048)	(0.081)	(0.067)	(0.162)	(0.114)	(0.267)
Spain	0.058^b	0.132^a	0.108^a	0.176^a	0.103^b	0.163^b
	(0.024)	(0.036)	(0.034)	(0.049)	(0.048)	(0.069)
Obs.	30	30	30	30	30	30
Countries	10	10	10	10	10	10
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$ and time dummies						

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively.

Table 6

Income Inequality and Economic Growth

Dependent variable: per capita income growth rate. System GMM

LIS	$Gini^y$	90/10	90/50	80/20	Obs.	Countries
	(1)	(2)	(3)	(4)		
Advanced Economies						
1975-2005	**0.077**^{c}	0.003	0.017	**0.010**^{b}	80	17
	(0.046)	(0.002)	(0.011)	(0.005)		
1975-1990	-0.002	0.001	-0.003	0.002	31	14
	(0.053)	(0.003)	(0.014)	(0.006)		
1990-2005	0.079	0.002	0.018	**0.010**^{c}	62	17
	(0.051)	(0.002)	(0.012)	(0.006)		
European Countries						
1975-2005	0.055	0.001	0.014	0.097	69	16
	(0.051)	(0.002)	(0.010)	(0.064)		
1975-1990	-0.032	-0.006	-0.000	-0.011	23	12
	(0.088)	(0.006)	(0.020)	(0.014)		
1990-2005	0.076	0.003	**0.019**^{c}	**0.012**^{c}	57	16
	(0.053)	(0.003)	(0.011)	(0.006)		
Euro Area						
1975-2005	0.117	0.001	0.028	0.021	39	10
	(0.088)	(0.062)	(0.018)	(0.014)		
1975-1990						
1990-2005	0.071	-0.003	0.021	0.015	34	10
	(0.099)	(0.006)	(0.019)	(0.015)		
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$ and time dummies						

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively.

Table 7

Income inequality and Growth 1990-2005

Dependent variable: per capita income growth rate. System GMM

Robustness check: rule out one country at a time

	Euro Area	European countries	Advanced economies
	$Gini^y$	$Gini^y$	$Gini^y$
Austria	0.078	0.079	0.068
	(0.108)	(0.054)	(0.055)
Belgium	0.007	0.048	0.076
	(0.113)	(0.056)	(0.052)
Finland	0.233^b	0.109^c	0.098
	(0.111)	(0.059)	(0.056)
France	-0.010	0.073	0.072
	(0.109)	(0.055)	(0.053)
Germany	0.065	0.097^c	0.060
	(0.107)	(0.054)	(0.053)
Greece	0.112	0.083	0.084
	(0.086)	(0.052)	(0.050)
Ireland	0.007	0.021	0.003
	(0.008)	(0.052)	(0.043)
Italy	0.044	0.081	0.073
	(0.108)	(0.054)	(0.052)
Netherlands	0.068	0.067	0.072
	(0.119)	(0.056)	(0.053)
Spain	0.067	0.074	0.074
	(0.111)	(0.056)	(0.053)
Additional controls: $lny_{t-\tau}$, $Educ_{t-\tau}$, $(G/GDP)_{t-\tau}$, $Trade_{t-\tau}$, $Inflation_{t-\tau}$ and *time dummies*			

Note: Robust standard errors in parenthesis. a, b and c are 1, 5 and 10 per cent significance level respectively. There are not income inequality data for Portugal

TABLE A

INCOME GINI COEFFICIENTS FOR 56 COUNTRIES

Country	1965	1970	1975	1980	1985	1990	1995	Mean	St.dv.
Middle East and North Africa									
Algeria	-	-	-	-	-	0.453	0.419	0.436	0.024
Tunisia	-	-	0.506	0.496	0.496	0.468	-	0.492	0.016
Iran	-	0.521	0.489	-	-	-	-	0.505	0.022
Israel	-	-	-	-	-	0.309	0.305	0.307	0.003
Jordan	-	-	-	-	-	0.427	0.473	0.450	0.032
Sub-Saharan Africa									
Ghana	-	-	-	-	-	0.359	0.340	0.350	0.014
Mauritania	-	-	-	-	-	0.491	0.444	0.468	0.033
Mauritius	-	-	-	-	-	0.462	0.433	0.448	0.021
South Africa	-	-	-	-	-	0.630	0.623	0.627	0.005
Uganda	-	-	-	-	-	0.396	0.474	0.435	0.055
Latin America and the Caribbean									
Costa Rica	-	-	0.444	0.450	0.470	0.461	-	0.456	0.012
Dominican R.	-	-	-	0.450	0.433	0.505	0.490	0.470	0.035
Honduras	-	-	-	-	-	0.540	0.540	0.540	0.000
Jamaica	-	-	-	-	-	0.484	0.445	0.465	0.027
Mexico	0.555	0.577	0.579	0.500	0.506	0.550	0.570	0.548	0.033
Trinidad & Tobago	-	-	0.510	0.461	0.417	-	-	0.463	0.046
Brazil	-	0.576	0.619	0.578	0.618	0.596	0.637	0.604	0.025
Chile	-	0.456	0.460	0.532	-	0.547	0.556	0.510	0.048
Colombia	-	0.520	0.460	0.545	-	0.512	0.513	0.510	0.031
Peru	-	-	-	-	0.493	0.494	0.515	0.501	0.012
Venezuela	-	-	0.477	0.394	0.428	0.538	-	0.459	0.063
East Asia and the Pacific									
Hong Kong	-	-	0.398	0.373	0.452	0.420	0.450	0.419	0.034
Indonesia	0.399	0.373	-	422	0.390	0.397	0.383	0.394	0.017
Korea	0.343	0.333	0.360	0.386	0.345	0.336	0.382	0.355	0.022
Malaysia	-	0.500	0.518	0.510	0.480	0.484	-	0.498	0.016
Philippines	-	-	-	-	0.461	0.457	0.450	0.456	0.006
Singapore	-	-	0.410	0.407	0.420	0.390	0.378	0.401	0.017
Taiwan	0.322	0.294	0.312	0.280	0.292	0.301	0.308	0.301	0.014
Thailand	0.413	0.426	0.417	-	0.431	0.488	0.515	0.448	0.042
South Asia									
Bangladesh	0.373	0.342	0.360	0.352	0.360	0.355	0.349	0.356	0.010
India	0.377	0.370	0.358	0.387	0.381	0.363	0.386	0.375	0.011
Pakistan	0.387	0.365	0.381	0.389	0.390	0.380	0.378	0.381	0.009
Sri Lanka	0.470	0.377	0.353	0.420	0.453	0.367	0.410	0.407	0.044
Advanced Countries									
Canada	0.316	0.323	0.316	0.310	0.328	0.276	0.277	0.307	0.022
United States	0.346	0.341	0.344	0.352	0.373	0.378	0.379	0.359	0.017
Japan	0.348	0.355	0.344	0.334	0.359	0.350	-	0.348	0.009
Belgium	-	-	-	0.283	0.262	0.266	0.269	0.270	0.009
Denmark	-	-	-	0.310	0.310	0.332	0.332	0.321	0.013
Finland	-	0.318	0.270	0.309	0.308	0.262	0.261	0.288	0.026
France	0.470	0.440	0.430	0.349	0.349	-	-	0.408	0.055
Germany	0.281	0.336	0.306	0.321	0.322	0.260	0.274	0.300	0.029
Greece	-	-	-	-	0.399	0.418	-	0.409	0.013
Ireland	-	-	0.387	0.357	-	-	-	0.372	0.021
Italy	-	0.380	0.390	0.343	0.332	0.327	0.322	0.349	0.029
Netherlands	-	-	0.286	0.281	0.291	0.296	0.294	0.290	0.006
Norway	0.375	0.360	0.375	0.312	0.314	0.331	0.333	0.343	0.027
Portugal	-	-	0.406	0.368	-	0.368	0.356	0.374	0.022
Spain	-	-	0.371	0.334	0.318	0.325	0.350	0.340	0.021
Sweden	-	0.334	0.273	0.324	0.312	0.325	0.324	0.316	0.022
Turkey	-	0.560	0.510	-	-	0.441	0.415	0.481	0.066
United Kingdom	0.243	0.251	0.233	0.249	0.271	0.323	0.324	0.271	0.038
Australia	-	-	-	0.393	0.376	0.412	0.444	0.407	0.028
New Zealand	-	-	0.300	0.348	0.358	0.402	-	0.352	0.042
Transitional Economies									
China	-	-	-	0.320	0.314	0.346	0.378	0.340	0.029
Hungary	0.259	0.229	0.228	0.215	0.210	0.233	0.279	0.236	0.025
Poland	-	-	-	0.249	0.253	0.262	0.331	0.274	0.038
Mean	0.369	0.395	0.393	0.375	0.377	0.400	0.401	0.403	0.025
Std. dv.	0.079	0.097	0.093	0.085	0.083	0.095	0.097	0.088	0.015
Countries	17	26	36	40	40	52	45	56	56

Gini coefficients are taken from the latest available data closest to the corresponding period. A value of 0.066 has been added to the Gini coefficients based on expenditure. Source: Deininger and Squire (1996) and UNU/WIDER-UNDP World Income Inequality Data Base (2000) .

Economic Integration, Growth, Distribution: Does the euro make a difference?

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Abstract

The final stage of the EU's Economic and Monetary Union is an unprecedentedly strong form of economic integration among independent countries. By enhancing market competition, it should in theory foster production efficiency and also make it difficult for National governments not only to conduct independent macroeconomic policies, but also to enforce income redistribution schemes. In practice, the information conveyed by available data confirms that the Eurozone's aggregate production and employment performances have improved in comparison to other EU15 countries, and that its member countries have implemented less generous social policies accepting, as a consequence, an increase in disposable income inequality.

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1. Introduction

Inequality is an important concern for European citizens, income redistribution is intense at the National level within European Union countries, and feelings of economic insecurity are an important factor in the recent stasis of the European integration process. European countries' economic woes had many causes in the early 2000s, including the worldwide cyclical downswing, competition from newly industrializing trading partners, and slow adoption of new technologies. But it has often been easiest for public opinion and National politics to blame them on the most novel and most apparently avoidable aspect of recent experience: the euro and, more generally, deeper and wider economic integration in the European Union (EU). [1]

For researchers, economic integration has been a fertile field. Much has been written about the macroeconomic, trade, and productivity implications of economic and monetary integration.[2] And an extensive if somewhat inconclusive body of theoretical and empirical work has dealt with interactions between economic integration and income inequality within and across countries at vastly different levels of development.[3] But little attention has been paid by researchers to inequality issues in the context of the European economic and monetary union experience or of any other experiment of single currency adoption. The early stages of the European process of economic integration focused on deregulation and production efficiency.

This paper analyzes the implications for growth and income inequality of Stage Three of the European economic and monetary integration process, i.e. adoption of the euro as the single currency (EMU, for brevity, in what follows). Section 2 outlines the relevant theoretical effects of EMU, through macroeconomic channels and, especially, because of its implications for market and policy reactions to tight and irrevocable integration of goods and financial markets. Section 3 computes simple statistics in order to try and assess the empirical association between EMU,

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[1] Eurobarometer (see http://europa.eu.int/comm/public_opinion/flash/fl171_en.pdf) found that top reasons for a 'no' vote to the European Constitution referendum by French citizens included *'loss of jobs'* (31%), *'too much unemployment'* (26%), *'economically too liberal'* (19%) and *'not enough social Europe'* (16%). Opposition to the first draft of the Services directive was similarly rooted in the fear that supply of cheap, unregulated labor in Continental European countries would endanger their social welfare models.

[2] See for example the papers in Baldwin, Bertola, Seabright (2003), and their references to other studies of the impact of EMU on a variety of structural features and economic outcomes, notably the intensity of trade.

[3] See, e.g., Spilimbergo, Londoño, and Székely (1999), Sala-i-Martin (2006).

economic performance, inequality, and social policy. Section 4 concludes outlining the policy implications of the paper's theoretical perspective and results.

2. Income distribution, market integration, and policy

Monetary union's main consequence is the removal of independent macroeconomic policy tools from the member countries. By renouncing its own currency and monetary policy, countries can no longer conduct an independent monetary policy, and exchange rates cease to affect competitiveness. To the extent that the Growth and Stability pact is a binding constraint, fiscal policy instruments are also less than fully available under EMU. As discussed in more detail by Sapir et al (2004), macroeconomic policies can stabilise an economy in the face of imperfectly co-ordinated savings and investment decisions and imperfectly flexible price and wage arrangements. The same fiscal and monetary instruments that can be useful in that context, however, can also generate and propagate aggregate shocks if used in pursuit of objectives different from macroeconomic stability, and can precipitate crises if implemented in unsustainable ways. Monetary union has undoubtedly allowed member countries to achieve stability: in some cases by granting previously elusive credibility; in the case of countries that already implemented sound macroeconomic policies, by preventing spillovers from trading partners' unstable policies.

Stability can clearly foster growth, in that long-horizon investment and innovation decisions are easier and better informed in a more predictable environment. Its relationship with income inequality is less obvious. Of course, macroeconomic volatility can influence incomes differently across different individuals. Wage and unemployment developments are very important determinants of personal income inequality, and labour market features, such as the structure of contracting and the influence of unions in wage setting, affect distribution as well as macroeconomic developments.[4] If nominal prices and wages are rigid, for example, foregoing devaluations may require sharper activity slowdowns, unemployment increases, and consumption wage reductions for the purpose of restoring competitiveness. Credibly ruling out devaluation options may however enforce wage moderation at any given level of unemployment, while in conditions of poor monetary policy credibility wage negotiations would routinely discount devaluation and imply real wage rigidity, attempting to shift purchasing power losses toward bondholders or to fixed-income earners other than workers.

[4] Arpaia and Pichelman's (2007) careful analysis uncovers a number of differences in wage adjustment mechanisms across European countries. It would be interesting in future work to see assess the extent to which country-specific patterns of adjustment reflect institutional and/or economic structure features.

More generally, it is doubtful that National macroeconomic policy and labor market reactions would be able to support favorable income dynamics within an integrated economic area. Activity is still less regionally specialized in Europe than in a fully integrated economy like that of the United States. As economic integration proceeds, however, regions and sectors will typically span national borders, blunting national monetary and fiscal policies as stabilization tools. When most labour market shocks occur at the regional or industry level, the fiscal policy independence suppressed by EMU would likely be a source rather than a remedy for national economic fluctuations (Darvas, Szapáry, and Rose, 2005). And as macroeconomic stability and tight market integration calls for wage an employment flexibility in response to sector- and regions-level shocks, the coordinated wage bargains that proved useful in order to cope with country-specify adjustments to shocks may hinder the necessary adjustments, as centralization tends to compress wages.

From this market-oriented perspective, EMU does not only deprive its member countries' of macroeconomic policy independence: it also opens the way to new market forces and new sources of shocks. Adopting a single currency is also an extremely important step towards full integration of microeconomic market interactions. The absence of currency risk improves price transparency, reduces the extent to which price and wage stickiness may blur relative productivity signals, and supports economies of scale in deeper, no longer segmented markets for goods, services, and financial products. Wider and deeper market integration fosters efficiency both through such direct channels, and also by exerting pressure towards efficiency-enhancing reforms, which may also be spurred by the absence of devaluation and other macroeconomic escape routes towards at least temporarily better competitiveness (Belke, Herz, and Vogel, 2007, review the relevant theoretical channels and evidence).

2.1 Integration, distribution, and risk

Like any change, economic integration affects not only the aggregate amount but also the distribution of income and welfare. Diversion of trade from within to across countries' borders can benefit some producers and damage others. Most intuitively, integration with poorer countries may increase inequality in rich countries, as their poor citizens' incomes are bid down by competition from substitutable workers in poor countries. More generally, however, factors of production can be complementary rather than substitutable across borders.[5] And factors can move or accumulate over time, in ways that influence patterns of production and income across countries and individuals interacting in integrated markets. If income is higher and returns to investment lower where more capital is available, integration should reduce inequality as production grows faster where it is

[5] See O'Rourke (2001) for a very clear overview of mechanisms and evidence.

initially low; but if production exploits increasing returns instead, market integration can increase income inequality.[6]

The interplay between these channels implies that the inequality impact of integration is theoretically ambiguous overall, and amenable to empirical investigation. In practice, inequality in most advanced countries has been increasing since the 1970s, bringing to an end a long decline in the earlier part of the 20th century.[7] This pattern broadly parallels that of global economic integration indicators, but it is difficult to identify the effects of economic integration separately from those of technological change. On the one hand, because the extent of economic integration is shaped by progress in transportation and communication technologies, as well as by trade liberalization and other policy trends. On the other hand, because the two phenomena have similar effects on the distribution of incomes in advanced countries. A portion of the observed increase in income inequality is accounted for by widening pay differentials across education levels, and may be explained by mechanisms whereby unskilled workers are substituted (and skilled workers complemented) by machines and/or by less developed countries' labour.

A particularly welfare-relevant portion of income inequality, however, may reflect *ex post* random events rather than *ex ante*, permanent factors. The volatility of each worker's income over his or her lifetime may also be related to economic integration: as more widely integrated markets react more promptly and more sharply to differences in prices, small cost shocks can have dramatic effects on production. Survey evidence indicates that perceived labour market risk is higher for workers working in more internationalized sectors (Scheve and Slaughter, 2004), and that, even though integration is expected to be beneficial on average, the average individual is against immigration and trade in most countries. Higher aggregate production levels are not unambiguously beneficial when markets (especially financial markets) are imperfect and incomplete, making it impossible to assess welfare on a "representative individual" basis. As integration changes the distribution of income and of consumption across heterogeneous agents, attitudes towards it depend on whether individual agents expect to find themselves above or below the average of income changes. In surveys, opposition to economic integration is indeed sensibly stronger on the part of individuals who are theoretically more likely to be damaged by it, such as low-skilled workers in countries that receive low-skilled migration inflows (see Mayda, O'Rourke, and Sinnott, 2007).

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[6] Bertola, Foellmi, and Zweimueller (2006) offer an exhaustive introduction to the relevant interaction channels, with particular emphasis on the role of financial market structure in determining convergence or divergence across individuals as well as across countries and regions.

[7] See Piketty and Saez (2006) and their references.

Studies of such channels of interactions have mostly focused on economic integration between countries at vastly different levels of development, as in the case of North/South globalization patterns or of the EU's enlargement to transition countries. Economic integration among countries with similar endowments, such as the original six members of what is now the European Union and the current Eurozone members, has often been supposed to yield mostly economies of scale and of variety, with little (if any) implications for within-country income distribution. Different aspects coexist in all economic integration experiences, however, and there is no reason to expect any income-volatility implications of economic integration to be less pronounced in the case of Eurozone countries than in that of more diverse, but less tightly integrated economies. And in light of Continental Europe's pervasive Welfare State tradition, it is particularly interesting in the EMU context to consider interactions between integration of the markets where individual agents' decisions take place, and implementation of collective policies.

2.2 Social policy

People do not only interact through markets. Reducing *ex ante* inequality can be desirable in order to foster social cohesion, and redistribution policies can offset *ex post* income shocks when information and implementation problems prevent insurance markets from smoothing out they welfare impact. If imperfect and incomplete information does not make it possible to distinguish random events from the effects of individual efforts, however, then redistribution decreases production efficiency at the same time as it reduces the role of luck in the determination of individual welfare.

Thus social policy, like all policies, has desirable and undesirable effects, whose relative strength depends on the economy's characteristics. The impact of economic integration on its implementation is twofold. On the one hand, new cross-border sources of risk increase the appeal of policies meant to buffer the welfare implications of uninsurable risk, and may explain why more open countries' governments are more deeply involved in economic matters (Rodrik, 1998). On the other hand, international economic integration also affects on the viability of National redistribution policies. Wider, less constrained market interactions improve efficiency because they offer more choices to individual economic agents. But they also make it more difficult for policies to shape individual choices differently from what would be implied by unavoidably imperfect market mechanisms. Depending on whether demand or supply influences dominate, accordingly, integration may in practice increase or decrease the intensity of collective redistribution and other interferences with laissez fair markets at the country level (Agell, 2002; Bertola and Boeri, 2002). Survey evidence indicates that attitudes towards economic integration are also shaped by their impact on redistribution policies (Facchini and Mayda, 2006). Hence, economic integration's political sustainability may well require coordination of social policies at the same level as that of market interactions (Bertola, 2006).

3. Income distribution in EMU

The previous section's review of theoretical insights suggests that the impact of integration on inequality is ambiguous overall, but plays out through well-defined and policy-relevant channels of interaction. Identifying such channels and assessing overall inequality effects is an essentially empirical problem, albeit a very difficult one, which this section explores focusing on the possible effects of EMU on social policy and inequality.

For a useful set of countries and periods, Eurostat publishes the "quintile ratio" inequality indicator, i.e. the ratio of income earned by the top quintile of the population to that earned by the bottom quintile, for household equivalised disposable income. This statistic, which would be equal to one in the case of perfect equality, ranges up to infinity as less income accrues to the bottom fifth of the households, and more to the top fifth. It is far from an ideal indicator of the phenomena of interest, as it may fail to capture important changes in the middle of the income distribution and need not be tightly related to income volatility and consumption dispersion. However, and despite comparability and measurement problems (discussed below), no other data appear nearly as suitable for this paper's purposes.

As shown in figure 1, a rather sharp swing occurred in EU-level inequality indicators around adoption of the euro. According to the Eurostat indicator, inequality was declining until 2000, remained flat through 2001, and increased very sharply back to its 1996 level by 2004. The swing is if anything sharper, in both directions, for the aggregate of the first 12 Eurozone countries. The latest available data refer to 2005, when Eurostat reports that inequality declined in the Eurozone and remained flat across all the EU15.

The picture painted by figure 1 makes a forceful case for exploring the relationship between EMU and inequality. However, it can be very misleading for several reasons. First, the measurement of inequality has changed in terms of definitions and underlying data, again roughly at the same time as EMU. [8] Between 1995 and 2001, indicators were computed from the now discontinued European Community Household Panel (ECHP) survey's data. Beginning in 2003, Eurostat gradually adopted the Community Statistics on Income and Living Conditions (EU-SILC) methodology. The quintile ratio indicator still refers to disposable household income, the definition of which is broadly similarly with a few exceptions (EU-SILC included in income in-kind income

[8] I am grateful to Carmen Raluca Ipate and Erich Ruscher of DG-ECFIN for researching and forwarding this information.

from work, imputed rent from owner-occupation, payments made to other households and interest payments on loans) which may or may not matter depending, for example, on how home ownership varies systematically across income groups. Available country-specific observations are plotted in figure 2, with different symbols depending on the methodology, for each of EU15 countries between 1995 and 2005. The change in measurement procedure occurs at different times in different countries, and typically implies a missing observation. The new data do not appear systematically different from the old data. The dynamics across the methodological change are similar to those observed in other periods, and in several cases within-country inequality dynamics follow a U-shaped path around the turn of the millennium.

Second, inception of EMU (the impact of which is obviously difficult to time precisely, due to anticipation effects and adjustment lags) is not the only factor driving inequality in this period. A global recession and EU enlargement both took place at roughly the same time as EMU, and inflation, budget balances, and other aggregates ceased to converge across its member countries. One reason why individual incomes may become more unequal is, of course, increasing inequality across countries. As figure 3 shows, however, country-level incomes have continued to converge in Europe (Luxembourg is omitted, to reduce the size the horizontal axis and improve legibility). Convergence rates, as measured by the slope of the regressions of growth on initial income shown in the figure, are very similar before and after EMU, and for countries that did and did not join the Eurozone. Thus, there is no indication that tighter economic integration fosters convergence, as is theoretically possible in the absence of strong agglomeration effects; more detailed studies paint a similarly pessimistic picture of macroeconomic variables' convergence in EMU (see Roubini, Parisi-Capone, and Menegatti, 2007, and its references). The data in figure 3 also make it clear that growth has certainly slowed down rather uniformly after 2000. Slower and/or more variable growth in the cyclical slowdown phase may or may not be affected by EMU, as both fiscal and monetary policy were already blunt in the after-Maastricht run-up to EMU when individual countries faced stringent exchange rate and budget constraints. But it will be important in what follows account for aggregate dynamics when characterizing the association between EMU membership and within-country inequality.[9]

[9] Countercyclical variation in wage inequality and volatility has been documented by many authors, including Storesletten, Telmer and Yaron (2004), mainly on American data. The regressions below assess inequality developments controlling for both income and unemployment fluctuations and trends. In European countries wages tend to be inflexible and cyclical fluctuations might instead be reflected in unemployment, which however tends to reflect structural and institutional as well as cyclical factors. Detailed analysis of the influence of labour market institutions on wage dispersion

The third and most important reason why the dynamics shown in figure 1 may motivate but not satisfy curiosity as regards the relationship between inequality and EMU is that inequality, even if correctly measured, is not really interesting *per se*. What is important is the relationship between inequality and other dimensions of economic performance and policy that may also be affected by EMU, such as income and unemployment, and labour market and redistribution policies. The data shown in figure 2 indicate that cross-country differences in inequality levels dwarf dynamic developments.[10] Apparently small changes in broad inequality statistics are important, however, because the aggregate efficiency effects of integration are similarly small,[11] and because they can hide dramatic changes in individual circumstance. *Ex ante* uncertainty about who exactly will lose out can foster resistance to reforms (inducing in policy choices the "status quo bias" of Fernandez and Rodrik, 1991). And to the extent that higher inequality across individuals results from more pronounced instability over time of individual incomes, the associated increase in uninsurable consumption volatility may well be such as to more than compensate higher levels and faster growth of consumption and income (see Krebs, Krishna, and Maloney, 2005, for a model and some relevant evidence).

3.1 Configurations

In order to set the stage for empirical assessment of the joint dynamics of EMU, economic performance, and country-specific inequality developments, it is important to examine broad relationships between the variable of interest. Table 1 displays summary statistics for a sample of 11 yearly observations in 14 countries.[12] All 154 observations are available for the measures of

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and more general inequality measures and may be found in Checchi and Garcia Peñalosa (2005) and Koeniger, Leonardi, and Nunziata (2007).

[10] A portion of the impressive swing in Figure 1 is accounted for by composition effects, i.e., by high-inequality countries growing in importance within the aggregate at times of increasing inequality and vice versa, but the available data are too scarce to ascertain whether any such composition effects may be structural.

[11] The Single Market Program was estimated in the 1988 Cecchini Report to increase European GDP by some 2-6%, and in 1996 the effects of the first four years was estimated to be some 1.1-1.5% higher GDP; completion of a single market in services, according to the European Commission's revised Lisbon Strategy communication (COM(2005) 24), would increase GDP by 0.6% and employment by 0.3% in the medium run.

[12] Luxembourg observations are outliers, and excluded for the sake of sample homogeneity. While Luxembourg's inequality indicator is very similar to that of Belgium and of the Netherlands in Figure 3, that country's small size, very high per capita GDP, and peculiar financial specialization may spuriously affect relationships between these and other relevant variables, which are different enough from those prevailing across the countries to affect the results' significance.

income, unemployment, inequality, and country size defined in the table's notes. In the sample, the inequality indicator ranges between 2.9 and 8.2 across countries and over time. These and other summary statistics may be useful in order to assess the quantitative relevance of the coefficients in the following tables.

It is also useful to inspect the available data graphically in order to assess the character of variation across relevant dimensions of cross-country heterogeneity. Figure 4 displays the remarkably strong negative relationship between the available inequality indicator and real per capita income. In these data, there is a strong tendency for richer countries to feature lower disposable inequality (conversely, as the regressions below document, the relationship of inequality to country size not as strong as one might expect).

As shown in figure 5, richer countries also devote a larger fraction of their larger income to redistribution. In this and the other figures it is possible to detect well-known patterns of clustering across countries: Nordic ones such as Sweden, Denmark, and Finland feature particularly generous social spending and particularly low inequality; Mediterranean ones such as Portugal and Greece are at the opposite extreme in both respects; and the Anglo-Saxon observations for Ireland and the United Kingdom tend to feature more inequality and lower social spending than would be expected on the basis of their income and of overall cross-country relationships.

The strong positive relationship between income and social spending across EU member countries, of course, need not imply that the latter causes the former. Taxes and subsidies may in principle perform efficiency-enhancing roles that are beyond reach of imperfectly and incompletely informed markets. As mentioned above, however, if governments' attempts to do so encounter the same information and incentive problems as private market participants, more social spending improves equality at the expense of efficiency and aggregate production. Countries may well differ not only in terms of the political appeal of movements along such trade-offs, but also in terms of their ability to produce aggregate income. As the negative side effects of social policy are less serious for countries that are richer to begin with for geographical and historical reasons, such countries may well implement more extensive redistribution than poorer ones where strenuous effort is absolutely necessary.

Figure 6 shows that across States of the US there is a strong negative relationship between per capita income and (net) transfers, financed in good part by uniform taxes and contributions. This is doubtlessly also the case across regions within European countries, and indeed across households within each. But over a roughly comparable range of income levels (the United States 2002 data are in current dollars, while the EU income variables in the various years are in 1995 euro) citizens of the EU receive more generous subsidies when they live in richer member countries, for reasons that are obvious in light of the National character of social policy in the EU, and will be discussed further in the conclusions below.

While the strong relationship between income and social policy cannot easily be interpreted in structural terms, social policy does matter for inequality. Figure 7 shows that more generous social spending is negatively associated with disposable income inequality. And the same is also true after accounting for the relationship between (partly exogenous) income levels and inequality, as shown in figure 8. In these as in all other bivariate relationships illustrated by this section's figures, observations where pooled over time as well as across countries. It is however clear, particularly in figure 8, that not only income but also social policy and inequality feature interesting time-series variation along these relationships, and that there is substantial variation around each of the regression lines that might be driven through the data. This makes it interesting to explore next how such variation may be related to EMU membership along both the time-series and cross-sectional dimensions.

3.2 What has happened?

The effects of EMU are hard to gauge on inequality, and any other outcome of interest, because many confounding factors may affect observed correlations. The coincidence of EMU developments with enlargement and global cycles, the limited time elapsed from adoption of the euro, the uncertain timing of the latter; all makes it difficult to rely on statistical methods. But the issues are sufficiently important to warrant investigation, albeit on the basis of imperfect data and imprecise assessments. The empirical exercises below are in the spirit of Barr, Breedon, and Miles (2003), who focus on trade, foreign direct investment (FDI) flows and financial market activity and also briefly consider aspects of macroeconomic performance. In that and other papers in Baldwin, Bertola, Seabright (2003), difficult choices are necessary as regards the definition of EMU in terms of the country composition and dating of the newly integrated economic entity. The analysis and results of this subsection have the same important limitations and qualifications, but also have the advantage of a longer post-EMU observation span, and offer a novel set of findings on income distribution and social policy indicators.

The time interval covered by the data set introduced above is conveniently symmetric around dates that might correspond to adoption of the euro. Available data also span a boom-bust episode, and this makes it possible to control for cyclical influences on inequality and social spending. Unfortunately, lack of comparable data for earlier cycles makes it impossible to assess whether the relationship between inequality and macroeconomic conditions has been affected by EMU. Needless to say, countless other high-order issues cannot be addressed by these data, which however appear to be the best available, and prove suitable to provide useful insights into very important issues.

In the spirit of the "differences in differences" methodology, two dummy variables account for the common characteristics of countries that have so far joined the Eurozone, and for the changes in those countries after joining. EMU0 is equal to unity throughout the available sample for all the countries that have adopted the single currency as of 2005, and equal to zero for the other EU15 countries. Some specifications allow for country-specific intercepts, and omit the (redundant) EMU0 dummy. Another dummy variable, denoted EMU in the tables, is equal to unity in 1999 and later years for Austria, Belgium, Germany, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal, and in 2001 and later years for Greece. It is meant to capture variation associated, for a given country and in comparison to countries that remain out, with adoption of the common currency. Anticipation and lags may be relevant to those effects, of course, but one-year changes in the dating of the EMU=1 observations make very little difference to the results reported below.

Thus, in each of the regressions below the coefficient of the EMU0 dummy variable captures the effect of being a country that (sooner or later, in the sample) joins the Eurozone, and the coefficient of the EMU dummy captures the effect (for a country of that type, if EMU0 also appears among the regressors) of actually having joined the Eurozone. The presence in the sample of countries that did not adopt the euro (and were not 'treated' by EMU) makes it possible controls, to the limited extent possible, for the influence of the global cycle, of EU enlargement, and of other developments occurring at roughly the same time as EMU: the coefficient of the EMU dummy may be influenced by events occurring over the period it identifies only to the extent that such events affects Eurozone countries differently from Denmark, Sweden, and the UK. While this comparison group is of course far from ideal, the results are reassuringly robust to exclusion of any one of these three countries, and to inclusion in the non-EMU group of EFTA countries for which reasonably complete data are available.[13]

Closer economic integration is expected to foster productivity and growth. The regression coefficients reported in the first two columns of table 2 indicate that economic performance, both in terms of per capita income and in terms of unemployment, does improves significantly with EMU

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[13] Data for Norway (available from 1997) and for Iceland (only available in 2004-05) make a small difference to the results when included in the regressions below as part of the non-EMU control group. Inequality data are not available for Switzerland. Data for EU27 countries other than the EU15 and for Turkey offer interesting additional insights into the relationship between inequality, income, and social spending. But new member states' data only begin to be available in 2000, and as of 2005 do not as yet include any Eurozone member. Hence, they are not useful for this paper's purpose of assessing empirical patterns before and after EMU.

for countries that, as indicated by the coefficient of the EMU0 dummy, tend as a group to do worse than the comparison group of Denmark, Sweden, and the United Kingdom. The estimates of the EMU0 and EMU coefficient are robust in terms of sign and significance when country dummies are included among the explanatory variables in columns (3) and (4). The striking improvement of the regression's fit indicates that, not surprisingly, a very large proportion of the variation is across countries rather than over time. Examining the data from this perspective will prove informative, in different ways, in many of the regression specifications that follow: the variables of interest vary mostly across countries, within as well as across EMU and non-EMU groupings; but while time-series within-country variation is modest, it is sufficient and sufficiently related to the EMU dummy to yield significant coefficients in most cases for that dummy and for interesting control variables below.

The estimates in the table 2 indicate that Eurozone countries' output is higher after joining than that of countries that opted out. Higher output may result from lesser interference with efficient market interactions unemployment, which is over the full sample higher in current Eurozone countries, has after their adoption of the single country indeed declined more than in the control group. Higher efficiency is also expected to result from deeper integration itself. Columns (5-7) regress indicators of economic integration, in the form of 'openness' ratios for goods, services, and FDI, on the EMU and EMU0 dummies as well as on country population, as a rough control for the fact that larger countries are naturally less open to international transactions. The significantly negative coefficient of population confirms this prior, and the positive coefficient of the EMU dummy indicates that the economic effects of adopting the single currency do work through international channels.[14] The effect on FDI is especially strong and (in results not shown) remains roughly as large and highly significant also when controlling for income.

Integration is expected to make it more difficult for countries to implement uncoordinated policies interfering with market outcomes. Evidence of lower unemployment may indicate that high unemployment was previously a consequence of attempts to achieve credibility on the part of National macroeconomic policy maker in the run-up to EMU. But lower output and higher unemployment could also be side effects of interference with market outcomes that is meant to reduce labour income dispersion and instability: from this perspective, economic integration may foster efficiency and "growth" at the expense of equality or "cohesion", an example of the tension between different policy objectives of the type discussed in Sapir et al (2002).

[14] There is a vast literature on the trade effects of the euro and other common currency: see e.g. Micco, Stein, and Ordonez (2003) and its references.

To assess the relationship between euro adoption on the one hand, and the level and changes of inequality on the other hand, tables 3 and 4 apply the same approach of table 2 to the quintile ratio indicator of income inequality as the dependent variable of descriptive regressions. The choice of explanatory variables included along with EMU dummies is inspired by observation of broad and theoretically sensible empirical associations. Inclusion of per capita income is suggested by figure 4; population is included as a rough control for the likely higher heterogeneity of larger countries; and unemployment begs to be included in light of its large variation across countries and EMU status in table 2 (and, as we shall see, has significant and interesting coefficients).

Social policy, as we saw in figures 5 and 8, is also significantly associated with inequality, but is not yet included table 3's regression: accordingly, the association between social policy and inequality is absorbed by the coefficients of EMU, and of other included variables (unemployment, population, and per capita income) to the extent that they co-vary with social policy. The estimates in the first two columns of table 3 use and interpolate all available inequality data, disregarding definitional and measurement problems. The results in column (1) confirm the impression conveyed by figure 1: the EMU membership dummy is significantly associated with higher inequality. The specification reported in column (2) includes the EMU0 dummy, which enters with a positive coefficient and reduced the statistical relevance of EMU membership, indicating that higher inequality is to some extent a permanent characteristic of the group of countries that eventually joined EMU, rather than an effect of EMU in those countries after joining. In these descriptive regressions, the coefficient of the EMU dummy is influenced by the association detected in table 2 between EMU, unemployment, and income, and the coefficients of these variables also deserve to be discussed briefly. Countries with larger and possibly more heterogeneous population have higher inequality. Income's coefficient is very significantly negative, consistently with the strong bivariate relationship shown in figure 4 above. Interestingly, the coefficient of unemployment is negative: inequality of household disposable income, after controlling for the other variables in the regression, is lower when a country's average unemployment rate is higher.[15] This may indicate that most of the variation in unemployment is due to institutional features that keep wages higher than the market clearing level, rather than to differences in the efficiency of worker-job matching. The impact on household-level inequality may well be negative when employed workers earn higher wages, tend to be older, and live in the same households as unemployed youth.[16]

[15] Experimenting with indicators of regional unemployment dispersion yielded no significant results.

[16] The relationship between unemployment and inequality is indeed interestingly different when the latter is measured in terms of wages rather than of equivalised income. Bertola, Blau, and Kahn

As mentioned above and illustrated in figure 2, the definition and underlying data of the quintile-ratio dependent variable of these regressions have changed in subtle but precisely timed ways over the sample. Random measurement errors in the left-hand side variable of a regression would not bias the estimates: in the diff-in-difference specifications considered, the definitional change would affect the estimated coefficients of EMU dummies only if it had systematically different implications for the relevant groups of countries. There is little reason *a priori* to suspect this to be true (and, as mentioned, the results of regressions on all available data are remarkably robust to exclusion of individual countries from the 'treated' and 'control' groups). But it is possible to allow for the possibility that inequality provide completely (if additively) different information before and after the definitional change. The next two columns of table 3 include a dummy that takes value 1 when the inequality indicator is computed by Eurostat on the basis of the new methodology, and drops (instead of interpolating) all observations where Eurostat does not publish it. In this specification, it is no longer possible to detect a statistically significant association between EMU and inequality: the EMU coefficient is small and insignificant in column (3), and almost exactly zero when the EMU0 dummy is also included in column (4). This negative result is driven in practice by the fact that too few homogeneously defined inequality observations are available across the relevant divide. Taken at face value, however, it is consistent with theoretically ambiguous direct impact of economic integration on inequality; definitional problems, as we shall see, do not prevent empirical procedures from detecting less ambiguous and more interesting indirect effects, through government policies.

Another indicator that may be affected by economic integration and is potentially relevant to personal inequality is the share of labour income. As discussed in Section 2, economic integration may affect income distribution by allowing private agents to exploit cross-border opportunities. The higher mobility of capital may make it better able to do so (consistently with the large FDI effects measured in table 2), and this may affect personal income distribution if, as is realistic, financial wealth is more unequally distributed than labour earnings, and/or workers have limited access to financial instruments. A readily available proxy variable for the relevance of this phenomenon is the share in GDP of gross wages and salaries, provided by Eurostat for all countries and years in the sample of interest (with the exception of Portugal 1999-2005). As shown in column (4) of table 3, the wage income share does decline with the EMU dummy, and rather sharply so (almost 3

(2002), for example, find that when wage inequality and unemployment are measured in terms of deviations from country means, so as to control at least roughly for other factors influencing both, they are negatively related, consistently with the idea that tighter wage compression generates more unemployment among low-productivity workers.

percentage points in the specification reported, and up to 5 p.p. in similar regressions – not reported - with different sets of control variables). Interestingly, however, the wage share is completely irrelevant to personal income inequality when included in the regression of column (6), and is only very mildly and *positively* associated with the different inequality definitions accounted for by an additive dummy in the regression of column (7) of table 3. Thus, the share of wages in aggregate income may be influenced by integration, but appears unrelated to household income inequality.

The share of social expenditure in aggregate income, conversely, is very relevant to inequality. The regression reported in column (1) of table 4 estimates a significant negative coefficient for public social expenditure as an explanatory variable for inequality, consistently with figures 7 and 8. After accounting for heterogeneity in that respect, the EMU dummies are no longer at all significant in regressions that are otherwise similar to those reported in table 3. EMU is negatively associated with inequality when unemployment (and population) is omitted in column (2), and only very mildly positive and insignificant in column (3) when that variable's coefficient is allowed to absorb the EMU-associated variation detected in table 2. The estimates in the first three columns of table 3 again use and interpolate all available inequality data, which is appropriate if their variation is not dominated by definitional and measurement problems. But it is also possible to allow the inequality measure to differ across definitions both in levels, and in terms of association with social policy. Columns (4-6) of table 4 exclude observations whenever Eurostat does not publish a quintile ratio, and include the dummy that accounts for the definitional change as well as its interaction with the social policy indicator. The completely insignificant level effect and the marginally positive slope effect of the definitional change absorb a portion of the broad inequality increase observed in figure 1, while the EMU dummies remain insignificant, and public social expenditure remains negatively associated with inequality (if only insignificantly so within the new-definition subsample, whose observations are very sparse as shown in figure 2, and further reduced in this regression by unavailability of 2005 social expenditure data).

The direct association between the EMU dummy and Eurostat inequality statistics is small and ambiguous, consistently with the similarly ambiguous implications of theory as regards the inequality impact of economic integration. But the negative and rather significant coefficient of social spending in inequality regressions begs the question of whether EMU may influence inequality indirectly, through differences in social spending in the aftermath of euro adoption. Indeed, the regressions in table 5 document a negative association between social expenditure and EMU status. After controlling for per-capita income (as strongly suggested by the data plotted in figure 5), the share of GDP spent on social policies (other than old age pensions) is lower on average in Eurozone countries after adoption of the euro than in the comparison group, according to the estimated coefficient of the EMU dummy which is negative and highly significant in column (1) and is left unchanged in column (2) by inclusion of unemployment and population among the regressors.[17] It is still negative if less significantly so in column (3), where the EMU0 dummy is included to account for the overall character of social policies in the group of countries that eventually joined EMU. The regressions of columns (4) and (5) include the government budget balance, which enters with a negative sign, is highly significant, and absorbs much of the EMU dummy's statistical significance. This may indicate that the reduction of social policy expenditure was in this period associated in EMU countries with improvement of government budgets (rather than lower taxes, or reduction of other expenditures).

The association of lower social spending with EMU's fiscal policy constraints and market competitiveness concerns is consistent with the theoretically obvious limitations of each country's ability to conduct vigorous (and possibly misguided) independent policies in an integrated market environment. Of course, countries were not forced by an experimenter to join EMU, but chose to do so, and the choice was presumably influenced by the relationships detected in the data, which do imply that countries wishing maintain their own (whether Danish or British) social policy standards were well advised not to integrate with others as tightly as EMU implies.

4. Concluding comments

The various pieces of evidence reported and discussed in this paper paint a picture of post-EMU evolution that is intriguingly consistent both with economic theory, and with concerns expressed by citizens in Eurobarometer surveys. EMU appears to be associated with better aggregate economic performance, but also with somewhat higher inequality, and with lower social spending. Economic integration's inequality effects appear to be mediated by (comparatively, in comparison to pre-EMU and non-EMU status) less generous social policy in countries joining the Eurozone, and a portion of their better economic performance may reflect smaller incentive effects of redistribution rather than more efficient international market interaction.

Whether such developments should be viewed as good news depends of course on the side of redistribution budgets one finds himself on, and on whether one views redistribution as a suitable or a misguided tool for pursuing goals that markets could in principle but might in practice fail to achieve. Interestingly, declines in unemployment and wage shares appear to play a minor role in determining inequality developments, which are presumably driven instead by variation in the heterogeneity and correlation of earnings and capital income. EMU and other structural and policy

[17] The negative coefficient of population size may perhaps reflect administrative difficulties or political problems due to ethnic fractionalization (Alesina et al, 2004).

developments may be inducing substitution of private financial instruments for the labour market regulations and decentralized public redistribution schemes that are less viable in a tightly integrated system of markets. Financial market development can indeed fulfil some of the needs addressed by social policy in theory, and it would be interesting to find out whether it does so within EMU countries as well as at the global level (see Bertola, 2007b, for further discussion and evidence).

Like all empirical results, those reported here can be relied upon only to the extent of their statistical significance. Changes in the definition and measurement of inequality at times that broadly coincided with advent of EMU are an additional obstacle in the way of the results' reliability for the purpose of assessing extremely important and topical issues. But even if the data are treated as wholly incomparable before and after changes in definition, the qualitative character (if not the statistical significance) of the results is unchanged. The theoretically ambiguous direct impact of integration on inequality cannot be detected, while the data continue to support the implications of market and budgetary discipline for the feasibility of redistribution policies, and those of redistribution policies for household income inequality. The data that do exist tell an intriguing and theoretically consistent story that is not likely to be driven by measurement problems.[18]

Better and more abundant future data may of course yield different results. In the meantime, it would be wrong to disregard linkages between economic integration and not only growth, but also the sources and remedies of income inequality. While this paper focuses on inequality within rather than across countries, the two are related in obvious and less obvious ways. Within the EU and within EMU, richer countries tend to feature higher social spending. Hence, any lack of convergence of relatively poor countries' per capita incomes also hinders decline of their within-country inequality: high incomes are associated with generous social policies across EU member countries (see figure 6) and, as argued by Sapir et al (2004), aggregate income growth is also a necessary condition for the feasibility of redistributive social policy. When trying to speculate about

[18] For simplicity of interpretation, the specifications reported above include on/off EMU membership dummies (and the results are remarkably robust to the timing of such EMU switches). While inclusion of unrestricted country-specific dummies absorbs much of the empirical variation as to make EMU dummies insignificant, specifications where EMU and non-EMU countries are assigned different trends yield similar (and statistically more significant) results as regards the association between inequality, social spending, and EMU. Countries that join EMU during the sample period display slower (more negative) social spending trends, and faster (more positive) inequality trends. This is quite consistent with a structural effect of EMU developing slowly over time through anticipation and lagged reactions, and is not as likely to be driven by point-in-time definitional changes.

the possible evolution of the EMU project as regards inequality and social policy, it is very interesting to consider the contrast between the EU and United States configurations in terms of the relationship between income levels and transfer levels. As shown in figures 6 and 7, the sign of the income-transfers correlation is the opposite in the US, where residents of poor States receive more from a largely Federal welfare system, and in the EU, where country-specific welfare systems are more generous in poorer member countries. The overall generosity of the United States welfare system is also lower than that of comparably rich EU countries, as Federal co-financing schemes may not suffice to prevent race-to-the-bottom tendencies in a tightly integrated economy with high labour mobility.

Can EU countries continue to develop an ever tighter web of private markets without reforming and integrating their social policy systems, possibly to the lower levels and Federal configuration of their United States counterparts? In the current configuration of the EU, free mobility of goods and factors, local decision-making powers in the social protection area, and inequality prevention similarly coexist uneasily (Bertola, 2007b). All three are desirable goals of the European Union's system of policies: unfettered market interactions foster efficiency and growth; country-level social policy decisions have obvious appeal in light of the vast variety of configurations and historical traditions across member countries; and effective poverty-prevention policies are needed, in Europe as in the US, both to foster social and political peace, and to remedy the efficiency consequences of financial market imperfection. But pursuing two of the three goals implies forsaking the third, just as before EMU uncoordinated macroeconomic policies, fixed exchange rate, and free trade with capital mobility could not be consistent with each other: one had to be abandoned.

In the Eurozone, macroeconomic policy independence was given up, and the tight and irrevocable integration of its markets may call for forms of effective policy integration in the social policy area as well. Difficulties arise from the fact that different countries approach similar problems differently, in ways that reflect their own history and economic structure and lack of common grounds for political debate. So far, effective economic integration has been limited, especially as regards labour mobility and trade in services. Over time, as ever deeper integration takes place in all markets, solidarity schemes may develop across the European Union as they did in the United States. As long as some risk management pertains to policy rather than markets, the scope of policy should coincide with that of markets to the extent possible, and it is no less inconsistent to imagine a Single Market without a coherent welfare policy system as it was to try and run independent macroeconomic policies under fixed exchange rates in conditions of free capital mobility. But the very wide heterogeneity of economic circumstances and social traditions across the Eurozone and the EU may well make it difficult to build a harmonious common welfare infrastructure. And the importance of redistribution policy may well have to decline relative to that of markets, perhaps approaching a configuration similar to that of the United States where, for example, interstate private financial flows play an important consumption-smoothing role alongside local and Federal taxes and transfers (see Salemli-Ozcan, Sorensen, and Yosha, 2004, and its references).

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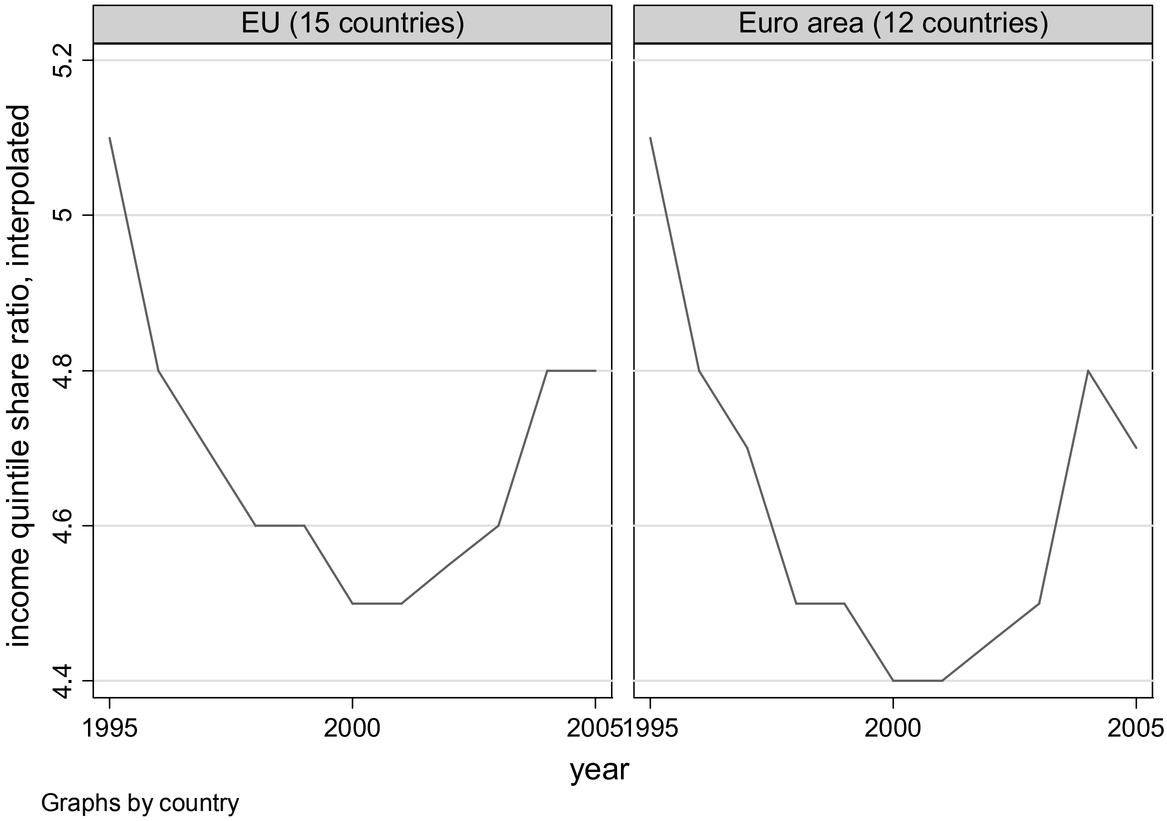

Figure 1 - Evolution of inequality, as measured by the income quintile ratio, in the EU15 and Euroarea12 aggregates (2002 is the average of data reported for 2001 and2003; methodology varies). *Source: Eurostat.*

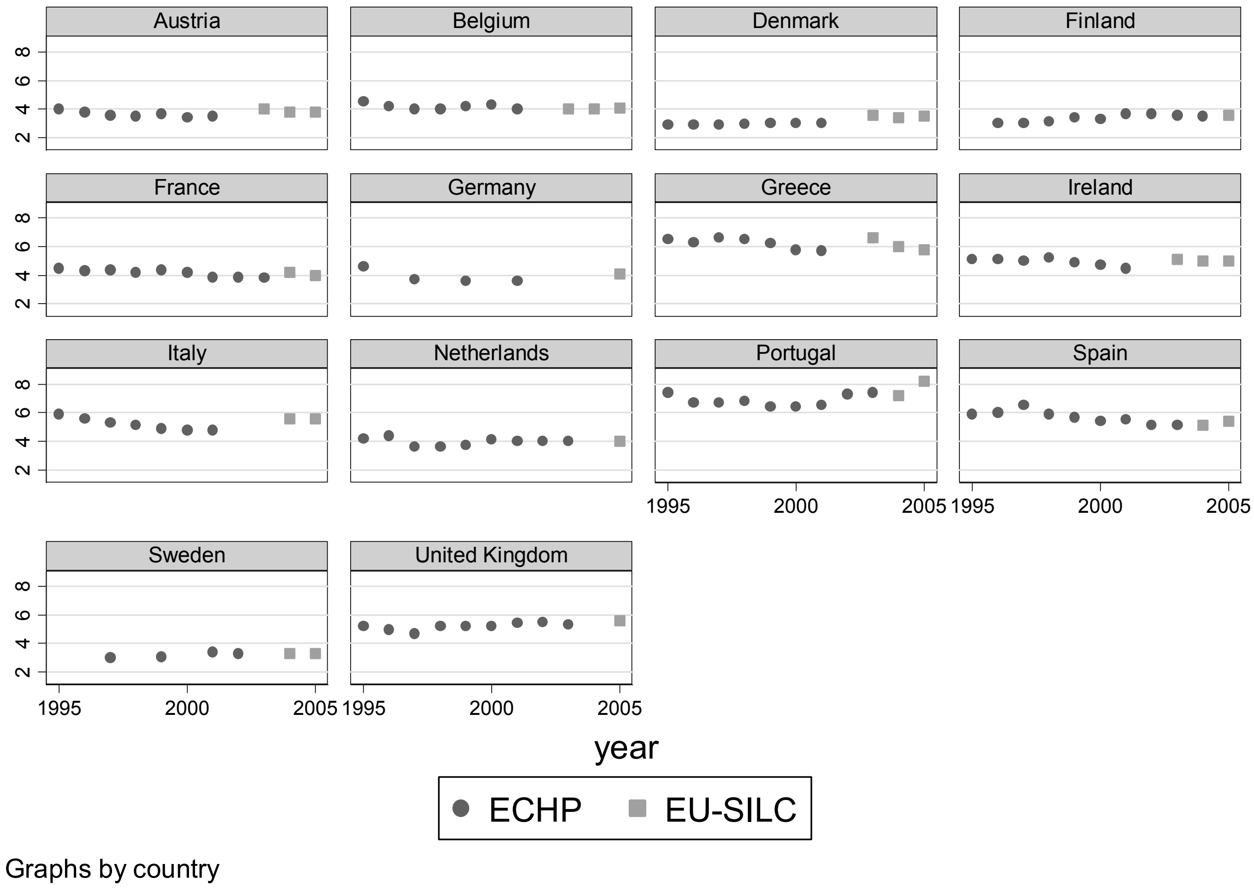

Figure 2 - Yearly 1995-2005 income quintile ratios for EU 15 countries. *Source: Eurostat.*

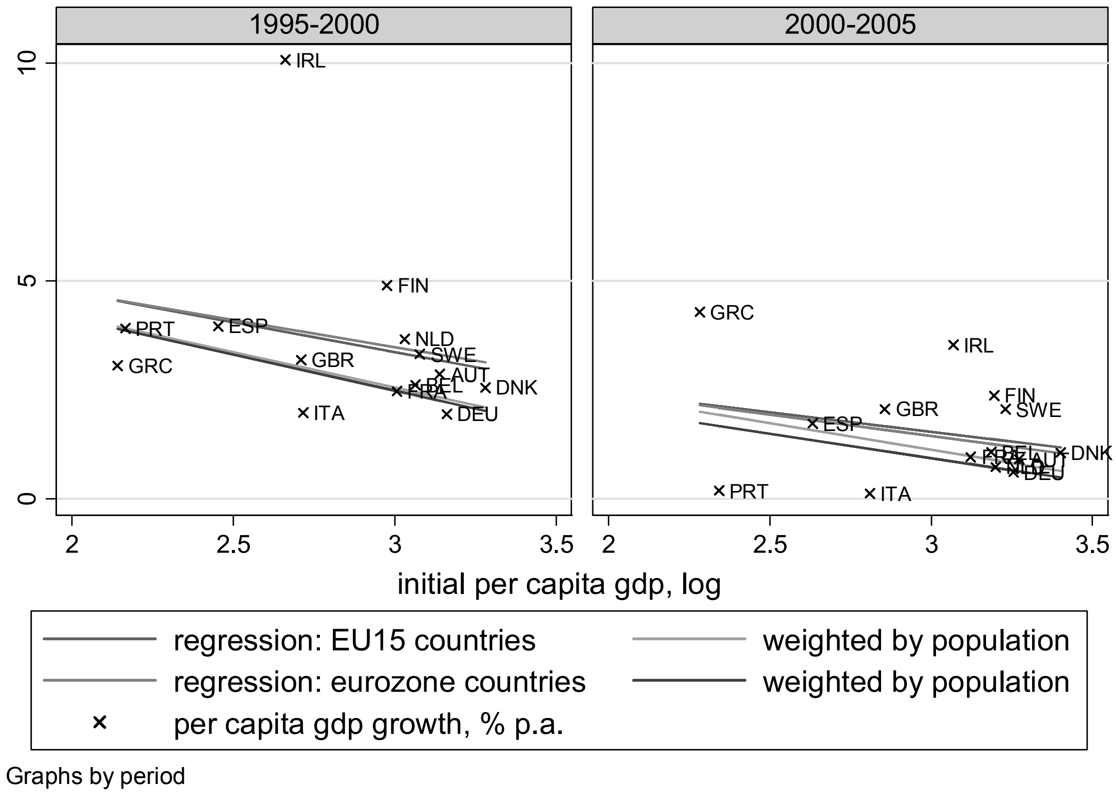

Figure 3 - Relation between initial per capita GDP and subsequent growth across EU15 countries (Luxembourg is excluded); GDP is measured in constant 1995 euro, its growth in annual percentage points. The slope of the regression lines gauges the strength of inequality-decreasing convergence forces. *Source: Eurostat.*

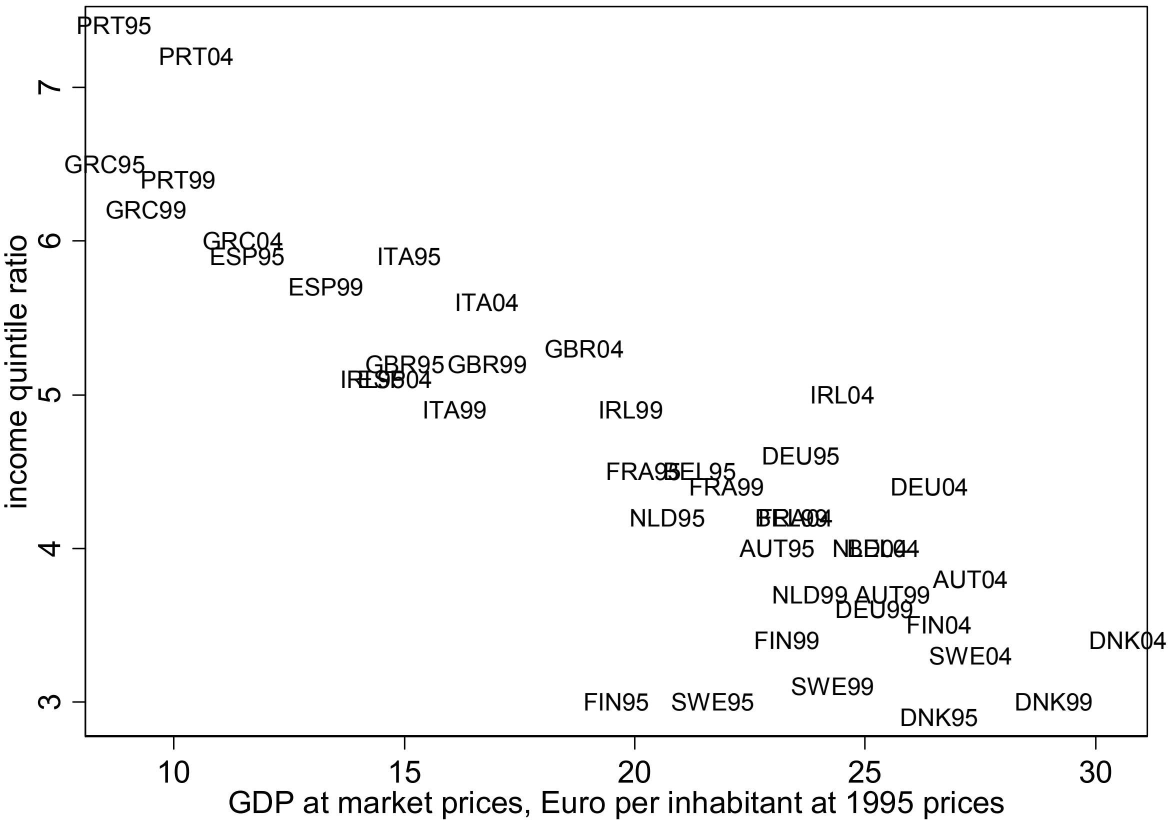

Figure 4 - Per capita GDP in constant 1995 euro and contemporaneous income quartile ratio; EU15 countries (except Luxembourg), 1995, 1999, 2004 (interpolation of 2001 and 2005 for German quintile ratio). *Source: Eurostat.*

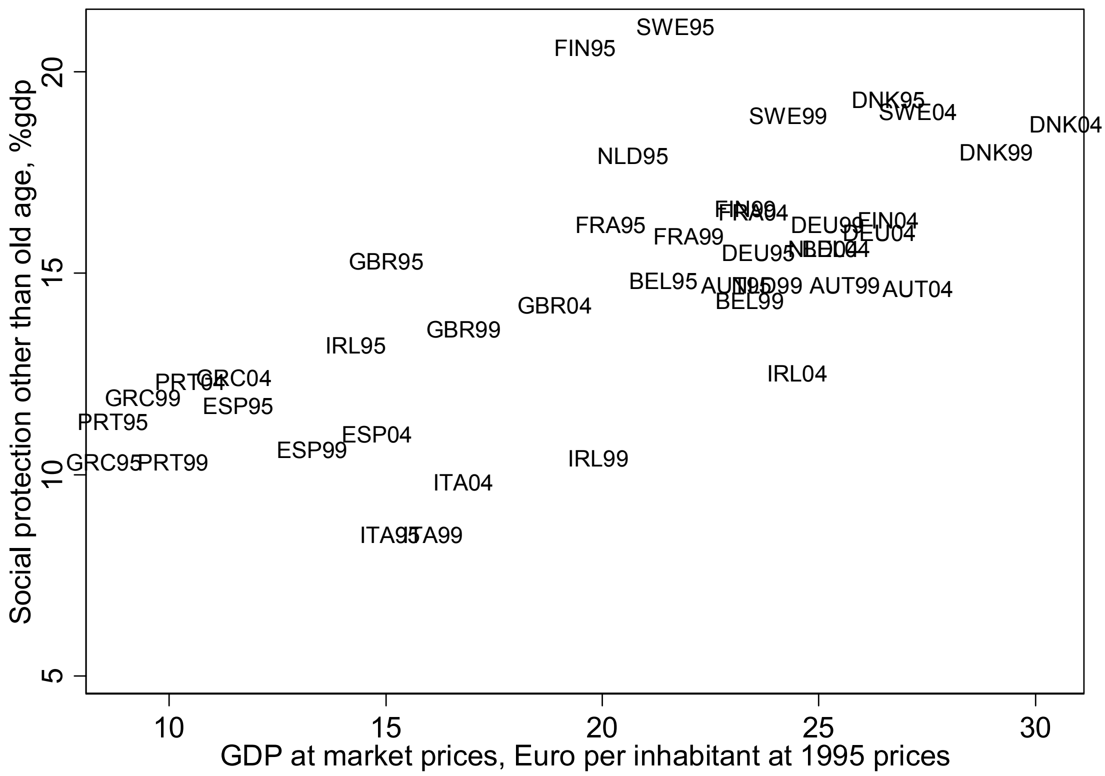

Figure 5 -Per capita GDP in constant 1995 euro and public social protection expenditure (ESSPROS definition, excluding old-age pensions) as a percentage of GDP; EU15 countries (except Luxembourg), 1995, 1999, 2004. *Source: Eurostat.*

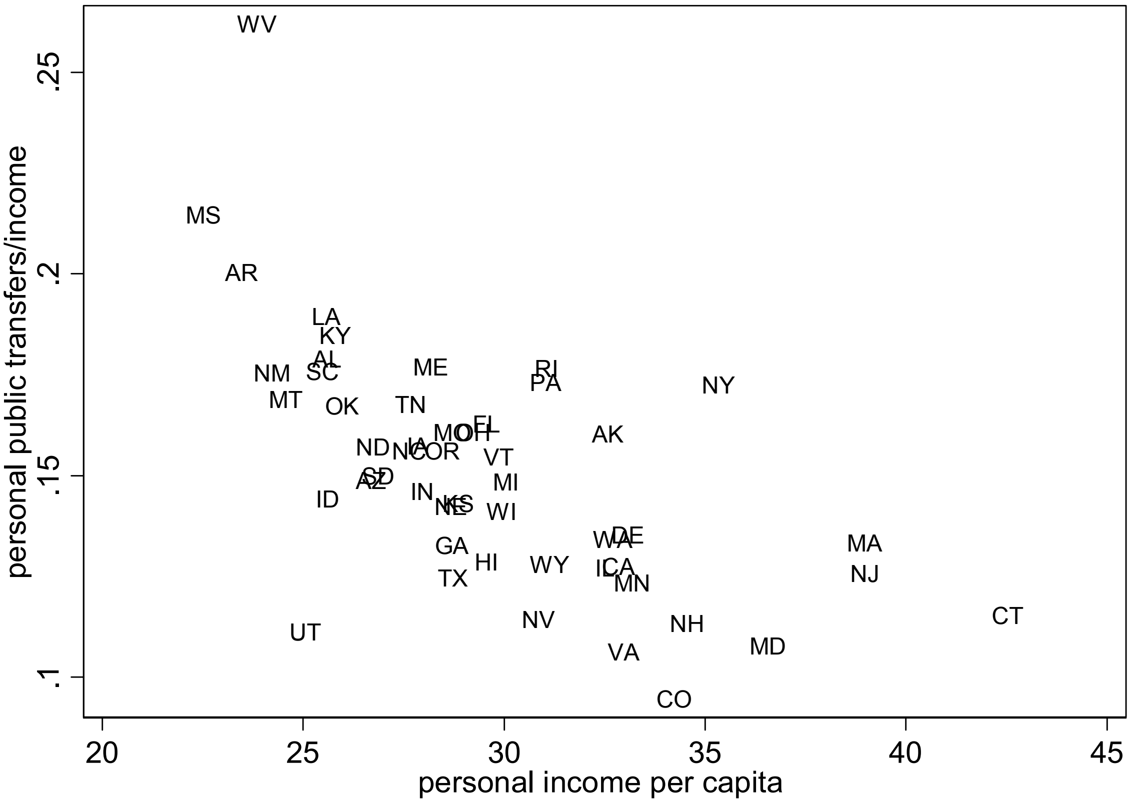

Figure 6 - Personal income in current dollars and Federal+State+local transfers to persons as a fraction of personal income; States of the US, 2002. *Source: Bureau of Economic Analysis.*

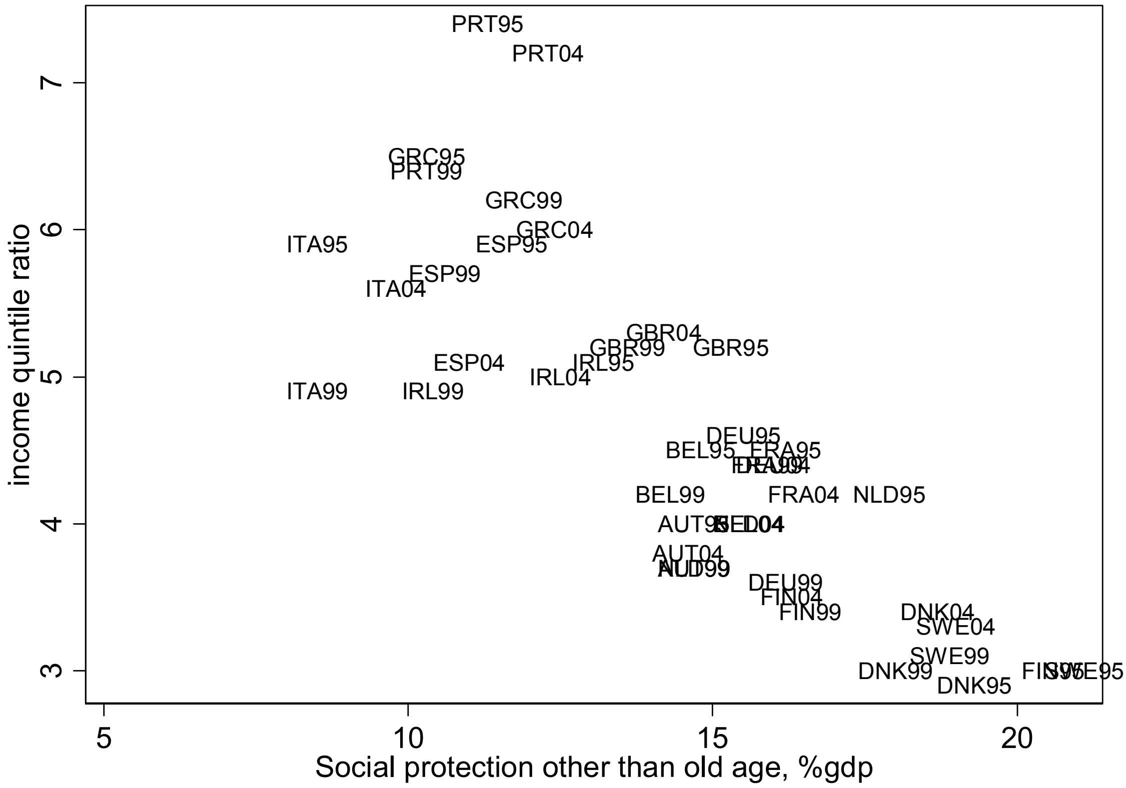

Figure 7 - Social protection expenditure (ESSPROS definition, excluding old-age and survivors pensions) as a percentage of GDP in 1995, 1999, 2004, and contemporaneous income quartile ratio as in Figure 2. *Source: Eurostat.*

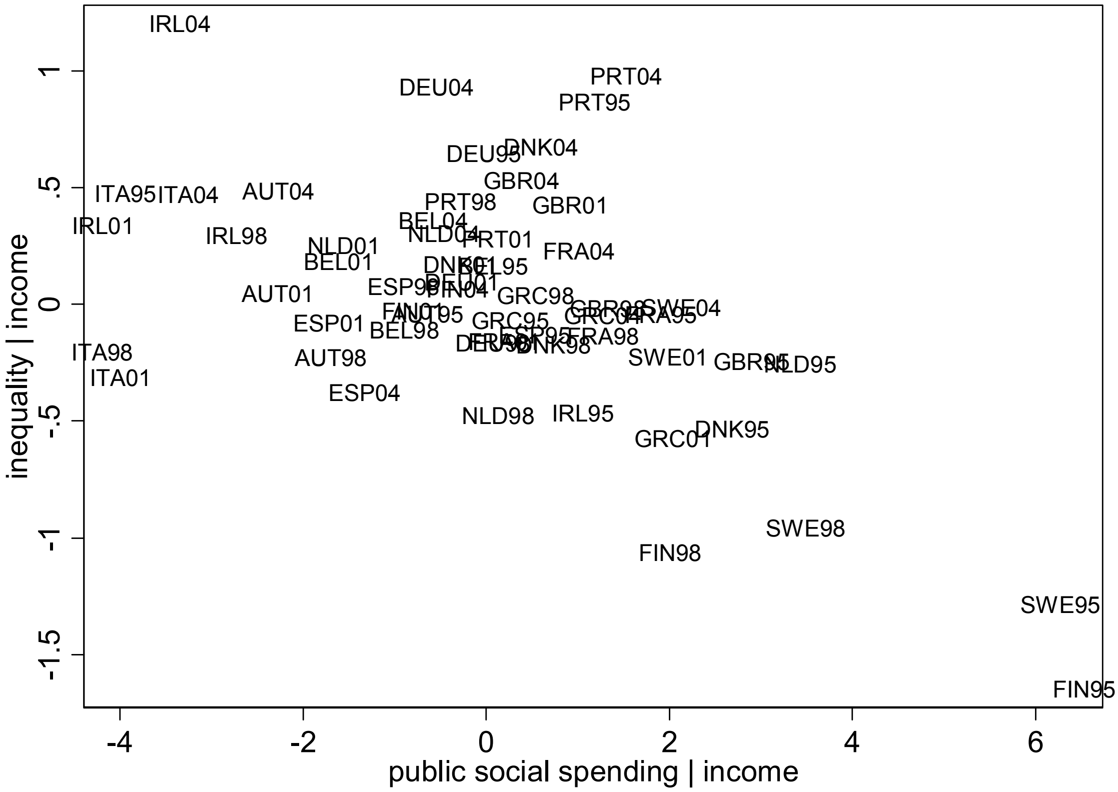

Figure 8 - Residuals from regressions of public social protection expenditure (as in Figures 5 and 7) and of income quintile ratios (as in Figures 4 and 6) on a constant and per capita GDP (as in Figures 4 and 5). The regression is run on 1995-2005 annual data, but only 1995, 1998, 2001, 2004 residuals are plotted to reduce clutter.

Table 1: Summary statistics.

	Mean	Std. Dev.	Min	Max
GDPp.c.	20.4	6.11	8.5	31.6
Unemp.	7.9	3.10	2.2	18.4
Ineq.	4.6	1.17	2.9	8.2
Pop.	27.0	26.01	3.6	82.5

Variable definitions:

GDPp.c.: GDP at market prices, Euro thousands per inhabitant at 1995 prices.

Unemp.: Harmonized unemployment rates, -/+ 25 years, yearly averages, in percentage points.

Ineq.: Inequality of income distribution, "income quintile share ratio: The ratio of total income received by the 20 % of the population with the highest income (top quintile) to that received by the 20 % of the population with the lowest income (lowest quintile). Income must be understood as equivalised disposable income." Missing values are interpolated for the purpose of computing these statistics.

Pop.: total population as of Jan 1st, millions.

Sample: 1995-2005 annual data for Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Netherlands, Portugal, Sweden.

Source: Eurostat.

Table 2: Growth, unemployment, integration and EMU.

					Economic integration		
	GDPp.c.	Unemp.	GDPp.c.	Unemp.	Goods	Services	FDI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pop.					-0.22	-0.11	-0.03
					-2.43	*-2.70*	*-2.06*
EMU	3.42	-2.44	7.91	-1.10	5.89	2.86	2.16
	4.88	***-4.16***	***4.73***	***-2.07***	***2.37***	***1.95***	***3.77***
EMU0	-6.35	3.78			0.87	-1.16	-2.51
	-1.80	***3.30***			***0.19***	***-0.87***	***-3.14***
Constant	23.72	6.07			31.81	12.03	6.20
	7.89	***13.08***			***12.55***	***8.94***	***9.91***
BEL			18.65	9.08			
DEU			20.33	9.15			
DNK			29.26	5.22			
ESP			8.49	13.77			
FIN			18.70	11.47			
FRA			17.13	10.77			
GBR			17.18	5.91			
GRC			6.35	10.83			
IRL			15.47	7.36			
ITA			11.19	10.50			
NLD			18.60	4.82			
PRT			4.93	6.57			
SWE			24.73	7.08			
N	154	154	154	154	147	147	133
r2	0.14	0.21	0.92	0.95	0.26	0.31	0.11

Robust t statistics (accounting for country clustering when no fixed effects are included) in italics below the slope coefficients.

Variable definitions (in addition to those given in Table 1):

Economic integration, Goods: imports plus exports of goods in percent of GDP;
Economic integration, Services: imports plus exports of services in percent of GDP;
Economic integration, FDI: inward plus outward foreign direct investment flows in percent of GDP.
EMU0: dummy, equal to unity for Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal.
EMU: dummy, equal to unity in 1999-2005 for Austria, Belgium, Germany, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal, and in 2001-2005 for Greece.
The specification of columns (3) and (4) include a full set of country-specific dummies.

Sample: as in Table 1, except: no economic integration data for Belgium are available before 2000 (the results are very similar if all Belgium observations are omitted). Some other observations of FDI flows are also missing: Denmark in 2004, Greece in 1995-99 and 2002-05, and Sweden in 2000 and 2002.

Source: Eurostat.

Table 3: Inequality and EMU.

	Ineq. (1)	Ineq. (2)	Ineq. (3)	Ineq. (4)	wage s. (5)	Ineq. (6)	Ineq. (7)
Unemp.	-0.08	-0.09	-0.07	-0.08	-0.20	-0.08	-0.07
	-2.74	***-2.60***	***-2.93***	***-2.84***	***-0.66***	***-2.15***	***-2.29***
Pop.	0.00	0.00	0.00	0.00	0.04	0.00	0.00
	1.71	***1.91***	***1.13***	***1.48***	***1.37***	***2.30***	***2.25***
GDPp.c.	-0.19	-0.19	-0.20	-0.19	0.59	-0.18	-0.19
	-15.48	***-15.62***	***-16.26***	***-15.96***	***3.27***	***-15.48***	***-19.61***
wage s.						0.00	0.01
						0.39	***1.26***
EMU	0.28	0.20	0.08	-0.01	-2.71	0.14	-0.06
	2.40	***1.47***	***0.74***	***-0.11***	***-2.52***	***1.18***	***-0.44***
EMU0		0.18		0.19	-4.80	0.24	0.30
		0.79		***1.07***	***-1.82***	***0.89***	***1.37***
IneqDef			0.56	0.59			0.58
			4.91	***5.32***			***5.60***
N	154	154	133	133	147	147	126
r2	0.85	0.85	0.89	0.90	0.66	0.84	0.89

Robust t statistics accounting for country clustering in italics below the slope coefficients.
All regressions include a constant.
Variable definitions (in addition to those given in Table 1 and Table 2):

IneqDef: dummy, equal to zero for country and periods when Eurostat makes available the ECHP-based inequality measure, to one for country and periods when the EU-SILK measure is available, and missing (thus eliminating interpolated values and reducing the number of observations) when neither is available.

Wage s.: Gross wages and salaries, percent of GDP.

Sample: as in Table 1, however Wage share is not available for Portugal between 1999 and 2005.
Source: Eurostat.

Table 4: Inequality, public social expenditure, and EMU.

	Ineq. (1)	Ineq. (2)	Ineq. (3)	Ineq. (4)	Ineq. (5)	Ineq. (6)
GDPp.c.	-0.13	-0.14	-0.16	-0.15	-0.15	-0.17
	-5.97	***-5.68***	***-7.05***	***-6.97***	***-6.27***	***-8.49***
Unemp.			-0.07			-0.06
			-2.36			***-2.90***
Pop.			0.00			0.00
			1.73			***1.48***
EMU		0.18	0.08		0.08	-0.03
		1.49	***0.71***		***0.64***	***-0.24***
EMU0		-0.18	0.05		-0.16	0.08
		-0.87	***0.26***		***-0.98***	***0.53***
P.social exp.	-0.12	-0.12	-0.08	-0.09	-0.09	-0.07
	-2.58	***-2.11***	***-1.89***	***-2.02***	***-1.82***	***-1.80***
P.social exp.				0.04	0.04	0.05
.*IneqDef				***1.00***	***1.01***	***1.47***
IneqDef				-0.07	-0.08	-0.22
				-0.11	***-0.13***	***-0.38***
	140	140	140	119	119	119
r2	0.86	0.86	0.88	0.90	0.90	0.92

Robust t statistics accounting for country clustering in italics below the slope coefficients.
All regressions include a constant.
Variable definitions (in addition to those given in Tables 1 and 2):
P.social exp.: Social protection expenditure, all ESSPROS classifications except “old age” and “survivors,” in percent of GDP.
Source: Eurostat.
Sample: as in Table 1, however social expenditure data are not available in 2005.

Table 5: Public social expenditure and EMU.

	P.social exp. (1)	P.social exp. (2)	P.social exp. (3)	P.social exp. (4)	P.social exp. (5)
GDPp.c.	0.37	0.40	0.37	0.41	0.43
	7.26	***6.90***	***5.90***	***8.42***	***6.64***
Unemp.		0.15	0.24		0.25
		1.20	***1.72***		***1.75***
pop		-0.01	-0.01		-0.02
		-0.72	***-0.85***		***-1.32***
EMU	-1.94	-1.78	-0.77	-1.80	-0.27
	-3.52	***-3.31***	***-1.73***	***-3.20***	***-0.77***
EMU0			-2.24		-2.75
			-2.47		***-3.01***
GovtBudg				-0.14	-0.27
				-1.25	***-3.98***
N	140	140	140	140	140
r2	0.62	0.64	0.63	0.68	0.72

Robust t statistics accounting for country clustering in italics below the slope coefficients.
All regressions include a constant.
Variable definitions (in addition to those given in previous tables):

GovtBudg: General government deficit(-) /surplus (+), % GDP (Maastricht criteria definition).

Source: Eurostat.

Dynamics of regional income inequality in Europe and impact of EU regional policy and EMU

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This paper analyzes the evolution of per capita income inequality among European regions during the 1977-2003 period. After examining the trend in inequality measured with conventional inequality indices, I consider two types of variation within the income distribution. First, interregional inequality is decomposed in its between-country and within-country components. Second, using a rank-size function, I check whether inequality varies with regions' ranks in the income distribution. Overall, inequality has decreased since 1977, owing to a decrease in between-country inequality, and despite an increase in within-country since the mid-1990s. Moreover, inequality has been greater among low-income regions than among high-income regions. I then examine whether the establishment of EMU, and changes in some demographic, macroeconomic, and policy-related factors help explain the aforementioned inequality variations. The panel analysis suggests that EMU has so far exacerbated regional inequality in richer EU countries, while it has not significantly affected regional disparities within poorer countries.

• *Keywords*: income inequality, European Union, EMU, regional disparities
• *JEL Codes*: R11, O52, E65

1 Introduction

Regional disparities and inequalities in Europe have been the object of extensive research over the last decade[1]. Several factors can explain this widespread interest. First, the revival of growth theory (Romer, 1990; Aghion and Howitt, 1998) was contemporaneous to a growing empirical literature on economic convergence (Sala-i-Martin, 2006; Barro and Sala-i-Martin, 1991, 1992, 1995; Quah, 1997, 1996; de la Fuente, 2000). Most of the empirical literature reports that, in Europe, the process of absolute convergence observed for decades has slowed down almost to an halt during the 1980s and early 1990s (Boldrin and Canova, 2001; Neven and Gouyette, 1995; Magrini, 1999) at a time when European economic integration was pursued further. Second, reducing regional disparities has been one of the most explicit and resolute goals of the European Union (EU)[2], which has consequently devoted an increasing share of its budget to its regional policy.

Concerns about the impact of economic integration on regional disparities have been revived by the establishment of the Single Market and of the Economic and Monetary Union (EMU). So far, most of the debate on the impact of the common currency has been focused on national economic conditions. Thus, the convergence criteria (price stability, low interest rate, stable exchange rates, and limited government debts and deficits) that countries need to satisfy in order to qualify for the common currency and the Cohesion Fund eligibility criteria[3] are based on national macroeconomic variables. Meanwhile, the possible impact of the euro on European regions has received much less attention, even though it is also very critical to guarantee the economic and social cohesion sought by the European Union (Martin, 2001; Thirlwall, 2000).

The current literature offers various and often conflicting models to explain

[1]Braunerhjelm et al. (2000); Puga (1999); Boldrin and Canova (2001); Basile et al. (2001); Neven and Gouyette (1995); Crespo-Cuaresma et al. (2002); Dunford (1993) among others.

[2] Article 158 of the Treaty establishing the European Community for instance states that “the Community shall aim at reducing disparities between levels of development of the various regions and the backwardness of the least favored regions or islands, including rural areas”.

[3] The Cohesion fund was established in 1994 to contribute to the fulfillment of the conditions of economic convergence as set out in Article 104c of the Treaty establishing the European Community. Countries qualify for the Cohesion funds when their per capita gross national products (GNP), measured in purchasing power parities, of less than 90 % of the Community average.

whether regional disparities will or will not disappear with further economic integration. Optimal Currency Area theory[4] considers that the adoption of a common currency brings both advantages and disadvantages. Lower transaction costs provide more price transparency and less exchange rate uncertainty, which ultimately promotes economic growth in the monetary union. But the absence of independent exchange rate and monetary policy would make it harder to tackle asymmetric shocks given the current lack of labor mobility across EU countries and regions. For proponents of neoclassical precepts, disparities are bound to disappear because of diminishing returns to capital. By promoting free movements of factors of production, further integration would lead to a more efficient resource allocation, and thus to economic growth. To contrast with this approach, contributions to the new economic geography theory argue that, by promoting trade and factor mobility, deeper economic integration will create new opportunities of economies of scale, activity specialization and economic agglomeration, which could generate regional disparities in growth and factor accumulation, and thus economic divergence (Krugman, 1991a, b).

On empirical grounds, the literature on the EMU has not yet eliminated these theoretical doubts. On the one hand, EMU is expected to bring more macroeconomic stability, notably in Southern EU countries, which could promote a more equal income distribution. But on the other hand, labor market rigidities, notably in Southern Europe, would make these countries more vulnerable to asymmetric shocks (Ardy et al., 2002; Barry and Begg, 2003; Barry, 2003; Begg, 2003). Padoa-Schioppa (1987) also concluded that the increased competition induced by further integration and improved price transparency could put more pressure on the less developed member states, which could ultimately lead to more inequalities. Yet, the loss of competition could internally induce a reduction in regional disparities in those countries, as only the more advanced regions in the country compete on the international market (Petrakos and Saratis, 2000).

To assess the impact of EMU on regional cohesion, this paper first investigates the dynamics of regional income inequality among 197 European regions between 1977 and 2003. The empirical analysis focuses on per capital income distribution as opposed to personal income distribution, because the former is a more appropriate scale to examine

[4] Kenen (1969); Mundell (1961); McKinnon (1962); Mongeli (2002).

the effects of economic integration (such as EMU) on income disparities. The overall level of systemic inequality is measured with indices commonly used to study personal income disparities (Atkinson, 2003; Partridge et al., 1996; Beblo and Knaus, 2001; Heshmati, 2004) but, until recently, rarely employed to assess regional per capita income distribution. This method does not however detect whether inequality is greater among some subgroups of regions, and smaller among other ones. To address this issue, the dynamics of per capita income distribution are studied in two complementary ways. First, I check whether within or between-country inequalities drive inequality across European regions. Using a rank-size function, I then follow Fan and Casetti (1994)'s approach and examine the extent to which inequality varies with a region's rank within the income distribution.

Finally, the role played by EMU in shaping interregional income inequality within EU countries is more specifically assessed with a panel data analysis that relates inequality measures to national demographic, macroeconomic and policy characteristics.

The paper is organized as follows. Section 2 discusses the data and methodology used to measure interregional inequality. Section 3 presents the evolution of interregional inequality. Section 4 looks at variation in inequality between and within countries, as well as variation within the income distribution. The panel analysis of the determinants of inequality is carried out in section 5. Finally, section 6 summarizes the main conclusions.

2 Data and methodology

I examine the distribution of per capita income across EU regions between 1977 and 2003. Inequality measures are calculated for 197 NUTS 2[5] regions from the following 13 EU countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden, and the UK. Ireland and Luxembourg are not included because each one was categorized as one region in the nomenclature; thus it is impossible to calculate within-country inequality. All of the countries are included in the analysis from 1977 to 2003, regardless of when they joined

[5]NUTS (Nomenclature of Territorial Units for Statistics) corresponds to Eurostat's classification of subnational spatial units where NUTS 0 refers to country level data and increasing numbers indicate increasing levels of subnational disaggregation.

the EU. Like Ezcurra, I exclude the region of Groningen in the Netherlands, because a change in the Dutch national accounting method in the mid-1980s creates an artificial jump in the inequality measures[6]. I also exclude Eastern Länder in Germany in order to keep the sample of regions constant. The possible impact of these Länder on inequality is discussed in the next section.

The GDP data are compiled by Cambridge Econometrics which provides a balanced panel of European regional data. The GDP variable is expressed in Purchasing Power Parity (PPP) because market exchange rate do not account for differences in relative prices across countries. Each region' s PPP per capita GDP has been scaled relative to EU15 average PPP per capita income. I also use time series instead of random years because the latter might not be representative of the overall evolution of inequality in Europe.

3 Inequality dynamics: 1977-2003

3.1 Trend in overall inequality

There is a great variety of measures available to income inequality scholars, and the choice of a measure is always tricky because each measure has its merits and shortcomings. Scholars yet agree on a set of axioms that an inequality measure should fulfill: the Pigou-Dalton transfer principle, income scale dependence, the principle of population, and the symmetry principle (see Appendix A for more details.) The Gini Index, the General Entropy measure with parameter 1 (GE(1), also referred as income-weighted Theil index), and the General Entropy measure with parameter 0 (GE(0), also referred as population-weighted Theil index) satisfy these four axioms and are thus used in this paper to assess the level of inequality among EU regions. Moreover, because decomposability is an important component of this paper's analysis, and is more easily done for General Entropy indices, the analysis will focus on GE(1) and GE(0) indices. I use the Gini index to verify the robustness of my results. The formulas used to compute these measures are reported in Appendix B.

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[6]Before the reform, the revenue from gas and oil of the North Sea were allocated to the region of

Figure 1 illustrates the temporal patterns of the aforementioned inequality indices. All of the indices show a remarkably similar EU-wide inequality trend. Overall, inequality has decreased between 1977 and 2003. The Generalized Entropy measures fell by 21% while the Gini index decreased by 10% over the same 26 years. The larger decrease in the GE(0) measure which is more sensitive to changes at the bottom of the income distribution, provides evidence that less-favored regions have partly caught up with richer regions. This fall in inequality is confirmed by time plots (figure 2) of the coefficient of variation (COV) and of the standard deviation of the logs (SDL) which are commonly used to measure σ-convergence (the dispersion of per capita income). These results are very close to the findings of Duro, despite slight differences in the number of regions included in the analysis[7].

Several phases can be discerned within the 26 years covered in this study. After a sharp fall in inequality between 1979 and 1982, the mid 1980s were marked by an increase in regional disparities. This increase suggests that inequality shows a countercyclical pattern[8]. After a short fall between 1986 and 1989, inequality rose again in the early 1990s (as European economies were heading towards the 1993 recession), and dramatically dropped between 1992 and 1993. Since then, regional disparities have kept a downward trajectory, and have experienced a much smaller variation than in the 1980s. One should also note that the smoother trend begins in 1993, which coincides with the ratification of the Maastricht Treaty and stage two of EMU.

To make more sense out of these statistics, the EU inequality measures need to be compared to some benchmark so that one can determined whether inequality among EU regions has been high or low. One possible gauge is the United States (U.S.) which have similar economic and population sizes. Moreover, since the U.S. constitute a more integrated economy than the EU, it could be used to predict future trend in regional inequality in Europe. Inequality has been consistently wider among European regions than among U.S. states. In 1989 for instance, Fan and Casetti (1994) estimate that the Shannon entropy index (similar to the GE(1) index) reached 0.0238. The GE(1) index

Groningen, while afterwards, the revenues were distributed to the whole country.

[7]Duro (2004) includes German Eastern Länder after 1991 and Austria, Finland and Sweden from 1995 to 1997.

[8]See Artis et al. (1997) for European business cycle peaks and troughs.

computed for EU regions was 0.0393 in 1989. In the same year, Ram (1992) found that the GE(0) index among U.S. states was equal to 0.012, which corresponds to one third of the European GE(0) index plotted in figure 1. Similarly, Boldrin and Canova (2001) find that European regional inequalities are twice those of the U.S. when measured either by the standard deviation of per capita income or the ratio of the top to bottom decile of regions. So if one accepts the U.S. as a reference point, regional disparities in Europe should be viewed as quite wide.

Besides differences in level, the EU and the U.S. have experienced different trends. Fan and Casetti (1994) find that inequality in the U.S. decreased between 1950 and 1975 and then increased from 1975 and 1989. More recently, Tsionas (2000) finds that, between 1977 and 1996, there was no sigma-convergence among U.S. states. The absence of reduction in disparities across U.S. states in the 1990s thus contrasts with the downward trend observed in Europe.

So far, the analysis provides a general overview of inequality among EU regions but does not offer any insights about disparities that could exist among or within countries. This issue is addressed in Section 3.2 which compares national inequality levels and trends.

3.2 National inequality trends

3.2.1 Comparison of the level of inequality in EU countries

The next three figures plot the evolution of three main inequality measures by country. Figure 3 presents the GE(1) index by country, figure 4 the GE(0) index, and figure 5 the Gini index. Levels of inequality vary significantly from one country to another. Belgium emerges as the country that has consistently experienced the highest levels of inequality[9]. Denmark and France have the lowest levels of inequality. These two facts support the conclusion of Felsentein and Portnov (2005) that it is incorrect to assume that small countries exhibit smaller regional disparities. Sweden is the only country where the level of inequality varies significantly with the inequality measure.

[9] This is partly explained by the large number of workers who commute to Brussels from neighboring Flanders and Wallony.

Sweden would be considered a low-inequality country based on the Gini and GE(1) indices, but a high-inequality country according to its GE(0) index, which suggests that inequality exists mostly in the low tail of the income distribution.

Countries can also be distinguished by the range their inequality measures take. Austria, Greece, the Netherlands and Portugal have experienced wider ranges of inequality levels, while inequality has been more stable in France, Denmark, Spain, and Germany. It is important to keep in mind that the inequality measures presented for Germany do not include Eastern Länder. The estimations in Duro (2004) confirm that inequality increases sharply once these German regions are added to the population of regions. He finds that, one year after the 1990 reunification, the GE(0) index had increased by 45%, the GE(1) index had increased by 36.6%, and the Gini index rose by 10%. Yet the author notes that, soon after the German reunification, inequality fell sharply in the early 1990s. Because Cambridge Econometrics database does not include PPP per capita income for these regions prior to 1997, I am not able to replicate Duro's finding. Yet, I do obtain that, for 1997 to 2003 inequality measures (EU-wide measures and German measures) rise if Eastern Länder are included, but only by a small percentage (less than 2% after 1998). Given the data limitation and the small percentage change aforementioned, excluding these 12 Eastern German regions should not affect the robustness of this paper's conclusions.

3.2.2 Trends in each EU countries

To get a better sense of the evolution of national income inequality, figure 6 illustrate the same inequality estimates from a different perspective, by plotting inequality measures for each country against time. Countries have experienced trends very different from the one depicted in figure 1, and can be classified in five categories: those who experienced (1)a decrease in inequality, (2)an increase in inequality, (3)a U-shaped trend, (4)an inverted U-shaped trend, and (5)no clear trend. Because all of the inequality measures depict the same trend in each country, the following comments and statistics are based only on the GE(1) index.

Four countries have experienced significant decrease in inequality over the last three decades: Austria (decrease by 60%), Greece (decrease by 65%), Portugal (decrease by 40%) and Italy (decrease by 15%). The fall in inequality was steeper in Austria and Italy in the 1980s. In Greece, the sharp drop in inequality occurs with the early 1980s, which coincides with its accession to the EU and with a major increase in government spending on welfare policies (Manessiotis and Reischauer, 2001). Inequality fell in Portugal at a relative constant pace between 1977 and 1995, before slightly increasing between 1995 and 1998. Regional disparities in Germany, Sweden and the United Kingdom have on the other hand widened. The GE(1) index grew by 22% in Germany (with and without the Eastern Länder), by 34% in the UK, and by 561% in Sweden. This dramatic surge in Swedish inequality happened mostly after 1995. Inequality in the next three countries has displayed a non-linear trend. Inequality in France is characterized by an inverted U-shaped trend, as it leveled off at higher levels between 1985 and 1995. The trends in Finland and the Netherlands have the opposite shape, as inequality decreased sharply in the early 1980s, and increased again in the late 1990s. One should also note that the recent increase was more pronounced in Finland. Finally, Denmark, Belgium and Spain have not experienced any clear trend in their inequality levels. Regional disparities were stable in Denmark until 1988, and then increased until the mid-1990s before returning to their initial levels. Inequality among Spanish provinces peaked in 1981-1983, before sharply falling between 1985 and 1995, and have since slightly increased. Regional disparities have remained high and stable in Belgium.

4 Inequality variations

The conventional inequality measures used in Section 3 capture the overall spread of per capita income distribution, but do not provide any insight about variation within the distribution. In addition to variation across countries and over time, inequality among European regions can be further analyzed with two complementary approaches. First, one can distinguish inequality within and between-countries. Second, I check whether inequality is homogenous throughout the income distribution or whether it varies with a region's ranking.

4.1 Inequality decomposition

The decomposition of inequality is carried out using the GE(1) index because, like the other Generalized Entropy measures, it is conform to five key axioms (presented in Appendix A) that one usually requires inequality measures to meet (Cowell, 2000; Bouguignon, 1979; López-Rodríguez and Faiña, 2006; Litchfield, 1999). The Generalized Entropy class of measures can easily be decomposed into within-group and between-group inequality: $I_{total} = I_{between} + I_{within}$. The decomposition is based on GE(1) instead of the GE(0), because the latter attributes more weight to the bottom of the distribution (i.e. to the poorer regions), while the former applies equal weight across the distribution. I checked the robustness of the results presented in this section by performing the same analysis with the GE(0) index, and the results were very similar.

Figure 7 represents the evolution of the overall GE(1) index and its between and within components over time. It clearly appears that the level of overall inequality is mostly due to within inequality. As indicated in figure 8, within-country inequality accounted for 60% of overall inequality until 1995[10]. Its share in total inequality then started to increase until it reached 70% by 2003. Yet, it is the between-country inequality that explains the variation in overall inequality. It is clear, for instance, on figure 7 that the increase in inequality in the early 1990s was due to a rise in between-country inequality. Moreover, since 1995, the decrease in between-country inequality was large enough to offset the slight increase in within-country inequality, and to cause a decrease in overall inequality. This reduction in inequality between EU countries has been mostly driven by the success of Cohesion countries (Spain, Portugal, Ireland and to a lesser extent Greece) at converging with the rest of the EU (European Commission, 2001).

Even though U.S. inequality has followed a different trend, its decomposition into between and within inequalities suggests a pattern similar to European inequality decomposition. Most of the inequality among U.S. states also comes from within-group inequality. When the 49 contiguous U.S. states are grouped into four regions, the share of

[10]Because this increase in within-country inequality started in 1995, and coincides with the increase in inequality among Swedish regions, I checked whether the trend of the within component could have been driven by the evolution of domestic inequality in Sweden. When the decomposition is estimated without

within-group inequality oscillates between 73% and 87.5% from 1950 to 1989 (Fan and Casetti, 1994).

4.2 Does inequality varies with a region's rank in the income distribution?

The decomposition performed in the previous section suggests that inequality between countries is much lower than among regions from the same country. Besides checking variation of inequality with the size of the geographic units (countries or regions) considered, inequality could also vary among groups of regions depending on these regions' positions in the income distribution.

I use a rank-size function to obtain an additional inequality measure, namely the power-law exponent. This technique is usually applied in urban economics where cities are ranked according to their populations in order to assess the level of urban concentration[11]. In the context of this paper, a region's size is captured by its PPP per capita income. The rank-size function describes the relation between a region's per capita income and its ranking when regions are ordered in descending order (i.e. the wealthiest region in the sample has a rank equal to one and the least favored a rank equal to 197). To obtain the power-law exponent, I regress logged per capita income (y) on logged rank[12]:

$$\ln y = a + q \ln rank. \tag{1}$$

The absolute value of the slope (q) is referred as power law exponent, and corresponds to a measure of inequality: the higher the absolute value of q the more unequal the income distribution across regions.

This rank-size function provides only a measure of the overall systemic inequality, because it assumes that inequality between all of the regions follows the same law. If inequality was similar throughout the income distribution, points on the scatterplot would form a straight line, with a slope equal to the power law exponent. Yet, when logged regional PPP per capita incomes are plotted against logged ranks (figure 9), the

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Sweden, the increase in the late 1990s persists.

[11]Midelfart et al. (2003); Krugman (1996); Nitsche (2005); Gabaix (1999); Brakman et al. (1999).

slope (i.e. the power-law exponent) tends to be steeper at lower ranks (ranks between 110 and 197 for this paper). This implies that, like for U.S. states (Fan and Casetti, 1994), inequality is higher among low-income regions than among high-income regions.

This non-linearity can be further studied by expanding the rank-size equation. Fan and Casetti (1994) suggest making the slope a function of the rank or the rank squared, so that the rank-size specification can be rewritten as:

$$\ln y = a + q_0 \ln rank + q_1 rank * \ln rank \tag{2}$$

$$\ln y = a + q_0 \ln rank + q_1 rank^2 * \ln rank \tag{3}$$

In both specifications, a negative and significant coefficient q_1 implies that, as the rank gets larger, inequality increases with the rank. As reported in table 1, inequality does increase with the rank, but this effect has decreased over time, with the exception of the second half of the 1990s. Both sets of estimates for q_1 are smaller in absolute value than those obtained by Fan and Casetti (1994) for U.S. states, which suggests that the disparities between high-income regions and low-income regions are more acute in Europe than in the U.S.

The findings presented in Section 4 have strong policy implications. First, the predominance of within-country inequality over between-country inequality suggests that structural policies designed to reduce economic and social disparities within the EU should be elaborated at the regional level, and not at the national level. Moreover, given that more inequality exists among the least favored European regions, funding should be extensively concentrated on regions at the bottom of the income distribution. These two conclusions call into question the current set-up of EU regional policy. Beyond its apparent desire to reduce interregional income inequalities, EU aid is not perfectly correlated with regional development gap or development potential (Fayolle and Lecuyer, 2000). Only objective-1 funds (which represented 70% of the funds allocated to the Structural Funds program between 1989 and 1999) are truly devoted to the poorest

[12] The associated R-squared range from 0.800 to 0.8517.

regions, those of which per capita GDP is below 75% of the EU average[13]. To further discuss the efficacy of the current EU regional policy it would be also interesting to examine whether the Cohesion Fund[14] received by Spain, Portugal, Greece and Ireland, has induced the reduction in between-country inequality, since its creation coincides with the recent downward trend in between-country inequality.

5 EMU and inequality: A panel analysis

In this section, the analysis goes beyond the description of variation in income inequality over time and across countries, and examines possible explanations for the evolution described in sections 3 and 4. More specifically, I check whether EMU has contributed to the recent decrease in inequality. So far, there is no consensus in the literature about the possible effect of monetary union on inequality and cohesion within the EU (Barry and Begg, 2003; Begg, 2003). On the one hand, further economic expansion is thought to favor core countries at the expense of the periphery because, according to the new economic geography[15], economic activity would tend to concentrate further in core regions and countries. Moreover, by inducing deeper industrial specialization, EMU might increase the risk of asymmetric shocks (Midelfart et al., 2003; Ardy et al., 2002). Yet Begg (2003) notes that, so far, the core countries have suffered from the advent of the euro, and have experienced slower growth than countries at the EU periphery. On the other hand, Ardy et al. (2002); Begg (2003) argue that EMU could lead to more cohesion (i.e. less inequality) because it will promote macroeconomic stability in countries that had previously poor inflation records, such as Greece and Portugal. These countries might however be penalized by the lack of flexibility of their labor markets (Ardy et al., 2002; Barry and Begg, 2003; Begg, 2003), which would make them more vulnerable to asymmetric shocks. Barry and Begg (2003) conclude that the effects of

[13] Objectives 2 and 3 concern aid for industry-restructuring that affects mostly regions that were formerly prosperous, while the remaining objectives target “social cohesion”.

[14] According to regulation No 1164/94 of 16 May 1994, a Member State is eligible for Cohesion Fund if it has a per capita gross national product (GNP), measured in purchasing power parities, of less than 90 % of the Community average.

[15] Fujita et al. (1999); Martin (2002); Brülhart and Tortensson (1996); Puga (1999).

EMU will be more pronounced in countries that to change the most in order to participate in EMU.

The explanatory variables considered fall into four broad categories: demographics, macroeconomic stability, institution/policy, and EU integration. The first three groups of explanatory variables have been commonly used in papers studying the determinants of personal income distribution (Gustafson and Johansson, 1999; Halsag and Taylor, 1993; Bourguignon and Morrisson, 1998; Breen and Garcia-Peñalosa, 2005). Because these demographic variables affect the regional per capita income level rather than the distribution of per capita income among regions, larger disparities in these regional demographic features exacerbate income inequality across regions. Thus, instead of using the level of these variables as independent variables, I use their standard deviations measured annually among regions from the same country. Larger standard deviations in regional demographic characteristics are expected to be positively related to interregional per capita income inequality. The demographic variables are the percentage of the regional population that less than 15 year-old and between 65 and 69 year-old[16], the female economic activity rate, the regional unemployment rate, the share of employment in agriculture, the share of employment in the manufacturing sector.

Income is likely to be less equally distributed among people over 65 year old because pension payments are most of the time earning-related, and thus reflect cumulated unequal earnings (Beblo and Knaus, 2001). On the other end of the age distribution, a larger share of regional population below 15 year-old would tend to decrease per capita income as this population is not involved in productive activities. Given that women are more likely to experience breaks in their professional careers, and to occupy part-time positions (i.e. lower wage), a higher female economic activity rate would result on lower average per capita income (Thurow, 1987). Yet, some authors argue that income inequality might fall with higher female economic activity rate as women's wage earnings may result in more middle-income households (Cancian and Danziger, 1993). Regarding unemployment, higher unemployment rates are usually associated with more people in the lower tail of personal income distribution, and thus

[16]Eurostat does not have regional data sets for the population over 65 year-old except for Austria, Greece and Sweden.

with lower per capita income (Levernier et al., 1995). Manufacturing sectors are usually associated with better salaries and more job security than services jobs (Gustafson and Johansson, 1999; Grubb, 1989). On the other hand, the agricultural sector is usually characterized by lower productivity and lower wages.

In Section 3, plots of inequality measures suggest that inequality usually rises during economic downturns. Business cycles tend indeed to be associated with reversal in inequality trends (Sala-i-Martin, 2006; Gramlich, 1974). Thus, following Blinder and Esaki (1978), and Breen and Garcia-Peñalosa (2005), I include some controls for macroeconomic stability, namely the growth rate of real GDP and the inflation rate. I use social transfers as a percentage of GDP (Gustafson and Johansson, 1999; Beblo and Knaus, 2001) and the union density (Freeman, 2000) as policy variables. The aforementioned macroeconomic and policy variables are all measured at the national level.

The effect of EMU on inequality is first captured by a dummy variable that is equal to 1 when a country has adopted the common currency[17] and zero otherwise. Yet, the economic dimension of EMU coincided with the 1993-1998 Stage two (creation of a Single market and implementation of the convergence criteria[18]). I therefore include one

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[17] 1999 for Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain, and 2001 for Greece.

[18] The four main criteria are based on Article 121(1) of the European Community Treaty.

• Price stability. In practice, the inflation rate of a given Member State must not exceed by more than 1.5 percentage points that of the three best-performing Member States in terms of price stability during the year preceding the examination of the situation in that Member State.

• Government finances. In practice, the Commission, when drawing up its annual recommendation to the Council of Finance Ministers, examines compliance with budgetary discipline on the basis of the following two criteria:

- the annual government deficit: the ratio of the annual government deficit to gross domestic product (GDP) must not exceed 3% at the end of the preceding financial year.
- government debt: the ratio of gross government debt to GDP must not exceed 60% at the end of the preceding financial year.

• Exchange Rates. The Member State must have participated in the exchange-rate mechanism of the European monetary system without any break during the two years preceding the examination of the situation and without severe tensions. In addition, it must not have devalued its currency (i.e. the bilateral central rate for its currency against any other Member State's currency) on its own initiative during the same period.

• Long-term interest rates. In practice, the nominal long-term interest rate must not exceed by more than 2 percentage points that of, at most, the three best-performing Member States in terms of price stability.

dummy variable ($Maastricht$) that takes a value of 1 from 1993 to 2003 (and 0 otherwise), to capture the effect of the Treaty of the European Union which entered into force in 1993 and started the negotiations on a monetary union. I also add a dummy variable to capture the effect of the Stability and Growth Pact (SGP) that was adopted in 1997 to ensure that countries would keep respecting the convergence criteria before and after adopting the common currency. This variable takes a value equal to 1 for 1997 and the subsequent years, and 0 prior to 1997. Finally, to distinguish the effects of EMU from those of EU trade integration, I proxy the latter with the share of intra-EU trade ($EUtrade$) in total trade:

$$Intra-EUtrade_{i,t} = \frac{X_{i,t}^{EU} + M_{i,t}^{EU}}{X_{i,t} + M_{i,t}} \tag{4}$$

where trade is measured as the sum of exports (X) and imports (M).

To determine whether changes in these variables can be used to predict changes in inequality, inequality is estimated as a function of the contemporaneous values of the explanatory variables. I also control for intertemporal changes in the effects of EU integration on inequality by interacting the EU variables with a time trend. Given the large number of regressors the analysis includes, I cannot run the similar estimation with a time series of overall inequality in the EU for lack of degrees of freedom. The equation to be estimated is:

$$inequality_{i,t} = \mathbf{x}_{i,t}\boldsymbol{\beta} + \mathbf{z}_{i,t}\boldsymbol{\gamma} + \mathbf{w}_{i,t}\boldsymbol{\delta} + \alpha t_t + u_{i,t} \tag{5}$$

$x_{i,t}$ is a matrix of the standard deviations of the demographic variables described above, $z_{i,t}$ is a matrix of the national macroeconomic and policy related variables, and $w_{i,t}$ is a matrix of the EU variables and their interaction terms with the time trend.

The error term, $u_{i,t}$, is defined as: $u_{i,t} = \gamma_i + \varepsilon_{i,t}$ where γ_i is time-invariant and denotes any country-specific effect not included in the regression and $\varepsilon_{i,t}$ denotes the remainder disturbance. By assumption, $E(\varepsilon_{i,t}) = 0$ and $Var(\varepsilon_{i,t}) = \sigma^2$. The panel data is estimated with a fixed-effect model because the Hausman test rejects the hypothesis that country-specific effects, γ_i, are uncorrelated with the regressors. The data set I employ contains data from the same 13 countries but Denmark (too many missing data). The data set is unbalanced, with countries contributing different numbers of observations according to data availability.

The regression results are reported in table 2. Inequality is first measured as the GE(1) index (columns 1 and 2). I investigate the sensitivity of the results to the inequality measure used as the dependent variable, and estimate Equation (5) with the GE(0) index and the Gini index. The results are reported in columns 3 and 4 of table 2. For ease of presentation in the tables, the inequality indices used as dependent variables are multiplied by 100. The absence of a significant coefficient on the time trend confirms the heterogeneity in inequality variation discussed in Section 3.2.2. The results do not confirm the importance of demographic factors in explaining interregional disparities in per capita income. This is possibly due to the level of aggregation used in the paper. The negative and significant coefficient on the standard deviation in regional unemployment is contrary to the hypothesis that wider disparities in unemployment would lead to wider disparities in per capita income and thus to higher inequality. The strong correlation between this variable and country dummies for Spain, Finland and Italy reveal that this negative coefficient is actually driven by data from these three countries. Once I exclude these three outliers, the coefficient on the unemployment variable looses its significance.

Among macroeconomic factors, inequality across regions decreases only with price stability. A one percentage point decrease in the inflation rate is associated with a 0.03-point decrease in inequality, which corresponds to 1.2% of the average GE(1) index. GDP growth does not have a significant impact on inequality. As regards policy, large social transfers are associated with lower inequality. A one percentage point increase in the share of social transfers in GDP is related to a 0.8 % decrease in the GE(1) index (decrease by 0.01 point out of an average of 2.5). There is moreover only weak evidence that union membership reduces inequality, as union density is only negatively related to interregional inequality when the latter is measured with the GE(0) index.

As for the effect of EU integration, countries who have joined the EMU have experienced on average higher level of inequality. This result is robust to changes in the inequality measure used as dependent variable. The results from column 2 suggest that inequality has been 57% higher under EMU, holding every thing else constant. The magnitude of the effect is even larger when inequality is captured with the GE(0) and

Gini indices. However, this negative effect has diminished over time, as suggested by the negative coefficient on the interaction term between the EMU dummy variable and the time trend. The coefficient in column 2 suggests that the increase in inequality induced by EMU is decreasing at a rate of 0.06 point per year (i.e. 2.5% of the index average). Similarly, deeper trade integration has been associated with larger inequality, corroborating the new economic geography predictions and the fears raised by Padoa-Schioppa (1987). A one percentage-point increase in intra-EU trade is associated with an increase in the GE(1) index by 0.04 or 1.5%. But this effect has also diminished over time, at a rate of 0.05% each year. The implementation of the Maastricht Treaty and of the convergence criteria has coincided with a decrease in inequality, but the magnitude of the effect has diminished over time. Unlike EMU, the impact of the other stages of the monetary union are not robust to using a different inequality index.

Following the literature on the effect of EMU on interregional disparities[19] that generally emphasizes the effects of EMU on Cohesion countries, I run the same analysis on two sub-samples of countries[20]. The first group includes the three Cohesion countries included in this paper's sample: Greece, Spain and Portugal. The other sub-sample includes the other ten countries. Results are reported respectively in tables 3 and 4. While inflation is still positively correlated with inequality, the effects of the demographic and policy variables are not robust to a change in the inequality measure. Regarding EU integration, it has affected Cohesion countries very differently. First, EMU and intra-EU trade no longer affect interregional inequality. The implementation of the Maastricht Treaty is now associated with a significant decrease in inequality, but that effect has weakened with time. Inequality was on average 100% lower after 1992. However, the implementation of the Stability and Growth Pact has been associated with higher levels of inequality in Cohesion countries (108% higher). The transition to EMU has thus been more painful for these countries that were used to high levels of inflation. This finding corroborates Eichengreen's conclusions that, when the monetary regime operates as an engine of deflation, it significantly slows down growth, and that this effect can be

[19](Barry and Begg, 2003; Barry, 2003; Begg, 2003; Midelfart et al., 2003; Artis et al., 1997)

[20]An alternative analysis consists on adding a cohesion dummy variable and interactive terms with the EU variables. Because the results obtained with this specification were not significantly different, they are not reported.

particularly disadvantageous in poorer countries. The negative coefficient on the interaction term between the SGP dummy and the time trend however indicates that this negative effect has decreased over time, as the Cohesion countries were gaining macroeconomic stability. One way to reconcile the positive effect of the Maastricht variable and the negative coefficient on SGP is to consider that the ratification of the Treaty of Maastricht coincided with the creation of the Cohesion Fund. Thus, the Maastricht dummy variable might also capture the effect of this new instrument of EU regional policy.

Inequality in the other nine countries is driven by a distinct set of factors. As predicted, larger disparities in regional manufacturing employment are associated with more inequality. The negative and significant coefficients on the standard deviations in agriculture employment, female economic activity rate and unemployment rate are unexpected, but are not robust when I drop observations from two outlier countries: Italy and Finland. Larger social transfers are still associated with less inequality, and this result is more robust than for Cohesion countries. This could suggest that transfers affect inequality once they have reached a certain threshold. Between 1977 and 2003, Cohesion countries annually spent on average 13% of their GDP on social transfers (other than in kind), while this share was 18% among the other ten countries. Moreover, higher union membership is now associated with lower inequality levels: a one percentage point increase union membership is associated with a 0.02 point decrease in the GE(1) (or 0.8% of the average).

Overall, EU integration has been associated with higher inequality among this group of more developed countries. Joining EMU is associated with an increase in inequality, and the effect is stronger when inequality is measured with the GE(0) index (increase of 140% instead of 61% with the GE(1) index). This suggests that the effect of EMU is concentrated on the lower tail of the income distribution (i.e. on the least favored regions). This result corroborates Begg (2003)'s finding that so far it is the core of the EU that has suffered from the advent of the euro. Similarly, the implementation of the Treaty of the European Union has been associated with a rise in inequality, as indicated by the negative and statistically significant coefficient on the *Maastricht* variable. The adjustments for joining EMU seem therefore to have been costly in terms of cohesion, but these negative effects have diminished over time. Trade integration has also contributed, albeit modestly, to increasing inequality (a one percentage point increase in the share of intra-EU trade is associated with a rise in inequality by 0.06 or 2.5%). Moreover, unlike Cohesion countries, the implementation of the convergence criteria has been associated with lower inequality, and that effect has declined over time.

6 Conclusion

In this paper, I examine the evolution of per capita income inequality among and within EU countries, and the relative contributions of demographics, macroeconomic conditions and policy towards explaining this evolution. Overall, interregional inequality has significantly decreased between 1977 and 2003, but remains nonetheless high, at levels twice as high as those measured for U.S. states. Furthermore, movements in interregional inequality have varied significantly across countries. Inequality reduction has been quite sizable in Southern European countries, notably after their accession to the EU.

The breakdown of inequality into between-country and within-country components suggests that most of interregional inequality occurs within countries rather than between countries. Moreover, the importance of the within component has increased over time, notably since the mid-1990s. Between 1995 and 2003, the decrease in regional income inequality has been driven by a decreasing between-group component, while the within-group inequality was increasing. If the U.S. are taken as a benchmark for predicting the evolution of inequality in an increasingly integrated Europe, one should expect overall inequality and the share of within inequality to rise.

In addition to distinguishing inequality between countries from inequality within countries, I check whether the inequality faced by a region depends on its ranking in the regional income distribution. Using an expanded rank-size function, I find that there is more inequality among regions with lower ranks (i.e. with lower per capita incomes) than among richer regions. This finding would support a reform of the current EU and national regional policies. While the increase in within-country inequality suggests that structural policies should be elaborated at the regional level, and not at the national level, higher inequality among poorer regions suggests that funds should be further concentrated onto these regions. López-Rodríguez and Faiña (2006)'s findings support this recommendation. The authors indeed find that the between objective 1 and non-objective 1 component of the Theil index has decreased since the end of the 1987, which suggests that objective 1 regions have been catching up.

In the last section of the paper, I examine which factors cause within-country inequality to vary over time, and whether EMU has had any significant impact. While demographic variables are usually found to shape personal income inequality, they do not significantly influence interregional income disparities. Per capita income distribution is influenced by several policy-related and macroeconomic factors. Higher price instability is consistently correlated with higher inequality, whereas more generous social transfers are associated with lower inequality. Regarding EU integration, EMU and intra-EU trade are associated with wider regional disparities, but these effects have declined over time.

I also distinguish the effects of EMU on Cohesion countries from the effects on non-Cohesion countries, because the former faced deeper economic adjustments before they could adopt the common currency. These more radical adjustments probably explain why the implementation of the convergence criteria have been associated with higher inequality in Southern European countries which had to curb more macroeconomic instability before being allowed to adopt the euro. These adjustments were however worthwhile, since EMU has had no significant effect on inequality in Cohesion countries while it was associated with higher inequality in non-Cohesion countries. As for the earliest stage of the monetary union creation, inequality has fallen with the implementation of the Maastricht Treaty in Cohesion countries, but has risen in the other member states. At this stage, further work would be necessary to distinguish the effect of the Cohesion funds from those of the Maastricht Treaty. This last result could provide some justification for the implementation of countervailing policies (such as the Cohesion Fund and Structural Funds), as argued in the Delors and Padoa-Schioppa Reports. Yet, the persistence of within-country inequality call for a reform of the existing EU regional policies, as there is not yet evidence that these policies has delivered the promised regional cohesion.

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Figures and tables

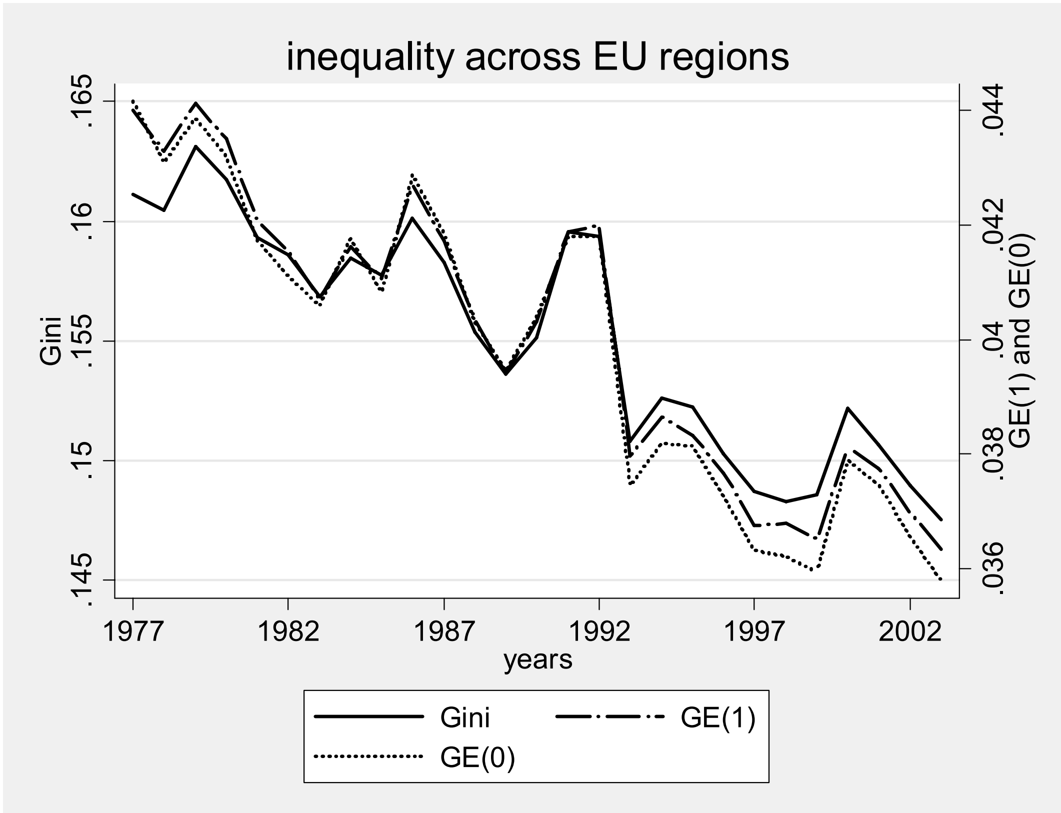

figure 1: Inequality across EU regions

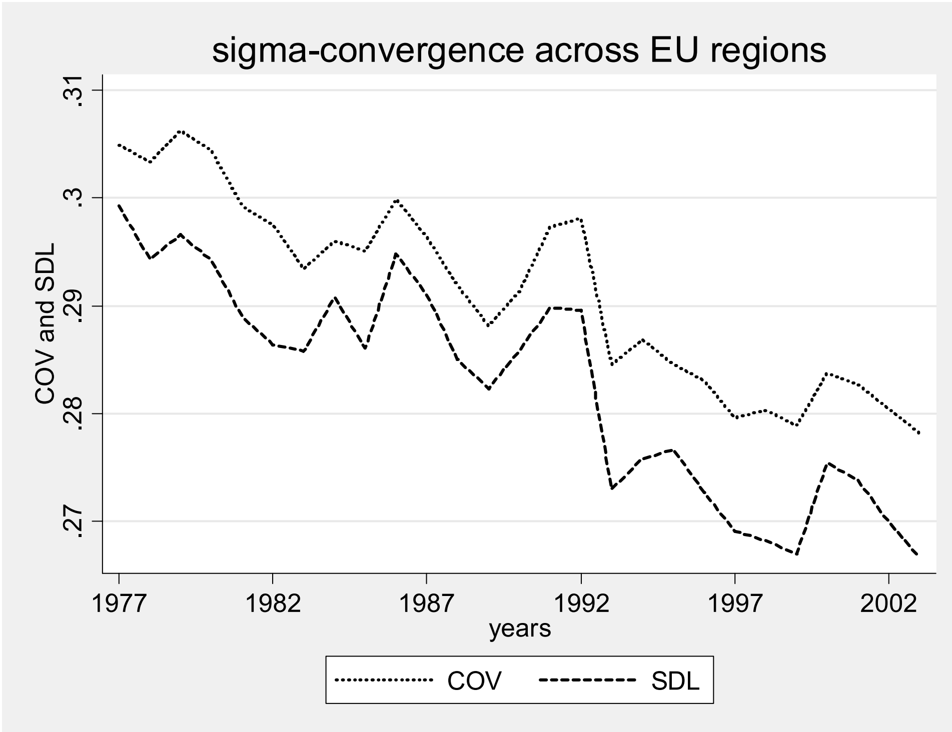

figure 2: σ -convergence across EU regions

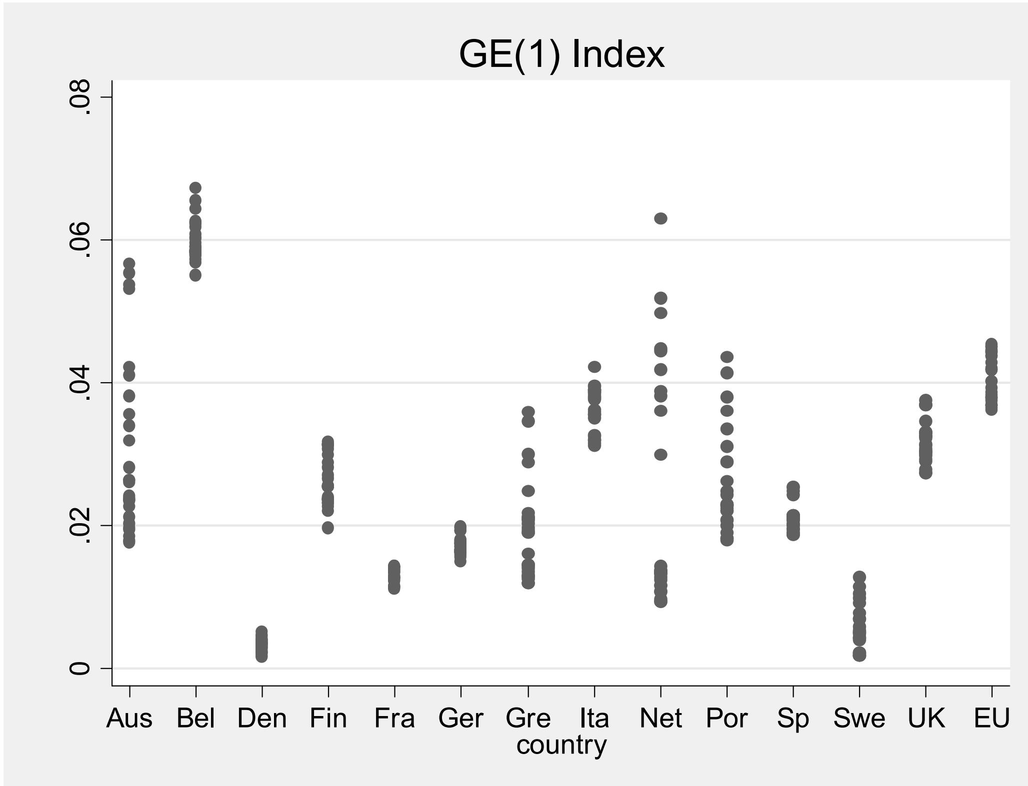

figure 3: Interregional inequality measured by the GE(1) index, by country and for the EU, 1977-2003

Note: Each data point represents one year and country.

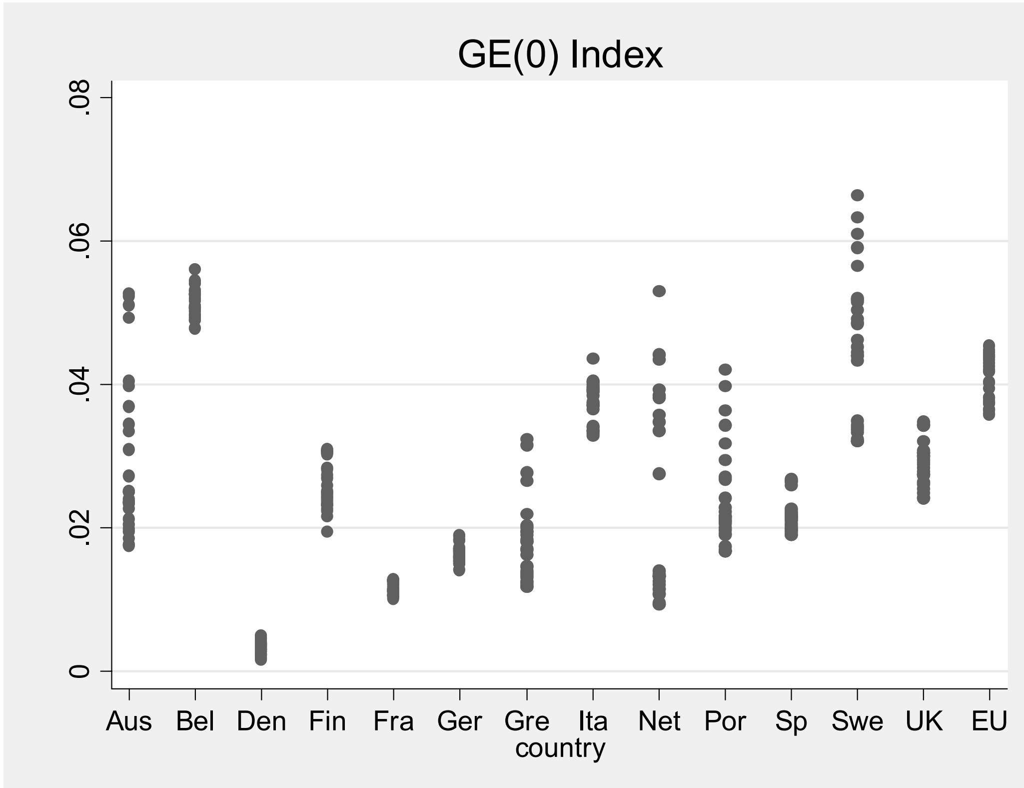

figure 4: Interregional inequality measured by the GE(0) index, by country and for the EU, 1977-2003
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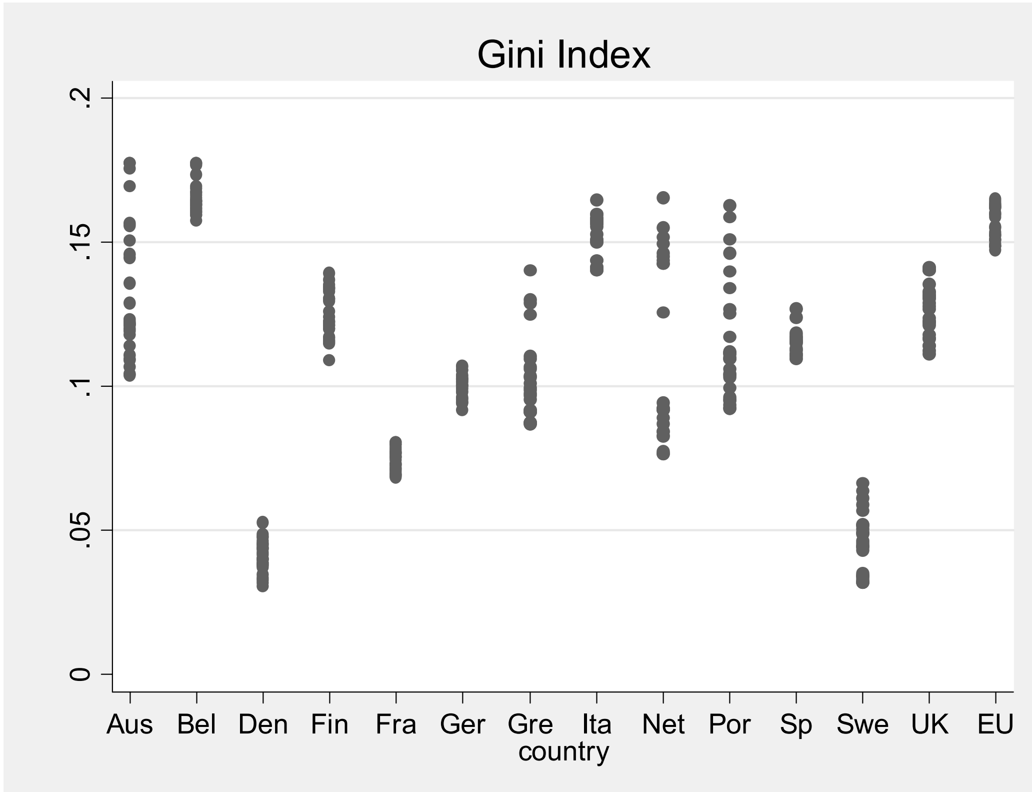

figure 5: Interregional inequality measured by the Gini index, by country and for the EU, 1977-2003

Note: Each data point represents one year and country.

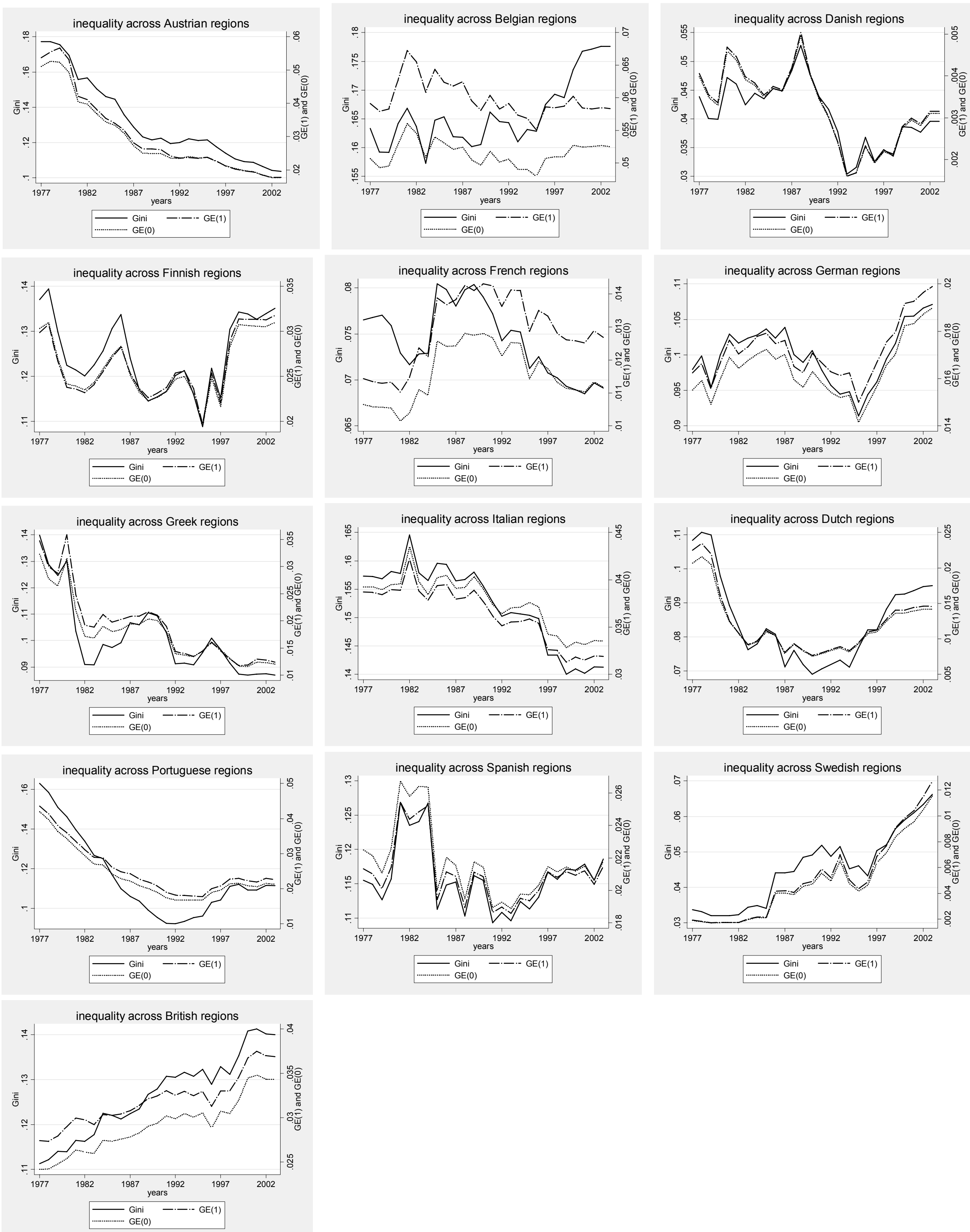

figure 6: Inequality within EU countries

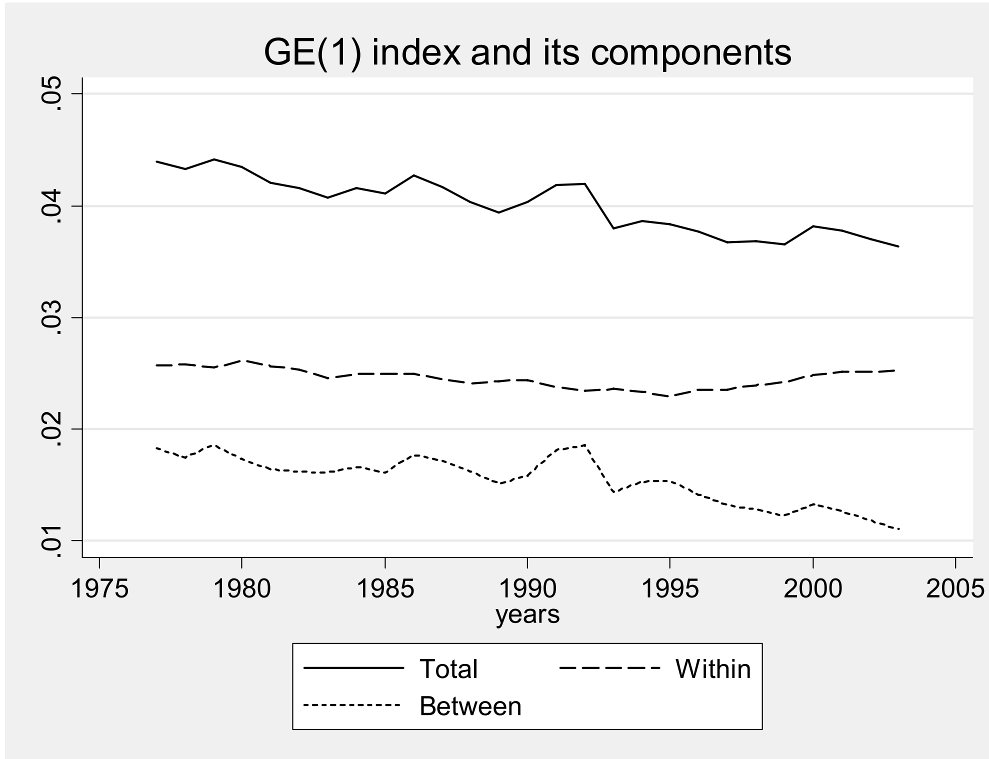

figure 7: Decomposition of the GE(1) Index

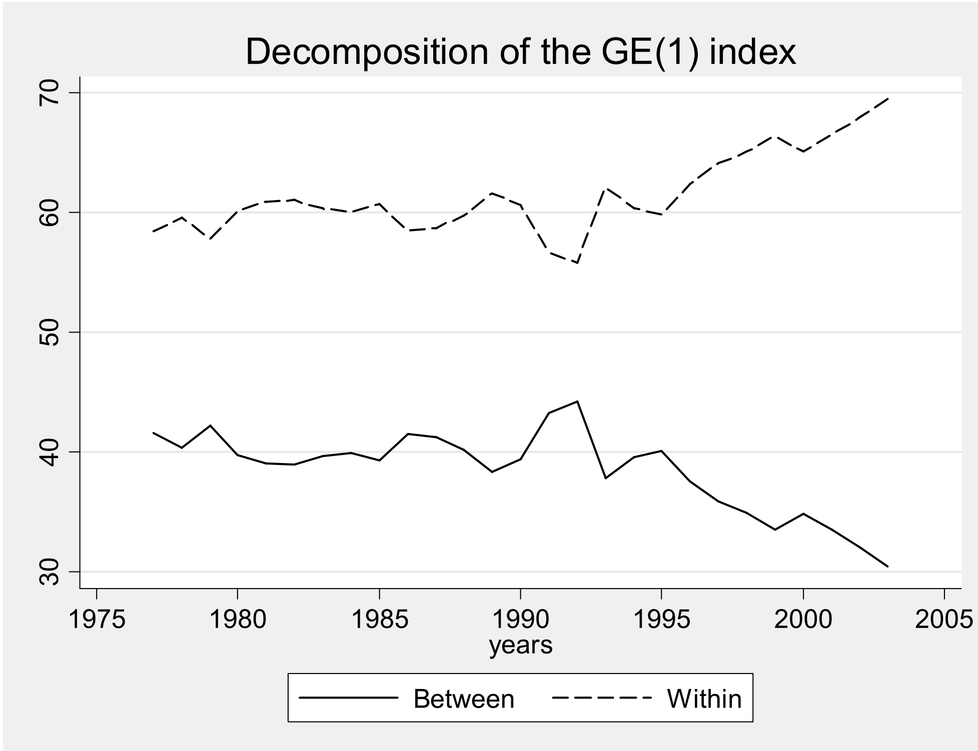

figure 8: Shares of between and within inequality in the GE(1) index

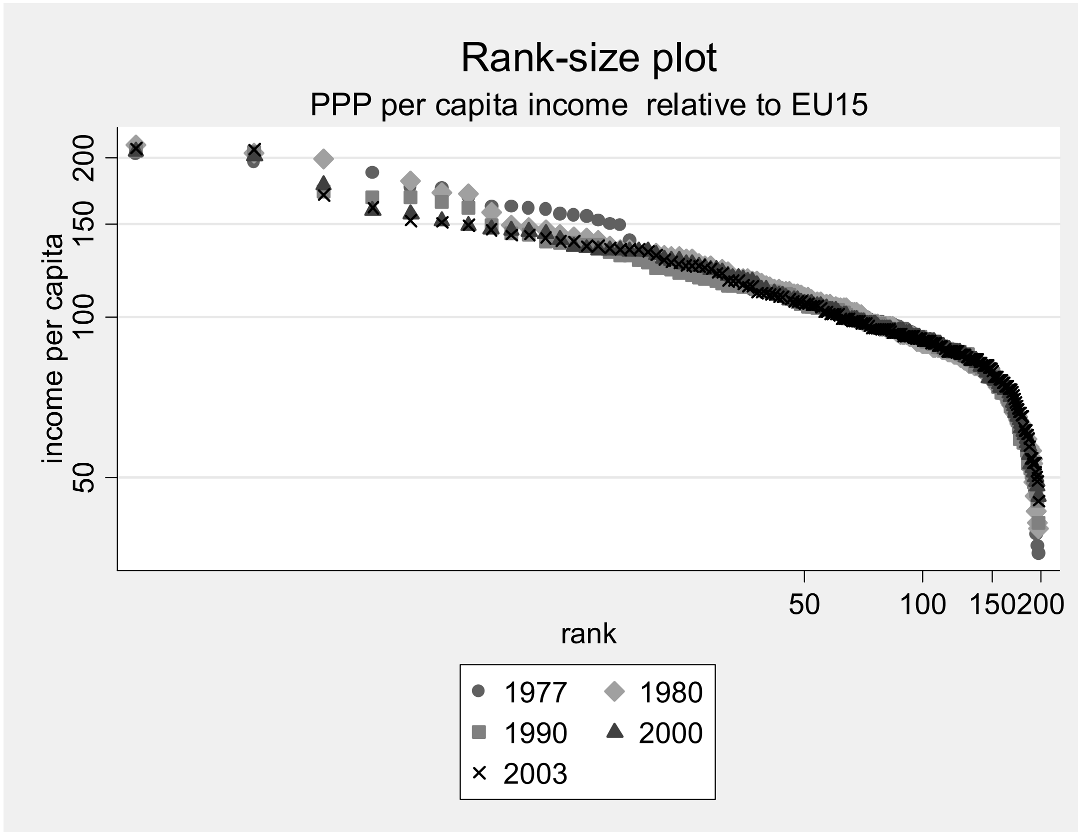

figure 9: Rank-size plots

table 1: Estimates of the expanded rank-size function

	q as a function of r			q as a function of r^2		
	q_1	p-value	Wald Chi square	q_1	p-value	Wald Chi square
1977-1979	-0.0147	0.064	404.5	-3.70E-05	0.051	1260.46
1980-1984	-0.0012	0	6308.21	-5.09E-06	0	40300.57
1985-1989	-0.0012	0	2047.39	-4.71E-06	0	16530.16
1990-1994	-0.0011	0	7480.46	-4.76E-06	0	2618.32
1995-1999	-0.0013	0	506.26	-4.75E-06	0	13256.08
2000-2003	-0.0011	0	4107.71	-5.72E-06	0	6796.46

table 2: The Determinants of Inequality in the EU

	(1)	(2)	(3)	(4)
	GE(1)	GE(1)	GE(0)	Gini
Growth rate of real GDP	0.0132	0.0049	0.0098	0.0345
	[0.0106]	[0.0097]	[0.0128]	[0.0306]
Inflation rate	0.0247***	0.0304***	0.0276***	0.0264
	[0.0087]	[0.0075]	[0.0093]	[0.0226]
Share of employment in manufacturing	0.0161	0.0127	0.0298	0.081
sector	[0.0215]	[0.0233]	[0.0236]	[0.0704]
Share of employment in agriculture	-0.0015	0.0105	0.0195	0.109
	[0.0245]	[0.0217]	[0.0245]	[0.0659]
Female Economic Activity rate	0.0148	0.0046	0.0144	-0.0933**
	[0.0162]	[0.0165]	[0.0189]	[0.0403]
Unemployment rate	-0.1112***	-0.0955***	-0.0743***	-0.2206***
	[0.0167]	[0.0175]	[0.0189]	[0.0371]
Share of pop.	-0.0772	-0.0274	0.0122	0.0034
Below 15 year-old	[0.0613]	[0.0713]	[0.0753]	[0.1936]
Share of pop.	0.2843	0.1056	-0.0446	0.011
Between 65-69 year-old	[0.2269]	[0.2667]	[0.2819]	[0.7244]
Social Transfers as a % of GDP	-0.0133**	-0.0207***	-0.0291***	-0.0739***
	[0.0056]	[0.0076]	[0.0079]	[0.0204]
Union membership	-0.0083	-0.0065	-0.0141**	0.0035
	[0.0060]	[0.0055]	[0.0070]	[0.0156]
EMU	0.9982**	1.4325**	3.1898***	4.0722**
	[0.4736]	[0.6037]	[0.9479]	[1.8211]
EMU*trend	-0.0381*	-0.0625**	-0.1472***	-0.1845**
	[0.0194]	[0.0256]	[0.0426]	[0.0772]
Intra-EU trade		0.0396***	0.0295***	0.0253
		[0.0093]	[0.0088]	[0.0250]
Intra-EU trade * trend		-0.0012**	-0.0005	0.0011
		[0.0005]	[0.0005]	[0.0014]
Maastricht		-1.0306*	-0.1927	-1.5473
		[0.5887]	[0.7354]	[1.6119]
Maastricht*trend		0.0680**	0.0195	0.1017
		[0.0325]	[0.0402]	[0.0882]
Stability and Growth Pact		-0.0603	-2.6464**	-1.6281
		[0.7071]	[1.2262]	[2.0286]
Stability and Growth Pact *trend		0.0052	0.1296**	0.0818
		[0.0351]	[0.0606]	[0.1007]
Trend	-0.0009	0.0321	0.0017	-0.1132
	[0.0058]	[0.0356]	[0.0371]	[0.1013]
Constant	2.9710***	0.8985	1.6028***	10.6269***
	[0.3308]	[0.5668]	[0.5771]	[1.6444]
Observations	192	190	190	190
R-squared	0.423	0.549	0.535	0.468

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

table 3: The Determinants of Inequality in Cohesion countries

	(1)	(2)	(3)	(4)
	GE(1)	GE(1)	GE(0)	Gini
Growth rate of real GDP	-0.0012	0.0123	0.0102	0.0123
	[0.0168]	[0.0157]	[0.0144]	[0.0503]
Inflation rate	0.0166	0.0309**	0.0263**	0.0558
	[0.0142]	[0.0140]	[0.0127]	[0.0394]
Share of employment in	-0.1092**	-0.0356	-0.0268	-0.1236
manufacturing sector	[0.0478]	[0.0406]	[0.0388]	[0.1325]
Share of employment in agriculture	-0.0531	0.0246	0.0558	0.2780**
	[0.0506]	[0.0382]	[0.0350]	[0.1093]
Female Economic Activity rate	-0.0421	-0.0423	-0.0437	-0.1971**
	[0.0333]	[0.0296]	[0.0273]	[0.0956]
Unemployment rate	-0.0399	-0.0302	-0.0352	-0.142
	[0.0591]	[0.0411]	[0.0374]	[0.1231]
Share of pop.	0.1588	-0.0909	-0.0963	-0.3007
Below 15 year-old	[0.1483]	[0.1045]	[0.1014]	[0.3398]
Share of pop.	-0.5754	0.3567	0.3768	1.1742
Between 65-69 year-old	[0.5493]	[0.3867]	[0.3747]	[1.2590]
Social Transfers as a % of GDP	-0.1130***	-0.0111	-0.0139	-0.0362
	[0.0300]	[0.0329]	[0.0294]	[0.0910]
Union membership	0.0209*	0.0117	0.0072	0.0269
	[0.0113]	[0.0105]	[0.0097]	[0.0336]
EMU	0.4458	-1.2293	-1.1893	-2.533
	[1.2137]	[1.0969]	[0.9586]	[3.1369]
EMU*trend	-0.0073	0.0607	0.0578	0.1277
	[0.0508]	[0.0487]	[0.0424]	[0.1378]
Intra-EU trade		0.0214	0.0181	0.0336
		[0.0142]	[0.0137]	[0.0457]
Intra-EU trade * trend		0.0004	0.0004	0.0028
		[0.0007]	[0.0007]	[0.0022]
Maastricht		-2.4935**	-2.3182**	-6.8235**
		[1.0132]	[0.9411]	[3.1918]
Maastricht*trend		0.1553**	0.1443**	0.4216**
		[0.0597]	[0.0550]	[0.1849]
Stability and Growth Pact		2.7157*	2.7439**	7.7081*
		[1.4261]	[1.2864]	[4.2629]
Stability and Growth Pact *trend		-0.1221*	-0.1249*	-0.3524
		[0.0707]	[0.0642]	[0.2137]
Trend	-0.0426	-0.1216***	-0.1027***	-0.3495***
	[0.0276]	[0.0417]	[0.0368]	[0.1174]
Constant	5.3267***	1.6028	1.2909	8.9670**
	[1.4233]	[1.2472]	[1.1368]	[3.6379]
Observations	53	53	53	53
R-squared	0.677	0.843	0.824	0.755

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Note: Cohesion countries are Greece, Portugal and Spain.

table 4: The Determinants of Inequality in non-Cohesion countries

	(1) GE(1)	(2) GE(1)	(3) GE(0)	(4) Gini
Growth rate of real GDP	-0.0079	-0.0009	0.0031	0.0187
	[0.0106]	[0.0109]	[0.0153]	[0.0295]
Inflation rate	0.01	0.0290**	0.0352**	-0.0181
	[0.0104]	[0.0134]	[0.0167]	[0.0325]
Share of employment in	0.0390*	0.0523**	0.0839***	0.2778***
manufacturing sector	[0.0221]	[0.0223]	[0.0317]	[0.0831]
Share of employment in	-0.0469	-0.0779**	-0.0770*	-0.1294
agriculture	[0.0455]	[0.0378]	[0.0463]	[0.0941]
Female Economic Activity rate	-0.011	-0.0368**	-0.0048	-0.1383***
	[0.0213]	[0.0178]	[0.0254]	[0.0455]
Unemployment rate	-0.1026***	-0.0855***	-0.0604***	-0.2004***
	[0.0171]	[0.0161]	[0.0193]	[0.0378]
Share of pop.	0.1047	0.2636***	0.1891	0.4033
Below 15 year-old	[0.1182]	[0.1005]	[0.1178]	[0.2594]
Share of pop.	0.3059	-0.3075	-0.4572*	-0.3217
Between 65-69 year-old	[0.2380]	[0.2237]	[0.2486]	[0.6381]
Social Transfers as a % of GDP	-0.0297***	-0.0547***	-0.0633***	-0.1366***
	[0.0053]	[0.0073]	[0.0091]	[0.0205]
Union membership	-0.0449***	-0.0194*	-0.0495***	-0.0377
	[0.0092]	[0.0113]	[0.0175]	[0.0373]
EMU	0.7068*	1.5176***	3.5639***	5.7926***
	[0.3838]	[0.5256]	[0.8649]	[1.5153]
EMU*trend	-0.0285*	-0.0674***	-0.1665***	-0.2611***
	[0.0157]	[0.0227]	[0.0386]	[0.0651]
Intra-EU trade		0.0644***	0.0317*	0.0093
		[0.0153]	[0.0187]	[0.0426]
Intra-EU trade * trend		-0.0032***	-0.0011	-0.0016
		[0.0008]	[0.0011]	[0.0023]
Maastricht		1.4435***	2.2820***	4.0699***
		[0.5471]	[0.8238]	[1.5003]
Maastricht*trend		-0.0719**	-0.1229***	-0.2285***
		[0.0305]	[0.0452]	[0.0830]
Stability and Growth Pact		-3.1629***	-5.5671***	-9.8039***
		[0.6934]	[1.2114]	[1.9125]
Stability and Growth Pact *trend		0.1526***	0.2690***	0.4584***
		[0.0344]	[0.0605]	[0.0949]
Trend	-0.0184***	0.1843***	0.0634	0.1252
	[0.0065]	[0.0484]	[0.0691]	[0.1468]
Constant	5.1799***	0.4701	3.7279**	13.8257***
	[0.5168]	[1.2756]	[1.7822]	[3.9148]
Observations	139	137	137	137
R-squared	0.627	0.735	0.702	0.692

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Non-Cohesion countries refer to Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Sweden and the UK.

Appendices

A. Five axioms an inequality measure should meet

• the Pigou-Dalton transfer principle: income transfer from a poorer region to a richer region should register as an increase (or at least not a decrease) in inequality.

• Income scale independence: the inequality measure should not change if all regions' incomes change in the same proportion.

• Principle of population: inequality measure should be invariant to replications of the population: merging two identical income distributions should not change the inequality measure.

• Symmetry: inequality is independent of any other regional characteristics besides regional income.

• Decomposability: overall inequality should be related to inequality for subgroups, so that if inequality increases in all of the population subgroups, overall inequality should also increase.

For more details, see Cowell (2000), Bourguignon (1979), López-Rodríguez and Faiña (2006), and Litchfield (1999).

B. Inequality measures: formulas

• Gini index

$$Gini = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j| \qquad (6)$$

where $y_i =$ per capita income in region i; $\bar{y} =$ the average per capita income across all of the regions; $n =$ the number of regions included in the sample.

The Gini coefficient takes on values between zero and one, with zero interpreted as no inequality.

• Generalized Entropy index with parameter 1

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}} \qquad (7)$$

• Generalized Entropy index with parameter 0 (or Mean Log Deviation)

$$GE(0) = \frac{1}{n}\sum_{i=1}^{n}\log\frac{\bar{y}}{y_i} \tag{8}$$

Generalized Entropy measures take values between zero and ∞, with zero representing perfect equality.

• Standard deviation of logs (SDL)

$$SDL = \sqrt{\frac{1}{n}\sum_{i=1}^{n}[\log(\frac{y_i}{\bar{y}})]^2} \tag{9}$$

• Coefficient of variation

$$COV = \frac{1}{\bar{y}}[\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2]^{\frac{1}{2}} \tag{10}$$

An increase in the coefficient of variation captures an increase in inequality.

• Power law index

The Power Law Exponent is obtained by estimating a rank-size function for regional income per capita. I regress logged income per capita on logged rank:

$$\ln y = a + q\ln rank. \tag{11}$$

The absolute value of the slope (q) is referred as Power coefficient, and corresponds to a measure of inequality: the higher the magnitude of q the more unequal the income distribution across regions.

C. Decomposition of the GE(1) index

The GE(1) index can be decomposed in within and between-group inequalities. If the n regions are divided into G groups (here countries), k is the number of regions in each group (country) and s_g is the income share of group (country) g, T_g is the Theil index for that group, and $\bar{y}_g$ is the average income in group g, then the Theil index can be rewritten as

$$T = \sum_{g=1}^{G} s_g T_g + \sum_{g=1}^{G} s_g \ln \frac{\bar{y}_g}{\bar{y}} \qquad (12)$$

where
G is the number of countries
n is the total number of regions
k is the number of regions in country g
$\bar{y}$ is the overall average per capita income
$\bar{y}_g$ is the average per capita income in country g

$$s_g = \frac{\sum_{i=1}^{k} y_i}{\sum_{i=1}^{n} y_i}$$

$$T_g = \frac{1}{k} \sum_{i \varepsilon g=1}^{k} \frac{y_{i \varepsilon g}}{\bar{y}_g}$$

The first term in Equation (12) measures within-country inequality, and the second term is a weighted sum of between-country inequality.

D. Data definitions and sources

	Definition	Source
Growth	Growth rate of real GDP (in percentage)	Cambridge Econometrics Database
Inflation	Inflation rate	OECD Monthly Economic Indicators
Manufacturing	Share of employment in the manufacturing sector (in percentage)	Cambridge Econometrics Database
Agriculture	Share of employment in the agricultural sector (in percentage)	Cambridge Econometrics Database
FEA rate	Female Economic Activity Rate	OECD
Unemployment	Unemployment rate	AMECO, database of the European Commission's DG ECFIN
Young	Percentage of the population younger than 15 year-old	AMECO, database of the European Commission's DG ECFIN
Old	Percentage of the population 65-69 year-old	AMECO, database of the European Commission's DG ECFIN
Union	Share of the employee population member of a labor union	OECD
Social	Social transfers other than in-kind, as a percentage of GDP	AMECO, database of European Commission's DG ECFIN
EUtrade	Share of intra-EU trade in total trade	UNCTAD Handbook of Statistics, 2006

Globalization and Income Inequality: A European Perspective

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"Growth and income distribution in an integrated Europe"
Does EMU make a difference?" on October 12, 2007

Final version, December 2007

Abstract

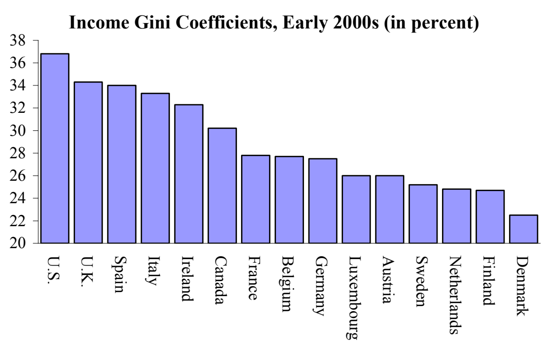
There is growing concern in Europe over the impact of globalization on high and evenly shared living standards. These concerns have often surfaced in response to falling labor income shares in aggregate national income data. However, these data may tell little about the underlying distribution of incomes based on household disposable incomes. While summary measures of income distributions also suggest that inequality has increased in most industrialized countries, this development was very uneven and much less pronounced in euro-area countries, suggesting that broad phenomena such as trade liberalization and financial integration may not be major drivers of inequality.

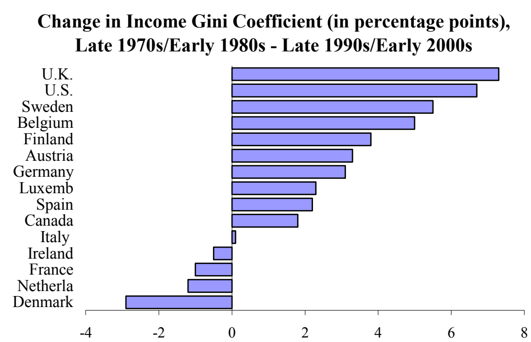
[1] I am grateful to Jörg Decressin, Erik Lueth, and Karl Pichelmann for helpful discussions and suggestions; and to Anastasia Guscina for assistance in assembling the data on labor shares. The views expressed in this paper are those of the author and do not necessarily represent those of the IMF or IMF policy. This paper is largely based on IMF Working Paper 07/169.

I. Introduction

There is growing concern in the industrialized nations over the impact of globalization on their ability to sustain relatively high and evenly shared living standards. Globalization is widely believed to have had a generally positive impact on global economic growth. But the effect of globalization on employment and the distribution of incomes has been intensely debated in recent years and has led some observers in Europe and the United States to call for protectionist measures, including barriers to cross-border trade, labor, and investment flows. This is particularly disconcerting in Europe where, spurred by international competition, the export sector has performed very well over past decades.

Income inequality has increased in many advanced economies over the past two decades. In some continental European countries, however, inequality rose only modestly, or even declined. The inequality upswing was much larger in the United Kingdom and the United States. In the United Kingdom, the Gini coefficient of net disposable household income rose from 27 in the late 1970s to 34 in the late 1990s, showing that inequality increased by almost 30 percent. Trends in income inequality across advanced economies have been quite different. In the United States, which started out with a relatively high degree of income inequality, it has increased even further. However, other countries with initially low levels of income inequality, including Denmark, France and the Netherlands, saw some further decline.





Source: Luxembourg Income Study; net disposable income. Results might not always be fully comparable as for some countries, datasets may be based on different surveys. The Gini coefficient is defined as a ratio (multiplied by 100) of the area between the Lorenz curve of the distribution and the uniform (perfect) distribution line and of the area under the uniform distribution line. 0 corresponds to perfect income equality and 100 corresponds to perfect income inequality.

A wide variety of economic and social trends have been associated with rising income inequality where it occurred (see, Nielson, Alderson and Beckfield (2005)):

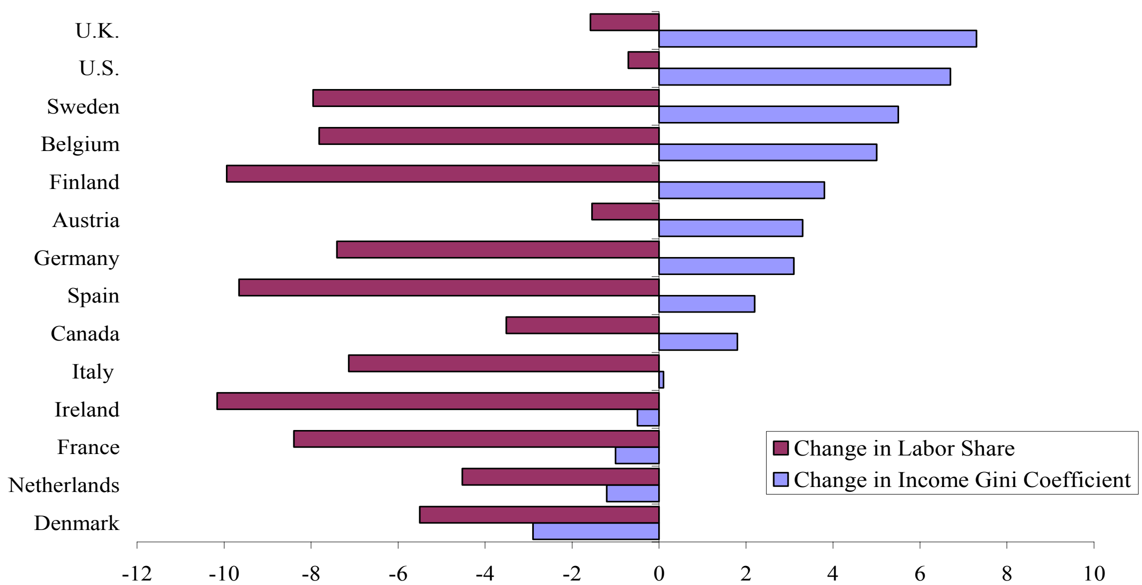
- *Changes Affecting Labor Supply* e.g., immigration, trends in education, female labor market participation, rise of part-time labor, government transfers.

- *Changes Affecting Labor Demand* e.g., technological (skill-biased) change, increased international trade, outsourcing.

- *Changes in Labor Market Institutions* e.g., Changes in minimum wages and the degree of unionization, tax law changes, deregulation.

In particular, the effect of globalization on employment and the distribution of incomes has been much discussed in recent years. Political changes and trade liberalization have accelerated the international integration of product, labor, and capital markets. Rapid technological change has contributed to lowering costs of trade in goods and services adding momentum to the process of international integration. Jaumotte and Tytell (2007, Spring WEO) find that globalization has been one of the factors that has negatively affected the share of income accruing to labor in the advanced economies—the labor share.

Change in Income Gini Coefficient and Labor Shares
(Late 1970s/Early 1980s - Late 1990s/Early 2000s)



Source: Luxembourg Income Study and OECD, STAN. Labor share (5 year moving average) is wage compensation plus computed labor compensation for self-employed over national income.

However, plotting changes in labor shares against changes in the Gini coefficient for net disposable income which also includes other income than wages does not suggest any obvious relationship between these two measures.[2] This is somewhat puzzling given the common perception that a fall in the labor share should be associated with an increase in income inequality. On the one hand, poor measurement of income other than wage income, in particular income from capital gains, interest, dividends, or other profits may explain this outcome to some extent. On the other hand, variations in labor shares may only reveal information about changes in overall income inequality if wages and other income (interest

[2] If a fall in the labor share caused a rise in inequality, the series should be negatively correlated. However, the correlation coefficient is 0.3 for our sample.

and dividend income, profits, government transfers, etc.) are mostly distributed across separate population groups. There are also other measurement issues related to the labor share that may distort the picture. If the labor share is calculated on the basis of value added at market prices (which is the case in the above graph), indirect taxes less subsidies constitute a wedge and a fall in labor's share could be associated with a rise in the share of indirect taxes less subsidies instead of a rise in the share of capital.[3] Furthermore, a decline in the labor share is often erroneously interpreted as a fall in real wages and associated with an increase in inequality. But the labor share also falls if real wages are rising but fail to keep up with changes in average labor productivity. Bentolila and Saint-Paul (2003) show that the correlation between changes in wages and changes in the labor share is relatively weak for a sample of 12 OECD countries.

This paper analyzes the evolution of income distributions based on household data across industrialized countries over the past decades with a view to identifying stylized facts that could help discriminate between competing hypotheses for the evolution of income inequality. Standard summary measures of inequality usually do not provide sufficient information for that effect. An increase in the Gini coefficient, for example, could reflect a fattening of the lower tail of the income distribution due to an inflow of relatively low-skilled, low wage-earning immigrants, or the abolition of minimum wages. Alternatively, a higher Gini coefficient could be caused an increase of inequality at the top of the distribution driven by greater demand for highly skilled workers owing to skill-biased technological change, capital market liberalization, or the "superstar phenomenon."[4] Therefore, the paper also presents more detailed measures of income distributions than Gini coefficients.

II. The Facts

Income inequality can be affected by the composition of the workforce which has changed in many countries due to increased labor force participation of women and immigration. Also, changes in taxes and government transfers often have a substantial impact on disposable income and inequality. However, it is unclear to what extent these developments and changes are driven by broader economic pressures related to technology or globalization, the hypotheses that are of greatest interest for this paper. Accordingly, to focus the analysis on these economic drivers of inequality and to ensure a high degree of data comparability, the data are restricted to a sample of hourly wage income of male household heads, aged 18 to 64, who are employed full time and worked at least 48 weeks per year.[5] The data are from

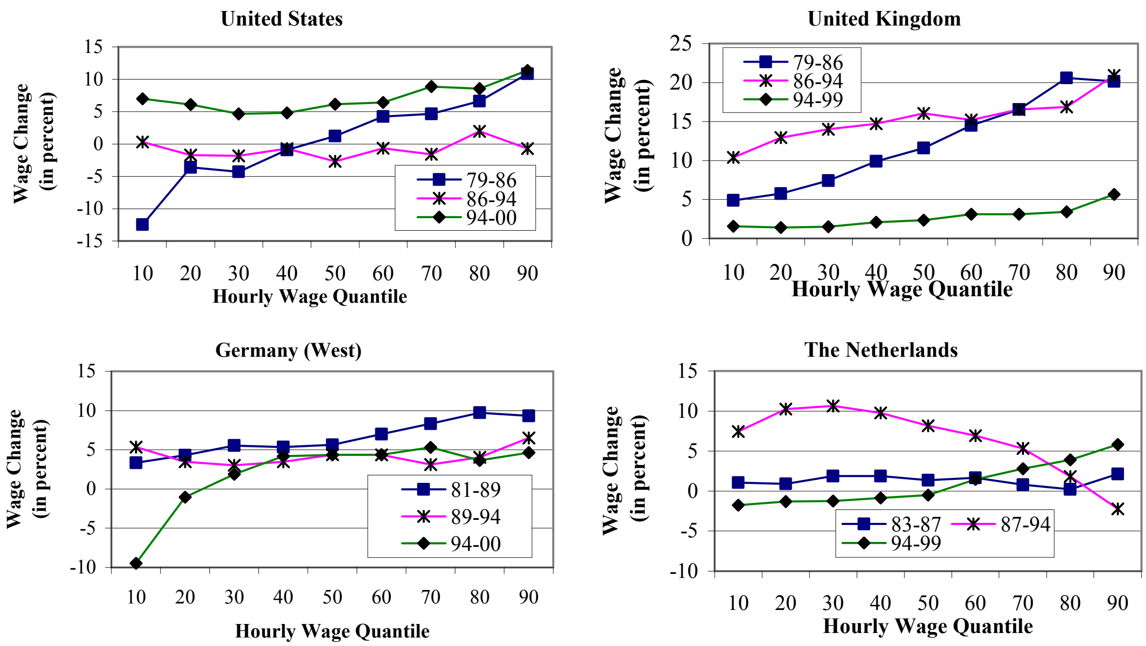
[3] Gomme and Rupert (2004) discuss measurement issues with regard to the computation of the labor share in the United States and show that "historic lows" in the early 2000s are observed only in the nonfarm business sector while other measures of labor's share—for example, for the nonfinancial corporate business sector or the macroeconomy more broadly—are currently near their averages over the last several decades.

[4] See, Piketty and Saez (2006).

[5] See appendix for further information.

the Luxembourg Income Study (LIS) which provides high quality household income data for a relatively large group of advanced economies. The LIS project is generally thought to be very successful in achieving a high degree of comparability of household income data across countries.[6]

Figure 1. Changes in Real Male Hourly Wages by Percentile



Source: Luxembourg Income Study. Hourly wage figures for the U.K. are computed on the basis of annual wages, assuming 52 weeks worked at 45 hours per week.

Median hourly wages of prime age males rose in many countries in real terms. In the United Kingdom, the median wage increased by an impressive 30 percent from 1979 to 2000, in West Germany (1981-2000) by about 14 percent and in the United States (1979-2000) by about 5 percent.[7] The median hourly wage for prime age males was roughly the same at about 16 U.S. dollars in these countries in 2000 (converted at PPP exchange rates). However, these numbers should be treated with some caution as datasets are not always fully comparable.[8]

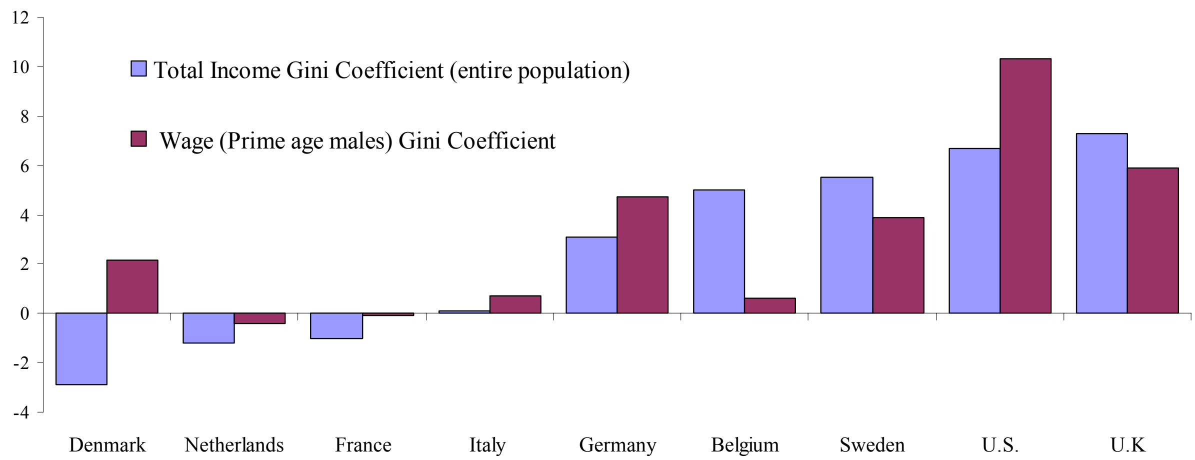
[6] The LIS project began in 1983 and the main objective has been to create a micro-database containing social and economic data collected in household surveys from different countries. The database currently contains information for some 25 advanced countries for one or more years. However, for most countries, data are currently available only up to 2000.

[7] In his speech on "The level and distribution of well-being" on February 6, 2007, Federal Reserve Bank Chairman Bernanke mentions that the median hourly wage of full-time workers rose by about 11.5 percent between 1979 and 2006, indicating a strong pick-up of real wage growth in the United States in the 2000s.

[8] Corresponding figures were not calculated for other countries in the sample, including France and Italy, that only report net income and wage data and which are also influenced by tax and transfer changes over time.

Wage inequality has broadly moved in line with income inequality in many industrialized countries over the past decades. Only in Denmark did wage inequality rise, while total income inequality fell. Table 1 refines these trends by showing the (log) differences of the 90^{th} and 10^{th}, the 50^{th} and 10^{th} and the 90^{th} and 50^{th} percentiles of the hourly wage distributions for male household heads. Developments in the Gini coefficient for wages (prime age males) and in the 90^{th}-10^{th} (log) difference, however, reveal some important differences between wage and income developments:

- Wage inequality increased in virtually all countries (for which data was available).
- Wage inequality increased significantly more in Denmark and the United States than income inequality.
- Income inequality grew much stronger in Belgium than wage inequality.



Source: Staff calculations. Data are from LIS.

Crucially, the data on wages suggest that there were very few common developments across advanced countries with respect to inequality. Changes in wage inequality (prime age males) often occurred at different times and in different parts of the wage distribution. In Germany (West), the wage distribution remained relatively stable during the 1980s but inequality grew sharply in the late 1990s in the lower half of the income distribution. Also, in Denmark inequality grew mostly in the lower half of the income distribution during the 1990s. In Belgium, France, Italy, and the Netherlands, wage distributions were relatively stable. The United Kingdom experienced a sharp increase in inequality across all wage groups until the mid 1990s and saw some modest rise at the top since then. The United States experienced its largest increase in wage inequality in the early 1980s. This is also shown by the steep positive slope of the curve in Figure 1 describing changes in real hourly wages for prime age males during 1979-1986. Table 1 shows that by the mid 1980s the median hourly wage was 74 percent higher than the wage at the 10^{th} percentile, compared to 60 percent at the and of the 1970s. In the 1990s, the United States saw some further increase that was mainly located in the upper half of the distribution.

Table 1. Log Percentile Differentials for Male Hourly Wages

Log 90th-10th Hourly Wage Differential

	Early 1980s	Mid 1980s	Early 1990s	Mid 1990s	Early 2000s
Belgium	-	0.76	0.77	0.68	0.78
Denmark	-	0.86	0.92	0.99	1.03
France	0.97	1.05	1.08	1.02	1.00
Germany (West)	0.80	0.86	0.86	0.87	1.01
Italy	-	0.77	0.84	0.84	0.81
Netherlands	0.88	0.89	0.83	0.80	0.87
Sweden	0.77	0.83	0.86	0.86	0.91
United Kingdom	0.72	1.08	1.10	1.18	1.22
United States	1.16	1.40	1.33	1.39	1.43

Log 90th-50th Hourly Wage Differential

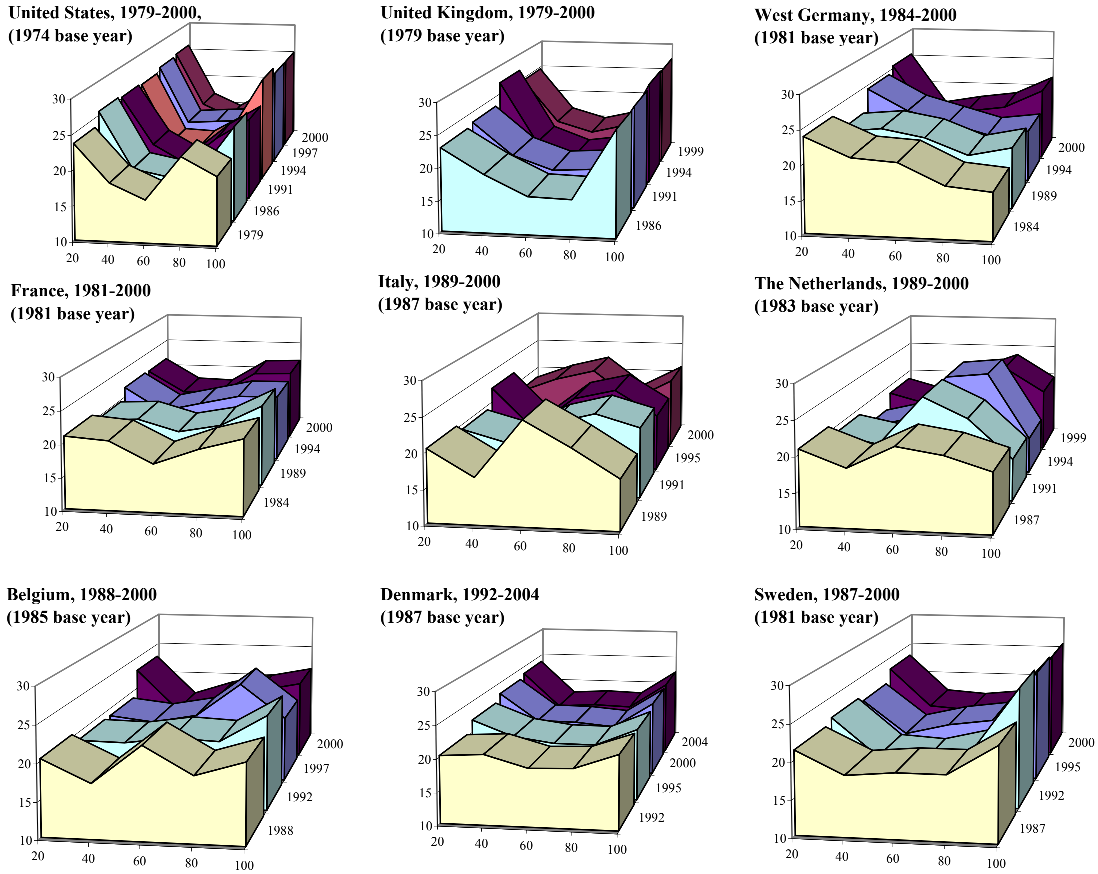
	Early 1980s	Mid 1980s	Early 1990s	Mid 1990s	Early 2000s
Belgium	-	0.45	0.46	0.37	0.45
Denmark	-	0.46	0.48	0.49	0.51
France	0.56	0.63	0.68	0.59	0.57
Germany (West)	0.47	0.49	0.50	0.52	0.53
Italy	-	0.44	0.47	0.46	0.46
Netherlands	0.53	0.54	0.48	0.43	0.50
Sweden	0.45	0.47	0.50	0.50	0.56
United Kingdom	0.30	0.59	0.59	0.64	0.67
United States	0.56	0.66	0.60	0.68	0.73

Log 50th-10th Hourly Wage Differential

	Early 1980s	Mid 1980s	Early 1990s	Mid 1990s	Early 2000s
Belgium	-	0.30	0.30	0.31	0.34
Denmark	-	0.40	0.44	0.50	0.51
France	0.42	0.42	0.40	0.43	0.43
Germany (West)	0.33	0.37	0.36	0.35	0.48
Italy	-	0.33	0.37	0.38	0.35
Netherlands	0.35	0.35	0.35	0.36	0.37
Sweden	0.32	0.36	0.36	0.37	0.36
United Kingdom	0.42	0.49	0.51	0.55	0.55
United States	0.60	0.74	0.73	0.71	0.70

Source: Staff calculations. Data are from Luxembourg Income Study. Data for Denmark and Sweden are based on annual wages and for Belgium, France and Italy on net wages.

Figure 2. Relative Distributions of Hourly Wages for Male Household Heads



Source: Luxembourg Income Study. Wages are deflated with median wages and the cutoff points for the percentiles are determined by a base year and kept constant. Data for Denmark and Sweden are based on annual wages and for Belgium, France and Italy on net wages.

Labor markets in the United States and the United Kingdom, and to some lesser extent in Sweden, witnessed some polarization, or hollowing out of the middle class as shown in Figure 2. This figure shows the evolution of the relative wage distribution where wages are deflated with median wages and the cutoff points for the percentiles are determined by a base year and kept constant.

III. The Evolution of Wage Inequality Across Countries—What explains the differences?

The diverse developments in wage distributions across industrial countries could indicate that country-specific events and policies may be more important for the wage inequality than common, global trends. Also, developments over time within countries raise some doubt as to whether globalization has played a major role in changing income distributions. Much of the literature on wage inequality is focused on the United States (Box 1), where an early consensus emerged in the 1990s.

Box 1. Rising Wage Inequality in the United States—A Brief Survey of the Literature

The sharp increase in earnings inequality in the United States during the 1980s triggered a renaissance of research on wage and income inequality. From the 1940s to the 1970s, the distribution of earnings and incomes in the United States had remained remarkably stable and there was little academic interest since Kuznets' (1955) seminal work that predicted a temporary increase in income inequality during the transition from an agriculturally based economy to an industrialized one. This changed with the marked acceleration in the growth of earnings inequality in the United States that started in the late 1970s and was documented by Katz and Murphy (1992) and Levy and Murnane (1992). In particular, the college wage premium expanded dramatically in the 1980s, after having fallen in the 1970s.

Some early consensus emerged concluding that economic pressures toward increased inequality and skill wage differentials appeared to be mostly driven by skill-biased technological change and between-industry shifts in labor demand. Katz and Murphy (1992) also noted, however, that wage inequality within groups defined by education, experience etc. had steadily risen even since the early 1970s. The differences in the time pattern of rising educational differentials and rising within group inequality suggested that there were at least partially distinct economic phenomena at play.

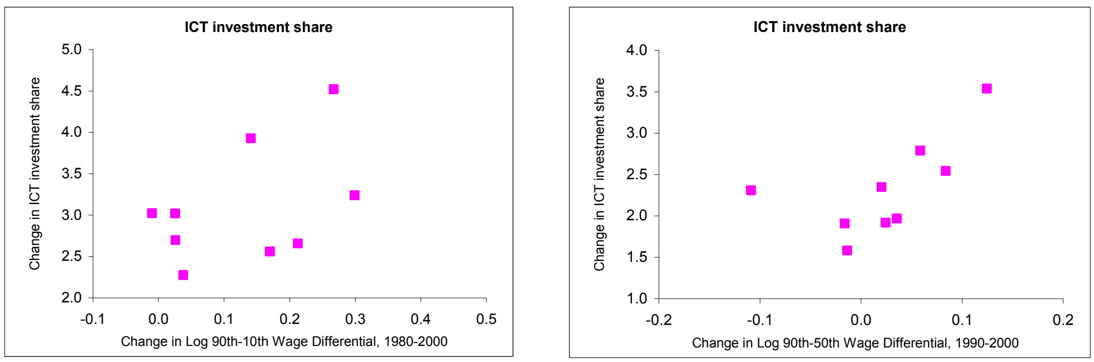
Subsequent studies suggested that growing international trade and economic integration were instrumental in explaining relative shifts in the demand for skills and rising inequality in the United States. Factor content models of trade predicted a small impact of trade on wages in advanced countries because imports of manufactured goods from developed countries amounted to less than 2 percent of the combined GDP of the OECD in the 1980s. Leamer (1996), however, argued that prices rather than quantities mattered, and economic liberalizations in Asia, Eastern Europe, and Latin America affected United States and European labor markets by declines in prices of labor-intensive tradables. Krugman (2000) strongly contested this view and showed that, in a two-country general equilibrium model, prices and wages were predominantly determined by developments in the large country (i.e., the OECD).

While there is still an ongoing debate on the causes of the apparent shifts in the labor demand, two broad conclusions seem to have been reached, according to Autor, Katz and Kearney (2005). First, much of the rise in United States earnings inequality during the 1980s appears explained by shifts in the labor supply of and demands for skills combined with the erosion of labor market institutions—including labor unions and the minimum wage—that protected the earnings of the low and middle wage workers. Second, the surge of inequality evident in the 1980s also reflected a secular rise in the demand for skill, possibly linked to the computer revolution and other technological advances. Autor, Katz and Kearney (2006) conclude that the changing distribution of job task demands, spurred directly by advancing information technology and indirectly by its impact on outsourcing, goes some distance toward interpreting the recent polarization of the wage structure in the US.

However, several studies have recently challenged these conclusions and claim that the rise of U.S. earnings inequality in the 1980s and the late 1990s were episodic events mainly accounted for by non-market factors. Card and DiNardo (2002) argue that the rise in inequality during the 1980s is largely explained by factors other than supply and demand for skills, namely, the declining real value of the minimum wage and conclude that the growth in United States earnings inequality was primarily a one-time event of the early 1980s. Lemieux (2006) also argues that the fall in the minimum wage explains most of the surge in inequality in the 1980s but finds that the changing composition of the U.S. labor force during the 1990s (rising education and experience) has added to some further inequality.

This concluded that economic pressures toward increased inequality and skill wage differentials appeared to have arisen mostly from skill-biased technological change, possibly reinforced by globalization and between-industry shifts in labor demand. Figure 3 provides some limited evidence that technological advance, proxied by changes in the information and communication investment share, may have benefited the highly skilled in advanced economies, in particular during the 1990s.

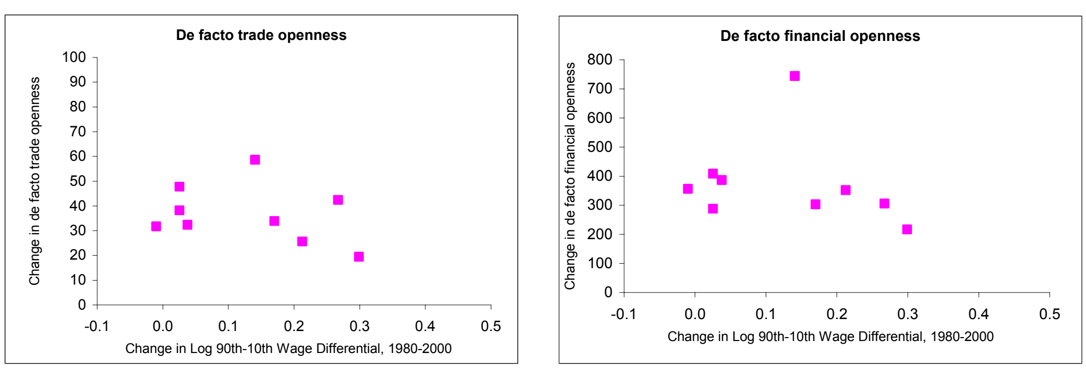
Figure 3. Developments in Technology versus Inequality, 1980-2000



Source: Authors calculations. Data are from LIS and World Economic Outlook, IMF 2007.

A problem with this approach is that although advances in information and communication technologies and globalization accelerated substantially in the 1990s, change in the U.S. income distribution slowed. This has led Card and DiNardo (2002), Lemieux (2006) and others to argue that the rise in inequality during the 1980s is largely explained by factors other than supply and demand of skills, namely, the declining real value of the minimum wage. Moreover, they find that the change in the composition of the United States labor force (rising education and experience) has increased inequality somewhat further during the 1990s.

Figure 4. Developments in Trade and Financial Openness versus Inequality, 1980-2000



Source: Authors calculations. Data are from LIS and World Economic Outlook, IMF 2007.

The lack of common developments in inequality in EU countries and of any visible link between some measures of globalization and inequality across countries (Figure 4) point to the importance of other factors than global trends.

Some authors, including Krugman (1994), have argued that European wage-setting institutions have prevented wage inequality from increasing but raised unemployment. But Card, Kramarz and Lemieux (1999) studied changes in the relative structure of wages in the United States, Canada, and France and found little support for the "tradeoff" hypothesis between wage inequality and employment growth. Acemoglu (2003) developed a model where labor market institutions creating wage compression also encourage more investments in capital-intensive technologies. These technologies increase the productivity of less-skilled workers and have prevented a fall in their relative wages. But Acemoglu (2003) employed summary measures of inequality such as the Gini coefficient and the difference between the $90^{th} – 10^{th}$ percentiles of the wage distribution. These measures did not catch the fact that the upper part of the wage distribution was very stable in several European countries during the 1990s.

This is somewhat at odds with Acemoglu's (2003) model as wage-setting institutions tend to cause wage compression and, possibly, some stability in the lower part of the distribution.[9] The fact that most changes in inequality, if any, occurred in the lower part of the wage distribution in several European countries since 1990 could indicate that changes in labor market institutions may have played an important role.[10]

Many European countries substantially reformed their labor markets and institutions over the past decades and this may explain differences in wage inequality trends. Annett (2006) studies Denmark, Ireland, the Netherlands, and the United Kingdom, countries that undertook major reforms and stand out in terms of their success in reducing unemployment. Ireland and the Netherlands centered their reforms on consensus-based agreements between social partners, trading wage moderation for labor tax cuts while the United Kingdom weakened the power of unions. Rather than address union behavior directly, Denmark concentrated on benefits reform, by combining continued generous benefit levels with lower duration, tougher conditionality, and stricter activation requirements. These different reform patterns may help to explain why the United Kingdom experienced such a sharp increase in inequality, while wage inequality remained relatively stable in the Netherlands and increased only slightly in Denmark and income inequality actually fell in both countries.[11]

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[9] The OECD (2007) shows that, for an average of 10 OECD countries, much of the cumulative increase in earnings dispersion since 1990 has occurred in the top half of the earnings distribution. But it is likely that this finding is strongly driven by developments in the United States, the United Kingdom and Sweden which are all included in this group.

[10] One could argue that these institutional changes were a response to globalization. However, Levy and Temin (2007) strongly dispute this and states that globalization clearly does not determine institutions.

[11] Income inequality has also remained stable in Ireland from 1987 to 2000. Wage data are only available starting in 1994.

IV. Conclusion

The evolution of income and wage inequality is a complex phenomenon, driven by many factors that must have played different roles in different countries. In fact, developments in income and wage inequality differed appreciably across advanced economies. In particular, changes in wage inequality occurred at different times and in different parts of the wage distribution across countries. Labor markets in the United States and the United Kingdom witnessed some polarization, but the evolution of wage distributions in euro-area countries has not followed any common trend and has remained relatively stable in several countries. There is currently no consensus on why inequality increased in some industrialized countries, but not in others. Some argue that increased inequality, where it occurred, was driven by skill-biased technological change and a changing distribution of job task demands, spurred directly by advancing information technology and indirectly by its impact on outsourcing. This has led some observers to lay the blame squarely on globalization and to call for protectionist measures. But others argue that the rise in inequality is largely explained by factors other than supply and demand for skills, namely, changes in labor market institutions, including minimum wages and the degree of unionization and this fits the stylized facts presented in this paper much better.

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DATA APPENDIX

Data are from the Luxembourg Income Study (LIS). They are based on national household surveys, but the LIS harmonizes and standardizes the micro-data from the different surveys in order to facilitate comparative research. The datasets can be accessed via the internet mailing system by submitting SAS, SPSS or STATA programs. http://www.lisproject.org/

The analysis is restricted to wage income of male household heads, aged 18 to 64, who are worked at least 48 weeks per year and more than 35 hours per week. The sample leaves out those observations with the lowest 1 percent earnings and with an income above ten times the median wage. More detailed information on data sources and definitions can be found on the LIS website.

Homeownership Inequality and the Access to Credit Markets

(Can Credit Availability Explain Cross-country Differences in the Inequality of Homeownership across Income of Young Households?)

This version: December 2007

Alena Bičáková[♣] and Eva Sierminska[♦]

ABSTRACT

This paper focuses on the cross-country differences in homeownership rates and the extent this variation can be explained by differences in the degree of financial development of the mortgage market. Expecting that home ownership among the young is mostly driven by their ability to borrow (against their future income) to buy their homes we focus on households 18 to 40 years of age. We use the newly developed Luxembourg Wealth Study and focus on five countries: Finland, Germany, Italy, the UK and the US.

We find that aside from Italy, homeownership rates and inequality in the four countries more or less correspond to their mortgage take up rates and its distribution across income, reflecting the different degree of size and development of their respective mortgage markets. In Italy, however, alternative ways of financing a home such as family transfers substitute the limited mortgage availability and take up rates. The mortgage market in the UK is the most open (in terms of mortgage take up) and the most equal (in terms of the distribution of mortgage take-up across household income deciles), which leads to the highest and most equally distributed homeownership in this country as well. The mortgage market in Germany is on the other side of the spectrum with very low mortgage take-up rates and strong dependence of homeownership and mortgage take up on household income (high homeownership/mortgage income inequality). Finland and the US are in-between.

Counterfactual predictions suggest that although household characteristics play some role in explaining the observed (and predicted) variation in home ownership rates across the five countries, it is mostly the country specific effects of these characteristics determined by the institutional environment as well as the functioning of the housing and mortgage markets that drive the main result. We conclude that in the absence of alternative sources, mortgage availability is the main determinant of home ownership across countries and also across income deciles within countries.

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1. Introduction

One of the important decisions individuals make during the life-cycle is the amount they wish to spend on housing services and whether or not to combine it with ownership. Given that housing is a major component of both consumption and investment, it absorbs a large portion of the household budget and in many countries is the largest item of households' wealth portfolios. Homeownership does not necessarily have to be preferable to renting. Individuals may prefer not to carry the risks and costs related to owning their homes. Homeownership may also decrease mobility and migration and thus lead to inefficiencies in the labor market. Nevertheless, in many countries, homeownership is identified as the preferred form of living arrangement and receives preferential treatment over renting, for example, in the tax code. It is seen as the principal means by which households accumulate wealth, at the same time providing a flow of services. As a major private asset, housing may also serve as a source of financial security and income during retirement. When compared to other forms of living arrangements, homeownership brings higher housing satisfaction across individuals in several European countries (Diaz-Serrano 2006). Owning ones home in some countries is also considered an important signal of social status and economic success (Constant et al 2007). However, rates of homeownership vary substantially across countries. In a sub-sample of highly developed countries we find[1] cross-country variation in homeownership among young households, ranging from 21.4 % of homeowners in Germany to 63.9 % of homeowners in the UK. ,

Recent literature has highlighted credit access as one of the key determinants of homeownership, next to permanent income, the cost of owning relative to renting, and household characteristics (Chiuri and Jappelli 2003, 2007; Ortalo-Magne and Rady 1999). Meanwhile mortgage market development also varies cross-nationally and exhibits a range of characteristics. Unless households have accumulated enough savings or have access to informal loans, the ability to purchase homes is largely determined by access to formal credit, in this case, mortgage availability.

Given the importance of housing as a primary and preferred asset and source of security, the aim of this paper is to examine the cross-country variation in homeownership rates and homeownership-income inequality among the young. We also explore to what extent this variation can be explained by differences in the degree of financial development of the mortgage markets in these countries.

The analyses in this paper are in many ways original partly because we use the Luxembourg Wealth Study data, which are new (the database has just been finalized in November 2007) and partly because there are relatively few methodological conventions available for measuring and comparing housing wealth. As we explore the role of mortgage availability in determining the observed variation in homeownership rates, we focus our analysis on young households (18 to 40 years of age), who are most likely to depend on mortgage access to finance their home purchases. It is unlikely that these households have high enough savings from their short labor market career to be able to buy their home without other funds. Therefore, unless they have an initial endowment in the form of wealth or transfers from their parents, they have to take a mortgage to finance their home purchase. We therefore expect home ownership among the young to be mostly driven by their ability to borrow (against their future income) to buy their homes. As a result we would expect that in countries with more developed consumer credit markets, such as the US or the UK, higher home-ownership and lower homeownership-income

[1] See Table 1.

inequality than observed elsewhere. In the latter part of the paper, we link our findings to country-specific institutional and regulatory environments and discuss the likely impacts of the currently proposed European mortgage market integration.

We find that the mortgage market in the UK is the most open (in terms of mortgage take up) and the most equal (in terms of the distribution of both homeownership and mortgage take-up across household income deciles). The mortgage market in Germany is on the other side of the spectrum, with very low mortgage take-up rates and strong dependence of homeownership and mortgage take up on household income (high homeownership/mortgage income inequality). Finland and the US are in between - both in terms of homeownership and mortgage take up inequality - with the Finnish mortgage market and homeownership distribution somewhat more equal than in the US. While it is possible that it is the high financial development of the mortgage market that ensures high homeownership rates and wide mortgage availability in the US, it is also the relatively small housing prices that lead to a similar result for Finland. The ranking of the four countries according to homeownership rates and inequality more or less correspond to their mortgage take up rates and its distribution across income, reflecting the different degrees of development of the markets for housing debt.

The only country that does not fit the rankings is Italy. While it has low use of mortgages, similar to Germany, homeownership there is almost as high and equal across income as in the UK. The data and qualitative evidence suggest that it is the alternative sources of home ownership funding, namely transfers (and possibly loans) from family (and friends) that substitute the highly underdeveloped mortgage market in Italy.

Our paper is organized as follows. The introduction is followed by a section that discusses the economic background of our analysis and surveys related previous research. We next describe the data and methods and sample characteristics. This is followed by a discussion of housing and mortgage market characteristics and institutions. The results section first presents results on homeownership and mortgage take up rates and their distribution across income. This is followed by homeownership-income inequality measures and a section with results for a full probability model showing differences in homeownership and mortgages rates across income deciles. The last section of the results decomposes the cross-country differences due to effects and those due to characteristics, and predicts counterfactual homeownership rates based on cross-country interactions of effects and characteristics. A section discussing policy implications of our main results comes next, followed by conclusions.

2. Economic Background and Selected Research

The standard economic theory suggests that what really matters for the current well being (consumption or leisure) of the forward-looking utility maximizing household, is the present value of the sum of the current household wealth and the expected lifetime income. With perfect financial markets, where individuals can borrow against their future earnings, the distribution of the current consumption (and asset holdings) reflects the "overall" economic inequality in population, as given by the present value of lifetime resources. This is not the case when there are liquidity constraints: two households that are at the beginning of their career and that have the same expected lifetime resources - one with higher initial assets but flatter labor income profile, the other with lower initial assets but higher expected future earnings - are no longer economically equal when measured by current consumption or asset holdings.

As pointed out in Bertola and Koeniger (2004), countries with higher income inequality and instability, like the US and the UK, have the most developed financial markets, whereas countries where consumer credit is still limited, such as countries of continental Europe, tend to have a more compressed wage distribution and higher income stability due to labor market regulations. Therefore, some of the impact of income inequality in the US and the UK is likely to be mitigated by easier access to consumer credit, whereas this is less likely to happen in countries of continental Europe. Due to differences in financial market development, the differences in the "overall" economic inequality between US and UK on the one hand, and continental Europe countries on the other, might be effectively smaller than documented by the current earnings and income inequality measures. Krueger and Perri (2002) show that the substantial increase in income inequality in the US over the past 30 years was accompanied by only a minor increase in consumption inequality, which suggests that the main cause of increased income inequality was higher income volatility and that the growth of consumer credit market made consumption-smoothing easier. In this paper, we explore whether the same also holds for wealth inequality across different countries, and, in particular, for the distribution of homeownership across income groups among the young. That is to what extent does access to credit markets help explain homeownership inequality.

What drives the observed differences in home ownership across different countries? The cross-country variation may solely reflect country-specific personal preferences (possibly affected by cultural and historic traditions) for owning a house, for investment in equity and for mobility. The decision whether to own a home and when, is often related to the decision about marriage and child bearing. As the characteristics of the young differ across countries - in terms of demographic and human capital characteristics (such as family structure and schooling) – the household formation and therefore the need for one's own home varies as well. The choice of owning one's home also depend on the cost of home-ownership relative to the cost of renting, which also varies across countries. There are also cross-country differences in terms of economic characteristics of the young households (such as distribution of income and wealth). Finally, provided the young are the same in terms of personal preferences and characteristics, the observed variation may be driven by the differences in access to funds, namely, the access to credit.

In the context of the life-cycle model of borrowing and saving, we would expect that youngest households, which do not have other sources of funds, the need to finance the purchase of home through mortgage to be the greatest. Given the uneven pace of the development of financial markets, the cross-country differences in home ownership rate among the young may just reflect different mortgage availability. The size and efficiency of the mortgage market, terms of housing loans as well as transaction costs are likely to play a key role in explaining the cross-country variation in the home-ownership rate among young.

The same holds for cross-country differences in the relationship between homeownership and household income and therefore the homeownership-income inequality. In countries with less developed credit markets and lower mortgage availability, we would expect low homeownership rates, strong homeownership dependence on income and high homeownership-income inequality among the young as many of the young are likely to be credit constrained.

Preferences vs. Constraints

Homeownership does not necessarily have to be preferable to renting as suggested in the introduction. In terms of personal preferences that determine demand for home ownership as well as in terms of overall economic efficiency, renting may be preferred to owning one's home. Some people may prefer not to carry the risks and costs related to owning their homes. Homeownership may decrease mobility and migration and therefore lead to inefficiencies in the labor market. This may not be so if housing and mortgage markets are efficient and keep the transaction costs of moving low. Nevertheless, in many countries, homeownership is identified as the preferred form of living arrangement and as will be seen in section 5 on Institutions receives preferential treatment over renting (for example, in the tax code) since it is seen as the principal means by which households accumulate wealth and obtain financial security.

The homeownership distribution that we observe in each country is an outcome of an interaction of supply and demand factors, such as personal preferences, risk attitudes, household composition, distribution of income, relative costs of renting versus home owning, liquidity constraints and mortgage availability on one side and supply of housing on the other. Our analysis does not make any explicit assumptions about which of the factors dominate. From the most conservative point of view, making the least assumptions, we document the homeownership rates and the distribution of home ownership across household income deciles across five different countries, regardless whether the observed patterns reflect, preferences or constraints. Although we proxy the preferences and needs, which drive the demand for home ownership, with demographic household characteristics and other factors, and carry the estimation separately by each country, we are not able to control for any unobserved attitudes towards homeownership that vary with income.

However, we need to explicitly state that in several respects, our analysis and conclusions do go a step further and assume home ownership is the preferred housing arrangement among young households. This is not only through the choice of the topic and the key question – as we focus on, analyze and explain probability of home ownership and inequality of its distribution across income – but in particular – through the interpretation that we give to our results.

Once we document the homeownership rates and the distribution of home ownership across household income deciles, we provide several measures of inequality in homeownership across income and compare them across the five countries. The interpretation we have in mind is to show the differences in the access to homeownership by different types of young households, based on their income status, and relate it to the inequality in the access to mortgage market across income. In this sense, we interpret our results as reflecting the constraints and assume that homeownership is the preferred housing arrangement. This assumption is also necessary to be able to make cross-country comparisons and draw conclusions about the inequality of the distribution of home-ownership and mortgage availability across income.

The same holds for the decision to take a mortgage versus using other funds in order to purchase one's home. When interpreting the documented mortgage rates and distribution of mortgage rates across income deciles, we conjecture that the outcomes reflect liquidity constraints (differences in the access to mortgage market) rather than cross-income differences in the attitudes toward taking a mortgage versus using other funds.

We kindly ask the reader to bear these considerations in mind when reading the interpretations of our results. A structural model of the joint decision of owning one's home and of taking a mortgage would be the adequate treatment of these considerations but is beyond the scope of this paper.

Previous research

Past literature on the demographics of homeownership has conventionally identified three main factors affecting tenure choice: permanent income, the cost of owning relative to renting, and household characteristics. In recent literature credit access has been brought to the forefront as one of the key determinants of homeownership. Chiuri and Jappelli (2003) is one of the first attempts to account for age differences in home ownership across countries. They find that the availability of mortgage finance, as measured by down payment ratios, mortgage equity withdrawal or reverse mortgages- affects the distribution of owner occupancy rates across age groups including the young. In countries with developed mortgage markets the home ownership profile is much more tilted towards the young. In single country studies, such as the one for the UK by Ortalo-Magne and Rady 1999, access to mortgage credit is also found to be crucial to the observed increase in homeownership in the 1980s. When Chiuri and Jappelli (2007) study homeownership trajectories in old age, they find that across countries they are highly correlated with the degree of mortgage market regulation.

A number of studies have also examined homeownership by race and by family types. Here again, the main barriers that stand out in purchasing a home are wealth, income and credit constraints (Bostic, Calem and Wachter (2004)). Quercia, McCarthy and Wachter identify that in the US populations associated with such constraints are those with lower incomes, city residents and the young. Sedo and Kossoudji (2004) examine homeownership by family types in the US and find that increases in income are more important to homeownership at lower income levels than at high income levels for each family type. Age, like income also exhibits a concave shape in all family types. Overall, they find that the impact of householder's characteristics on the probability of owning a home is similar for all the householders, regardless of gender and family type. When doing counterfactual predictions they find that each householder regardless of race and sex have the highest predicted probabilities of home ownership if they were to have coefficients form a married couple household. Marriage appears to be powerful enough to stimulate demand for housing and alter mortgage lenders decisions, or change behavior in a way that is more compatible with home ownership.

This also indicates that the most important aspect of the homeownership gap that exists across gender and family type is family type itself. It is not clear whether behavior on the part of the household or behavior on the part of mortgage lenders (or both) is the culprit. Combine this with limited credit availability and credit market development across countries and we find that the highest homeownership among young couples is the most prevalent in countries where there is the highest rate of married couples among the young or credit markets are very well developed.

Bostic and Surette (2001) find that in the 1990s differences in homeownership between minority and non-minority families and between middle-income and lower-income families declined significantly. Additionally, changes in family-related characteristics explain homeownership trends only among the top two income quintiles. Their results suggest that favorable changes in mortgage and housing markets and changes in the regulations that govern those markets and have facilitated credit access help explain the increase in homeownership among lower-income families.

Di and Liu (2005), on the other hand, examine the importance of wealth and income on homeownership over time in the US and their effect on different racial groups. Their findings suggest that the proliferation of mortgage products that allowed for low down payments in the late 1990s may have contributed to a reduction in the importance of wealth for achieving homeownership and they do not find a reduction in the importance of income, despite the fact that allowable ratios of debt-to-income have increased. Other studies have consistently found that wealth and to a lesser extent credit constraints are more important than income constraints in limiting access to homeownership (eg. Barakova et al (2003); others also point to the cost of owning relative to renting as a significant determinant (Haurin, Hendershott and Wachter 1997).

Another issue encountered in the literature on homeownership is the fact that there exists differential household formation across countries. Chiuri and Jappelli (2003) outline the problem of the Italian and Spanish young adults that tend to live with their parents well beyond the age of 25, due to higher unemployment and greater difficulty of having independent living arrangements. Martins and Villanueva (2006) examine whether differences in household structure can be traced back to restricted credit access for the young and find that access to a mortgage loan increases the probability that a young adult creates her/his household by between 31 and 54 percentage points in Portugal. Similar argument may possibly also explain the relatively older age of young households in Italy. Combining their estimates with cross-country data, they establish that differences in the availability of credit can explain up to 20% of the cross-European variance of nest leaving.

3. Data, Methods and Descriptive Characteristics

To analyze the impact of credit market development and mortgage availability on the differences between the distributions of homeownership across income we use the Luxembourg Wealth Study (LWS). This is a new project within the Luxembourg Income Study (LIS).[2] The LWS database contains harmonized wealth and income data from ten industrialized countries. The primary goal of the project has been to assemble and to organize existing micro-data on household wealth into a coherent database, in order to provide a sounder basis for comparative studies on household net worth, portfolio composition, and wealth distributions. It is the first cross-country comparable dataset, which includes information about households' assets and liabilities, necessary to identify homeownership and mortgage take-up, as well as expenditures and income and a range of other demographic and economic characteristics of the households. For more details see Sierminska, Brandolini and Smeeding 2006 and consult the LIS website. Detailed information about different types of debt (home-secured, non-home-secured, informal debt) also allows us to identify the cross-country differences in the role of informal credit, and to what extent this provides a substitute to the official credit, when credit markets are underdeveloped.

In this paper, we include five countries from the period of 1998-2002. These countries include two Anglophone countries, the United States (US) and the United Kingdom (UK); two continental European countries, Italy and Germany; and one Nordic country Finland. These countries have diverse economic outcomes and varying housing and mortgage systems.[3] In all countries considered the data period of analysis falls

[2] LIS is a cross-national archive of harmonized datasets from the industrialized countries, which include income data at the household- and person-level, as well as extensive demographic and labor market data. Currently, the LIS database includes over 160 datasets from approximately thirty countries, covering the period 1967 to 2004. More information is available on the LIS website (http://www.lisproject.org).

[3] The original datasets that the LWS project harmonized, and that are included in this study, are: for the United States, the 2001 Survey of Consumer Finances (SCF); for the United Kingdom, the 2000 British Household Panel Study (BHPS); for Italy, the 2002 Survey of Household Income and Wealth (SHIW); for

during a time of positive house price growth, particularly in Finland, Italy, the UK and the US (Consult Appendix Figures A.2-A.6 for details). In Germany the change in house prices has been more moderate and not as strikingly positive.

Sample and Sample Selection

We select households, where the head and spouse are between 18 and 40 years old and are not students. We exclude extremely rich individuals that are defined as having financial assets greater then the 95th percentile of the distribution of financial assets.

The sample data for the US and Germany has undergone multiple imputation and consists of 5 replicates of the original data. Consequently, since the five implicates would be treated as independent observations and correspondingly inflate the reported significance of results[4] we have corrected the standard errors for multiple imputation.

Methods

We start our analysis by documenting the cross-country variation in homeownership rates and homeownership-income inequality among the young, and then we link it to mortgage take-up, mortgage availability, alternative sources of homeownership financing, and credit constraints of the young across the five countries under analysis. We first focus on cross-country differences in homeownership rates. We then analyze the relationship between home ownership and income, looking at the distribution of home owners across household income deciles. We develop several measures of homeownership-income inequality, such as homeownership in the lowest decile, various ratios of homeownership rates across deciles (the ninth to the fifth, the ninth to the first, the fifth to the first), and the rank of the first decile in which the home ownership rate exceeds half, and the cross country average, then we compare these measures across countries.

Next, we take into account the observed heterogeneity across different households, and estimate for each country separately a probability model of homeownership as a function of income, while controlling for other factors, such as age, education, family structure, presence of children, self-employment status and so on. We follow two specifications regarding the household income variable: first, the logarithmic function of household income, second (more flexible), the ten binary indicators reflecting the household income decile. The coefficient of the logarithm of income and the coefficients of the ten (nine with a constant) binary variables provide us with further and improved measures of homeownership-income inequality. We present the cross-country differences in the marginal effects of income variables on homeownership of the country-specific representative households, as well as the differences in the marginal effects of income variables for the same representative household across different countries, to document what drives the observed cross country variation in these effects: either it is due to the underlying distribution of endowments (income) and other factors, or due to the differences in the relationships between income and homeownership.

Germany, the 2002 Socio-Economic Panel Study (German SOEP); and for Finland, the 1998 Wealth Survey.

[4] The imputation procedure is described in Kennickell 1998.

We further explore this issue as follows: we predict cross-country counterfactual homeownership rates using the population (sample) of one country and the estimated coefficients from the other. The pair-wise cross-country comparisons allow us to identify whether it is the differences in the *characteristics* of the country-specific populations or the differences in the country-specific *effects* of these characteristics on homeownership, that drive the cross-country variation in homeownership rates. This procedure is similar in nature to the Oaxaca-Blinder decomposition, when applied to binary outcome models. As it is the case for the Oaxaca-Blinder decomposition, while the procedure is useful for identification of the two components of homeownership rates, it fully ignores any causality between them, i.e. the fact that the distribution of the characteristics may reflect their impact and vice versa. However, the question of causality cannot be addressed with data available for each country only for one point in time.

After providing a thorough cross-country comparison of homeownership-income inequality, we explore to what extent the observed variation in this inequality may be a result of cross-country differences in credit market development and mortgage availability. First, we look at cross-country differences in mortgage take-up rates among the young (18 to 40 years of age) and explore what percentage of owned homes is funded through mortgages. Next, we document the distribution of mortgage take-up rates across household income deciles and estimate a probability model of mortgage take-up. We control for financial wealth as well as for the risk aversion concerning the willingness to borrow by an indicator of whether a household has any other debt except for mortgage.[5] The marginal effects of income on having a mortgage and the predicted counterfactual homeownership rates complement our previous findings and indicate to what extent mortgage take up explains the documented cross-country variation in homeownership among young.

Sample Descriptives

Table 1 shows differences in homeownership in our sample of young households, ranging from 21.4 % of homeowners in Germany to 63.9 % of homeowners in the UK, with Finland (43.3 %), the US (47.9 %) and Italy (50.9 %) in between. In terms of mortgage financing, the UK has the highest mortgage rate (62 %), followed by the US (43 %) and Finland (39 %). Germany (19 %) and Italy (16 %) have much lower mortgage incidence than the other countries under analysis, and are similar in this respect, which sharply contrasts with the low homeownership rate in the first and high homeownership rate in the latter. Comparing the homeownership and mortgage take-up rates, we see that homeownership in four of the countries is mostly driven by housing loans. In Italy, home purchases by young households are much less mortgage dependent, which suggests that there exist alternative ways of obtaining homes other than mortgage and these compensate for the low mortgage availability. Past studies, have indicated that strong, intergenerational transfers (homes passed down from generation to generation or new homes bought for the young by their parents) provide a substitute for the limited supply of housing loans, with the result of homeownership rate among young households being comparable to those in countries with highly developed mortgage markets. [6] (This is also confirmed for the whole population. See Appendix for these results)

[5] As discussed later, this coefficient may also reflect other factors than just risk aversion towards debt.

[6] In Italy, for instance, Guiso and Jappelli (2002) find that inter vivos transfers and bequests play a considerable role in home purchases, particularly in the case where there are credit market imperfections. Haliassos et al (2006) also find this strong cultural effect for Cyprus.

Table 1

Country	Home ownership	Mortgage (of all)	Mortgage financing	Sample size
Germany 2002	0.214	0.185	0.866	3,270
Finland 1998	0.433	0.386	0.891	1,102
USS 2001	0.479	0.427	0.891	1,130
Italy 2002	0.509	0.157	0.308	1,178
UK 2000	0.639	0.621	0.971	1,335

Note: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights, Sorted by home-ownership rates. Extremely rich individuals are defined as having financial assets greater then the 95th percentile of the distribution of financial assets.

Table 2 compares the country-specific datasets of young heads of household in terms of the key variables used in the analysis. The first set of factors that we assume to have an affect on homeownership, are demographic characteristics of the household. Young household heads are substantially older in Italy, and also somewhat older in the UK and Germany, when compared to the US and Finland. Besides the different demographic structure of the various populations, this may also reflect the propensity and timing of young individuals to leave home and form their own household. Such a decision is likely to be influenced by the situation on the labor market, housing market and also access to credit (Martins and Villaneuva 2006). In Appendix Figure A.1 we find the distribution of households across ages. The probability of forming a household varies a great deal across countries for the young and then for the older individuals.

In Italy individuals form households at a similar level as their counterparts in other countries in their thirties. The highest she of young households can be found in Finland followed by the US, Germany and the UK. At this point, we do not address the potential selection of the individuals to the samples of young heads, but we survey the typical country specific characteristics of young households in their respective populations in section 4.1.

The cross-country differences in the distribution of young household heads across the three education groups capture both the varying achievements of the national educational systems but may also suggest the limited comparability of the educational systems across countries. It suggests that there is substantially higher proportion of low-educated and substantially lower proportion of high-educated in Italy and in the UK, when compared to the rest of the countries. Household heads in Italy are more likely, while the ones in Germany are less likely to form couples, when compare to the other three countries.

Similar to headship, both marital status and children may be endogenous to the factors we are focusing on, in particular, to the situation in the housing market and mortgage availability. We discuss this issue later in the text. Young heads in Germany and Finland have fewer children younger than 15, compared to the US, the UK and Italian heads. The former two countries thus also form smaller households, compared to the household size of the rest.

Table 2

	Finland	Germany	Italy	UK	USS
age of hh head	31.02	31.97	34.04	32.07	31.19
low education	0.17	0.13	0.48	0.35	0.13
Medium education	0.49	0.59	0.41	0.44	0.58
high education	0.34	0.28	0.11	0.20	0.29
Couple	0.57	0.52	0.66	0.59	0.59
has children < 15	0.41	0.40	0.52	0.53	0.55
self-employed	0.11	0.08	0.30	0.12	0.05
hh size (in persons)	2.45	2.25	2.74	2.71	2.83
has other debt	0.58	0.22	0.19	0.69	0.78
income mean	25,905	25,950	26,011	35,618	36,513
income median	23,917	22,961	22,423	32,446	28,988
income min	797	298	290	337	453
income max	219,382	248,446	233,311	236,076	305,172
income SD	13,974	16,418	17,031	20,938	30,210
fin assets > 3000 USD	0.40	0.33	0.67	0.39	0.45
fin. assets mean	12,433	15,087	15,757	16,458	32,626
fin. assets median	8,113	11,004	11,690	10,866	11,792
fin. assets min	3,019	3,003	3,107	3,024	3,047
fin. assets max	56,602	44,297	62,135	60,773	329,290
fin. assets SD	10,645	10,389	13,339	14,743	52,326

Notes: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights, income is total disposable household income in 2002 USD, self-employed = head and/or spouse is self-employed, distribution of financial assets (last 5 rows) – only individuals with financial assets > 3000 USD

Self-employment and entrepreneurship and home ownership are also interlinked, although the effect may go in both directions. Self-employed, who typically have a less certain and more volatile income may either prefer renting to homeownership, or may be denied mortgages for that reason, and therefore credit constrained – excluded from the market. On the other hand, entrepreneurial activities may often be own-home dependent and positively related to housing tenure. In our sample, 30 % of the young households in Italy[7] are self-employed, it is 12% and 11 % in the UK and Finland, and less than 10 % in Germany and the US.

Having other (unsecured / consumer) debt may reflect both the willingness to take on the risks of borrowing on the one hand (demand) and the development of credit markets in general (supply) on the other. At the same time, it may capture the economic condition and the degree of credit constraints. Finally, individuals with mortgages may be less willing to add other forms of debt to their housing debt. Consistent with the credit market development story, the proportions of young households with other debt is much lower in Italy and Germany than elsewhere, with the highest proportion in the US. We do not find any striking differences among homeowners and non-homeowners holding other debt, except for the Italian renters and US homeowners. About 10 percentage more of the

[7] The definition of self-employed household indicator is that either head and/or spouse is self self-employed.

Italian renters and US homeowners, hold other debt then their home-owning and renting counterparts, respectively.

Table 2a – Homeowners Only

	Finland	Germany	Italy	UK	USS
age of hh head	33.03	34.92	34.52	33.11	32.98
low education	0.13	0.07	0.43	0.30	0.09
medium education	0.46	0.55	0.43	0.47	0.52
high education	0.41	0.38	0.13	0.23	0.38
Couple	0.75	0.82	0.70	0.71	0.77
has children < 15	0.60	0.66	0.56	0.53	0.66
self-employed	0.16	0.11	0.36	0.14	0.08
hh size (in persons)	3.11	3.15	2.90	2.83	3.25
has other debt	0.57	0.20	0.15	0.69	0.83
income mean	33,387	37,942	28,831	40,988	49,373
income median	32,743	35,419	25,357	38,317	42,561
income min	797	1,822	290	337	1,016
income max	219,382	201,537	233,311	236,076	305,172
income SD	14,413	19,311	19,891	21,534	35,397
fin assets > 3000 USD	0.58	0.45	0.76	0.51	0.63
fin. assets mean	13,837	16,369	16,112	17,437	38,712
fin. assets median	8,880	14,305	12,282	11,052	14,728
fin. assets min	3,019	3,003	3,107	3,039	3,047
fin. assets max	56,602	44,297	62,135	60,773	329,290
fin. assets SD	11,763	9,960	13,316	15,392	57,923

Notes: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights, income is total disposable household income in 2002 USD, self-employed = head and/or spouse is self-employed, distribution of financial assets (last 5 rows) – only individuals with financial assets > 3000 USD

Tables 2a and 2b provide simple comparison of the key characteristics of home owners and not-homeowners. Consistently with our expectations, young heads in all the countries tend to be older, more educated, be married, have more children and a bigger household size than the heads who do not own their homes. Homeowners have higher disposable household income, and wealth in terms of the financial assets. In all countries, young homeowners are more likely to be self-employed, compared to renters.

Considering that typical mortgage down payments are in the range of 20-30% of home values we would expect homeowners to have less liquid assets compared to those that have not purchased their homes (yet), ceteris paribus.

Table 2b – Non-Homeowners Only

	Finland	Germany	Italy	UK	USS
age of hh head	29.48	31.17	33.54	30.20	29.57
low education	0.19	0.14	0.53	0.45	0.17
medium education	0.51	0.60	0.38	0.40	0.63
high education	0.29	0.26	0.09	0.15	0.21
Couple	0.43	0.44	0.61	0.36	0.42
has children < 15	0.27	0.33	0.47	0.52	0.46
self-employed	0.08	0.07	0.23	0.07	0.02
hh size (in persons)	1.95	2.01	2.57	2.52	2.44
has other debt	0.59	0.22	0.24	0.69	0.73
income mean	20,187	22,684	23,086	26,098	24,586
income median	18,200	20,445	19,974	24,003	21,627
income min	3,019	298	290	337	453
income max	99,572	248,446	129,297	132,426	167,831
income SD	10,509	13,841	12,812	15,885	17,368
fin assets > 3000 USD	0.26	0.30	0.58	0.16	0.28
fin. assets mean	10,057	14,563	15,269	10,759	20,160
fin. assets median	7,358	11,004	9,320	8,287	8,633
fin. assets min	3,019	3,026	3,107	3,024	3,047
fin. assets max	56,602	44,193	62,135	47,882	273,426
fin. assets SD	7,903	10,516	13,376	8,156	35,287

Notes: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights, income is total disposable household income in 2002 USD, self-employed = head and/or spouse is self-employed, distribution of financial assets (last 5 rows) – only individuals with financial assets > 3000 USD

4. Housing market characteristics

4.1. Home ownership, mortgage, home value and home equity across the population

Next we look in more detail at the housing market and examine homeownership, mortgage, home value and home equity for the whole population and our sample of the young households. We compare these across countries for different ages keeping in mind we are observing one cross-section for each country in different years. We use a smoothing technique, which regresses homeownership on a third-order age polynomial.

Differences in homeownership by age and across countries can be found in Figure 1. Once again we find that homeownership in Germany is the lowest at all ages in relation to the other countries. The highest homeownership among the young is in the UK and among the older population in the US. Actually, the US is the country where we observe the flattest decline in ownership later in life. This is most likely a reflection of the ability to extract value from home equity, which is in fact, confirmed when we look at mortgage by age in Figure 2.

Figure 1

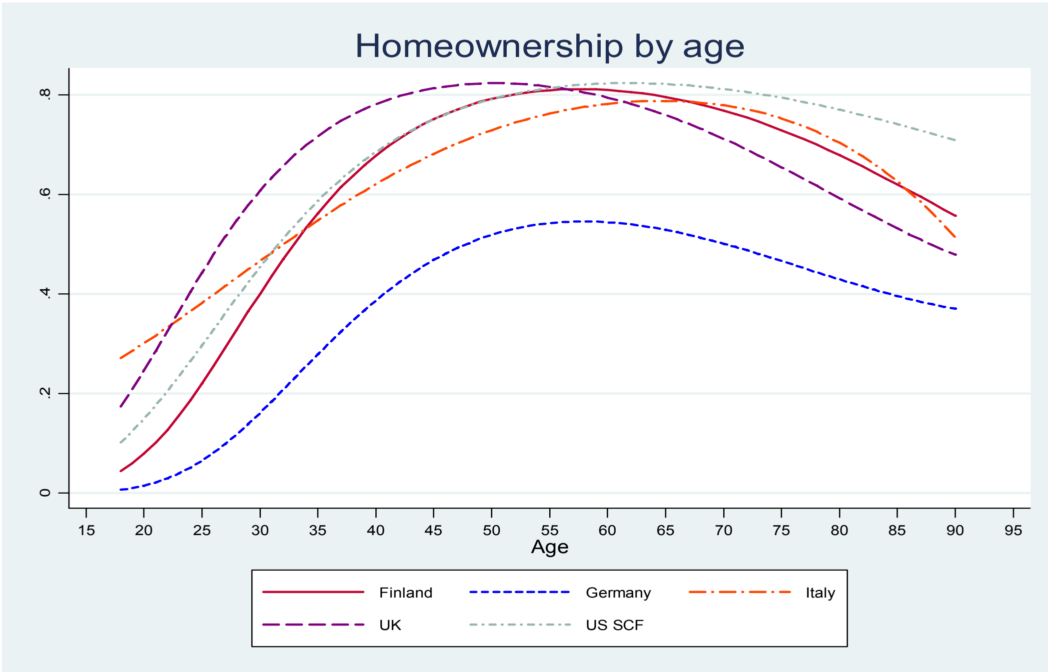
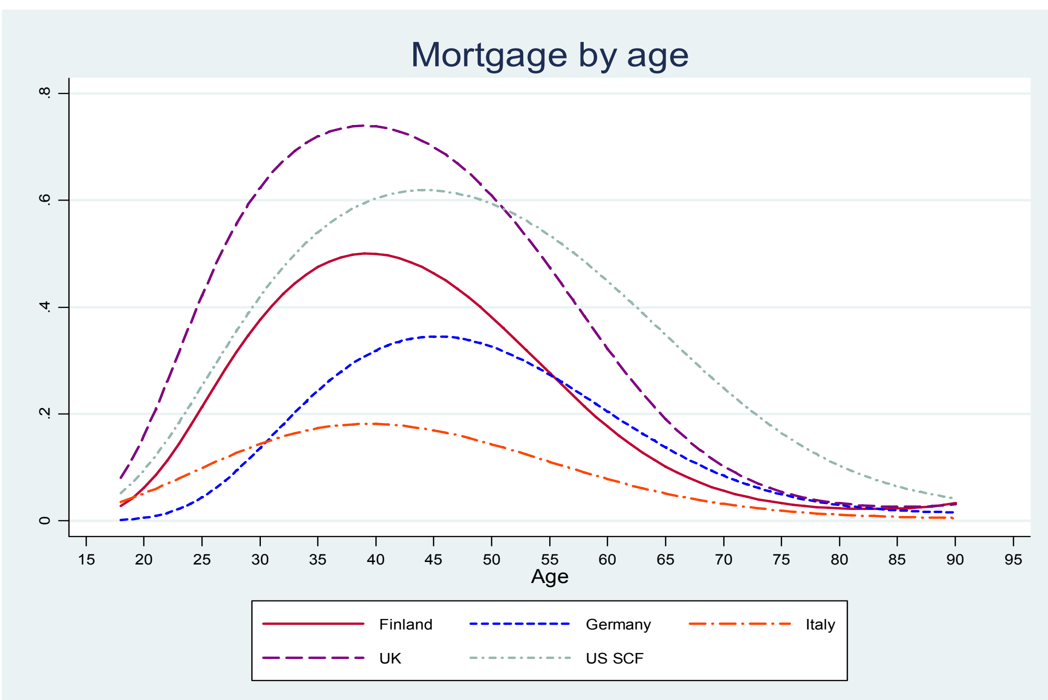


Figure 2



We find that the older population in the US has the highest rate of mortgage take-up. Peak homeownership occurs at different ages. In Italy and the US it takes place later in life, whereas in the UK, Finland and Germany, a bit earlier and in that order. Next, we examine the role of mortgage funding in homeownership. As previously indicated homeownership among young households in Italy does not depend on mortgage availability to a great extent and this is true across the age distribution. The highest mortgage take-up is in the UK for the young and in the US for the elderly. According to Figure 3 mortgage is the biggest source of funding in the UK and the US. It provides about 80% of the funding for young homeowners in most countries and about 20% in Italy. This country is quite unique in having low debt and low mortgage take-up.

Figure 3

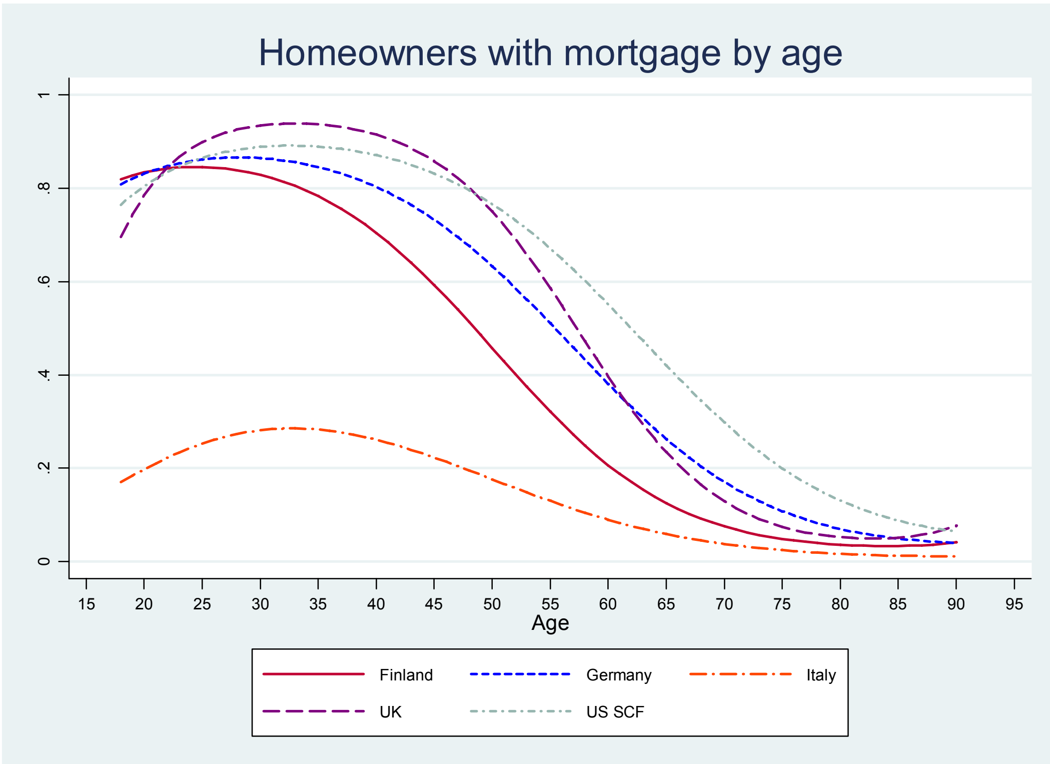


Table 3a. Home value, home equity and mortgage debt for homeowners for the whole sample.

		Finland	Germany	Italy	UK	USS
home value	**mean**	93,079	240,470	193,644	209,754	184,131
home value	**median**	75,469	218,308	155,337	156,538	124,931
home value	**min**	3,773	4,401	621	5,525	1,016
home value	**max**	1,132,039	8,252,641	2,485,398	1,841,619	20,300,000
home equity	**mean**	78,354	198,177	187,853	160,255	124,439
home equity	**median**	66,036	165,053	149,124	117,864	73,130
home equity	**min**	-179,240	-236,576	-124,270	-736,650	-648,017
home equity	**max**	1,132,039	3,576,145	2,485,398	1,565,378	20,300,000
home debt	**mean**	14,725	42,293	5,792	47,606	59,692
home debt	**median**	0	0	0	18,416	32,502
home debt	**min**	0	0	0	0	0
home debt	**max**	433,948	4,676,497	459,799	1,473,297	7,912,303

Looking at home values in the above tables for the whole population we find them to be the highest on average and at the median in Germany, the UK, Italy, the US and Finland. For the younger population the ranking is similar, with Italy moving to second place indicating that young homeowners in Italy own relatively more expensive homes across countries compared to the whole population.[8] One must not forget that even though Germany exhibits high home values, homeownership is only 20% versus 51% among the young in Italy. It may be the case that low home ownership in Germany is the result of high housing prices or due to selection – across income - only the very rich own their homes – that's why home value is high.

Home value is interesting in its own right as it can be used as a measure of long-run potential wealth. Home equity on the other hand is a good indicator of current wealth as housing is the main wealth portfolio component. In the whole population, the highest home equity is observed in countries with the lowest debt, in Germany and Italy, then in the UK, the US and Finland measured both by the mean and median. Among the young population we find a re-ranking among countries with the highest value of home equity. Italy has the highest home equity for the young followed by Germany, the UK, the US and Finland. Big gaps between home values and home equity are present in the UK and the US particularly for the young. In most countries we note the existence of negative home equity values indicating either a decline in home values since the purchase date (less likely since data is based on a self-assessed current value), or the ability to take additional loans using home as collateral (this could be the case in Finland and the UK, where mortgage information is combined with other housing debt).

Home debt for the whole population is the highest in the US, UK, Germany, Finland and Italy. Among the young it is a very important component of home equity in Germany, the UK, the US, Finland, and Italy.

8 This fact is confirmed in Guiso and Jappelli (2002) whose estimates indicate that young adults stay longer with their parents and as a result shorten the saving period before home ownership and increase the value of the house purchased.

Table 3b. Home value, home equity and mortgage debt for homeowners for the selected sample.

		Finland	Germany	Italy	UK	USS
home value	**mean**	91,183	219,262	175,220	168,317	138,545
home value	**median**	81,129	198,063	149,124	138,122	101,570
home value	**min**	3,773	13,754	12,427	31,308	1,219
home value	**max**	660,356	2,200,704	745,620	1,473,297	2,031,400
home equity	**mean**	53,428	123,390	161,045	75,027	56,130
home equity	**median**	43,584	100,257	136,697	49,724	30,471
home equity	**min**	-132,071	-105,422	0	-139,963	-30,471
home equity	**max**	653,753	2,135,381	745,620	1,473,297	1,157,898
home debt	**mean**	37,755	95,872	14,174	93,337	82,415
home debt	**median**	33,018	88,028	0	82,873	73,130
home debt	**min**	0	0	0	0	0
home debt	**max**	207,541	585,311	248,540	478,821	873,502

Note:

Figure 4 and Figure 5 present a complete picture of the age distribution of home values and home equity. Home values are the highest in Germany and then UK. This is followed by Italy for the young and the US for the older populations. Home values are the lowest in Finland. Home equity is the highest in Germany, the UK, Italy and the US for the older population and Italy Germany, the UK, the US for the younger part of the population. These rankings reflect different combinations of house prices and mortgage take-up in each of the countries. Apart from the very young, where Finland surpasses the US, it has the lowest values for home equity among the five countries.

Figure 4

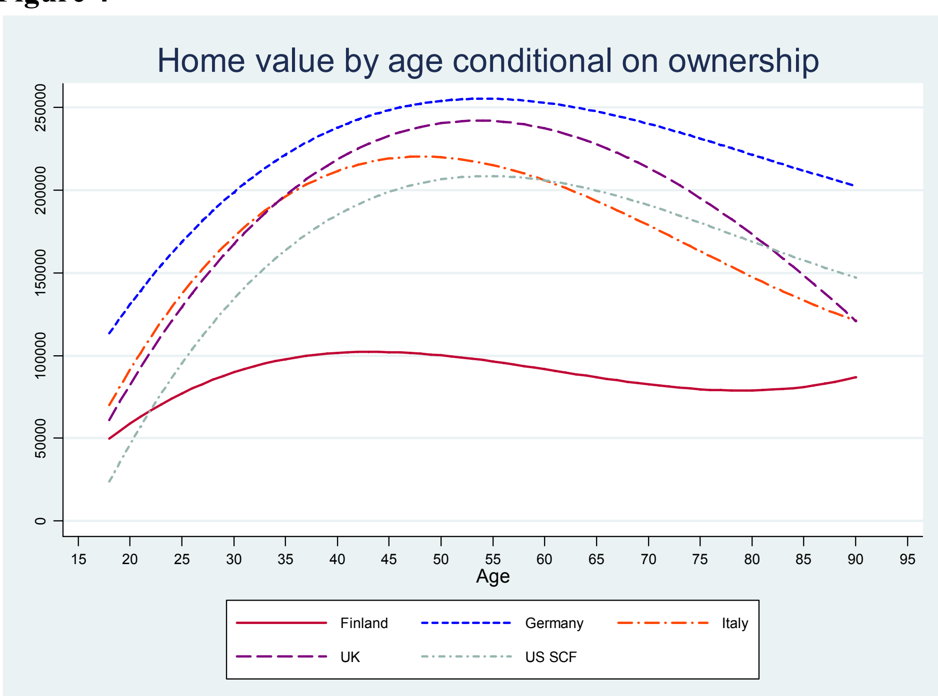


Figure 5

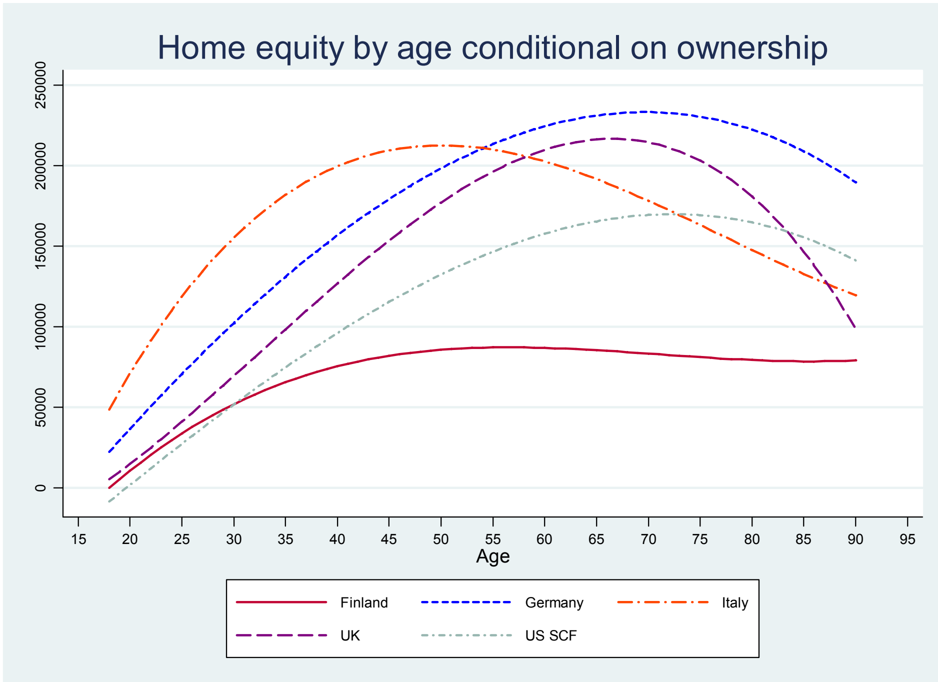


Table 4. Home value and income ratios by income quantiles for homeowners in the selected sample.

Income quantiles			Finland	Germany	Italy	UK	US
	1	Mean	4.06	15.26	15.44	12.15	8.11
		Median	3.54	12.46	13.11	7.87	6.00
		ranking	5	2	1	3	4
	2	Mean	3.05	8.46	7.95	5.14	3.57
		Median	2.80	8.15	7.61	4.27	2.98
		ranking	5	1	2	3	4
	3	Mean	2.61	6.91	7.25	3.92	3.07
		Median	2.39	6.44	5.64	3.44	2.89
		ranking	5	1	2	3	4
	4	Mean	2.65	5.64	5.62	3.88	2.66
		Median	2.49	5.22	4.68	3.33	2.26
		ranking	4	1	2	3	5
	5	Mean	2.43	4.73	3.89	3.33	2.65
		Median	2.42	4.45	3.98	2.99	2.35
		ranking	4	1	2	3	5

Next we look at home value-income ratios by income quantiles for homeowners, which is an indicator for home affordability. We divide the income distribution into quantiles and within these quantiles calculate mean and median home values and incomes for homeowners. The ratios of these values are presented in the following table. First, we find that the housing wealth/income ratios diminish for all countries as we move up the income distribution. Second, the rankings across countries in terms of the highest home value to income ratios are quite consistent across the quantiles with Germany and Italy exhibiting the highest ratios (being the least affordable), followed by the UK and the US and Finland. The highest ratios are in countries with the highest home values and lower incomes, the lowest where there are lower incomes and low home values. The wealth-income ratios are quite similar in all countries for the top quantile.

4.2. Institutions

Homeownership is substantially affected by the country-specific institutions and various market regulations. We next discuss the main institutions that affect housing and mortgage markets in the countries under analysis and discuss the implications they are likely to have in explaining the documented homeownership and mortgage take-up differences.

The tax system has a substantial impact on the incentives to purchase a home, to finance the purchase through a mortgage, as well as an impact on transaction costs related to housing turnover, i.e. the conditions of buying and selling one's home. In addition to the general wealth and property taxes, there are taxes and implicit tax treatments that directly affect homeownership. Compared to other forms of housing, homeowners benefit from not paying rent and from increases in the value of their homes. The neutral tax treatment implies that imputed rent be taxed as additional income and capital gains (i.e. home value appreciation) be subject to capital gains tax. This is, however, rarely the case, suggesting that most of the tax system implicitly favor homeownership over renting. In addition, in some cases mortgage interest payments are fully deductible.[9]

As reported in Table 5, none of the countries we analyze, imputed rents are taxed. In Italy, however, this is the case only for principal owner-occupied dwellings. While, capital gains on housing assets are taxable in all five countries, most of the principal homes of long term homeowners are exempt from this tax. The only exception is Italy, where while the owner-occupied homes are not exempted, they are subject only to 50 % of the value. There are differences across countries in the definition of the long term occupancy, ranging from more than 2 years ownership in Finland and the US[10] to 10 years in Germany. In the UK, all owner-occupied homes are exempt from the capital gain tax. Mortgage interest payments are tax deductible in Finland, Italy and the US but there is no tax relief on the interest payments in Germany and the UK.

In this paper, we focus on the degree of development of the mortgage market as a crucial determinant of homeownership. Mortgage market maturity depends on the general legal environment (such as the contract enforcement, judicial efficiency, collateral and bankruptcy laws), and on credit information availability and information sharing on one hand, and on the direct mortgage market regulations on the other. More specifically, the first three rows of Table 5 referring to enforcing contracts, report the number of procedures from the moment the plaintiff files a lawsuit in court until the moment of

[9] In our case, this applies to landlords in Finland and in the US.

[10] This was the case in the US until 2002.

payment, the time in calendar days required to resolve a dispute, and the cost of court fees and attorney fees expressed as a percentage of debt. According to all three criteria, in Italy, contract enforcement is by far the most difficult among the five countries. Germany follows, in terms of the number of procedures, time and then the direct cost. The rest of the countries fare similarly well, with Finland having more procedures but the lowest cost, while the UK and the US exhibit the opposite.

In the next section of Table 5 on getting credit, the legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index includes 7 aspects related to legal rights in collateral law and 3 aspects in bankruptcy law. The index ranges from 0 to 10, with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit.[11] The legal environment is the most favourable to lending in the UK, then Germany, the US, Finland and finally, again the least favourable in Italy.

The next three rows indicate the coverage, scope, quality and accessibility of credit information available through public and private credit registries. Credit Information Index ranges from 0 to 6, with higher values indicating the availability of more credit information.[12] Credit information is somewhat less available in Italy and Finland than in the other countries, in terms of both the index and the coverage. The index of mortgage market regulations in a straightforward manner ranks the countries from Italy with the most regulated mortgage market, followed by Germany and Finland, to the US and the UK with the most deregulated mortgage market.

The mortgage market characteristics are consistent with the analyzed institutional and regulatory environments. Mortgage market development, as measured by overall mortgage take-up, and the dependence of mortgage on household income, closely corresponds to the degree of mortgage market regulation in the five countries: countries with the most regulated mortgage markets such as Italy and Germany have the least developed mortgage markets.

In the five countries we analyze, one clear pattern emerges from the institutional information that we survey: the legal as well as regulatory environment in Italy are by far the least favorable for the development of the mortgage market, while those in the UK are the most supportive. While the legal institutions and information sharing possibly facilitates lending in Germany, the strong mortgage market regulations work in the opposite direction.

Less regulated markets are likely to be more competitive and offer greater variety and flexibility. As regards to collateral requirements and the mortgage length, reported in Table 5, the typical loan to value ratio and the duration ranges from 78 % and 30 years in the US, to 55 % and 15 years in Italy. The mortgage market completeness index describes the supply side of the mortgage markets both in terms of the range of products offered, the choice of the alternative repayment schemes and the period over which interest rates are fixed. It also contains information on the typical age, income and economic status of the borrowers that are granted mortgage. The much lower value of the index for Italy and Germany (57 and 58 respectively) suggest a rather limited supply of mortgages when compared to the UK (value 86).[13]

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[11] See Appendix for details.

[12] See Appendix for details.

[13] Unfortunately, comparable index is not available for Finland and the US.

Table 5

	Finland	Germany	Italy	UK	US
Tax System					
Tax on Imputed Rents	N	N	N*	N	N
Tax on Capital Gains	Y < 2 yr	Y < 10 yr	Y **	Y***	Y < 2yr
Enforcing contracts					
Procedures (number)	27	30	40	19	17
Time (days)	228	394	1210	229	300
Cost (% of debt)	5.9	10.5	17.6	16.8	7.7
Getting Credit					
Legal Rights Index	6	8	3	10	7
Credit Information Index	5	6	5	6	6
Public registry coverage (% adults)	0	0.5	7	0	0
Private bureau coverage (% adults)	14.9	93.9	67.8	86.1	100
Mortgage Market Regulation	0.5	0.7	0.9	0.1	0.3
Mortgage Market Terms					
Loan-to-value ratios (%) Typical	75	67	55	69	78
Loan-to-value ratios (%) Maximum	80	80	80	110	NA
Typical loan term (years)	15-18	25-30	15	25	30
Mortgage Market Completeness	NA	58	57	86	NA
Mortgage and Housing Market Characteristics					
Share of owner-occupied housing (%) in approx. 2002	58	42	80	69	68
Residential mortgage debt in % of GDP in 2002	31.8	54	11.4	64.3	58

Source: http://www.doingbusiness.org/; Catte et al.(2004); Jappelli and Chiuri (2007); Tsatsaronis and Zhu (2004); * Not for principle owner-occupied homes. ** 50 % of the value for principal
*** Yes, but primary owner-occupied dwellings are exempted.

The aggregate housing and mortgage market characteristics reported in the last two rows seem to be consistent with the institutional environments described. The aggregate homeownership rates follow the same ranking as the share of residential mortgage debt in GDP and also correspond to the legal and regulatory conditions in the five countries. The UK with the most favorable and the least regulated conditions has the highest homeownership rate of 69 % and the 64.4 share of debt in GDP, whereas Germany with one of the most regulated and least developed mortgage markets has the lowest homeownership rate of 42 %. The only country for which the homeownership rate does not correspond to its mortgage take up ranking is Italy. While Italy, with the most regulated mortgage market and least favorable conditions has indeed the lowest share of debt in GDP of 11.4 %, it has the highest occupancy rate of 80 %. This finding is consistent with our aggregate figures for the young households. It confirms that in Italy housing is fairly independent of the mortgage market, due to other means of home acquisition such as family transfers and passing of the property from generation to generation.

In the policy section of the paper we also discuss to what extent other institutions, such as labor market regulation and housing subsidies can be related to the observed cross-country differences in homeownership. For example, employment protection and the variation in the length of the employment contracts of the young individuals are likely to affect the decisions of credit institutions to grant a mortgage.

5. Results

5.1. Distribution of Homeownership across Household Income Deciles

Next, we look at the variation of homeownership across the income distribution. We find a wide variation of rates as we move up the income distribution. The biggest range is in Finland (from 9% in the lowest decile to 90% in the highest) and the lowest in Italy (from 40% in the lowest decile to 74% in the highest). Across all the decile we find the highest homeownership in the top decile. The highest in the UK (92%) followed by Finland (90%), the US (87%), Italy (74%) and Germany (60%).

Table 6a. Homeownership by income deciles.

Income Deciles	Finland	Germany	Italy	UK	US	Total
1	0.092	0.053	0.404	0.338	0.133	0.132
2	0.278	0.075	0.397	0.365	0.200	0.184
3	0.314	0.100	0.405	0.500	0.284	0.249
4	0.472	0.112	0.511	0.602	0.295	0.270
5	0.472	0.160	0.410	0.597	0.414	0.361
6	0.612	0.297	0.590	0.784	0.516	0.481
7	0.692	0.337	0.597	0.810	0.705	0.636
8	0.779	0.389	0.593	0.797	0.686	0.631
9	0.788	0.520	0.541	0.851	0.878	0.790
10	0.898	0.593	0.736	0.919	0.871	0.788
Total	0.433	0.214	0.509	0.639	0.479	0.424

P(H=1)>50%
P(H=1)>mean(country)

Using the table above we next identify at which stage in the income distribution the probability of becoming a homeowner exceeds 50%. This is highlighted with the light shading. As expected this occurs fairly early in the income distribution in a country with high ownership rates (the UK) and fairly late in the distribution in a country with low ownership rates (Germany). For the other countries this occurs in the 6th decile. We also determine when the probability of ownership exceeds the country average. This happens in the 4th decile in Finland and Italy and in the 6th decile in the other countries.

Table 6b. Mortgage by income deciles

Income Deciles	Finland	Germany	Italy	UK	US	Total
1	0.052	0.024	0.028	0.319	0.062	0.048
2	0.231	0.058	0.084	0.326	0.153	0.124
3	0.290	0.075	0.165	0.470	0.193	0.165
4	0.364	0.100	0.102	0.570	0.236	0.194
5	0.411	0.135	0.114	0.573	0.340	0.279
6	0.567	0.240	0.188	0.778	0.500	0.427
7	0.686	0.304	0.144	0.775	0.660	0.562
8	0.736	0.355	0.228	0.837	0.628	0.554
9	0.751	0.485	0.246	0.829	0.853	0.742
10	0.817	0.556	0.364	0.911	0.861	0.727
Total	0.386	0.185	0.157	0.621	0.427	0.352

P(M=1)>50%
P(M=1)>mean(country)

Next, we examine whether the mortgage take-up among homeowners is evenly distributed across the income distribution. An even mortgage distribution would suggest that credit constraints are not binding, as access to credit is not limited by the current income. This is found to be the case in the UK, where mortgage take-up is nearly 90% throughout the income distribution. In the other countries there is more variation in the mortgage take-up, but in all countries except Italy it exceeds 80% past the 3rd and 4th decile. In all countries mortgage take-up increases as we move up the income distribution. Italy is the only country where this is not the case and there is a lot more variation.

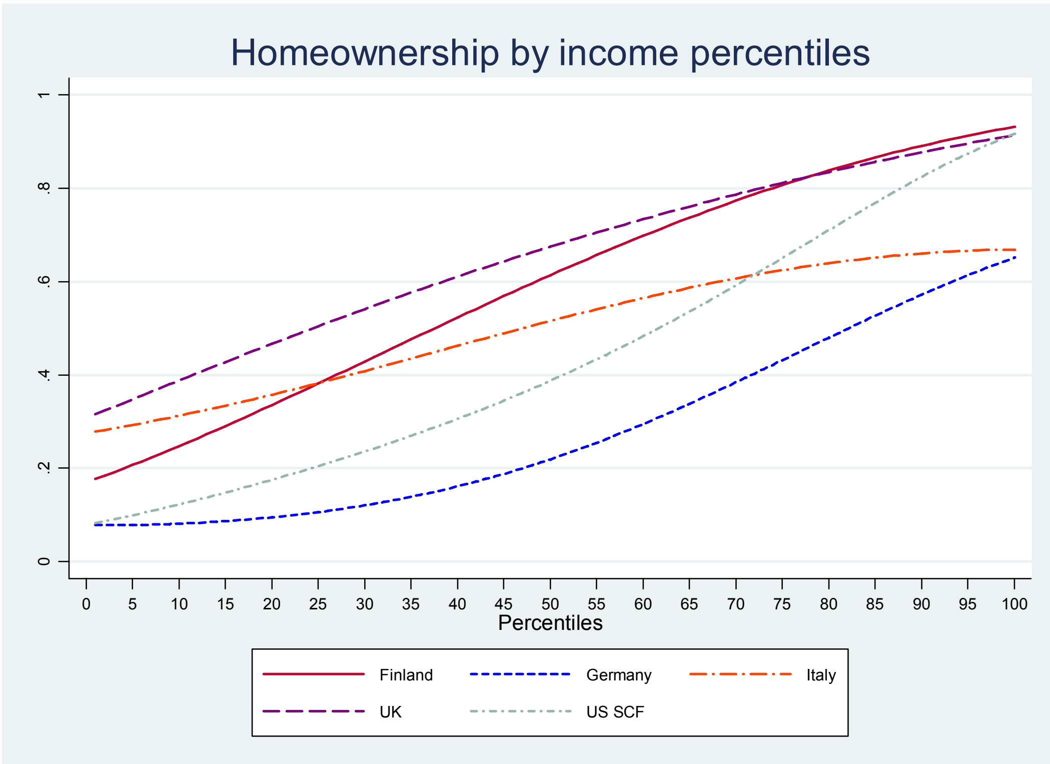
Table 6c. Mortgage among homeowners by income deciles

Income Deciles	Finland	Germany	Italy	UK	US	Total
1	0.545	0.447	0.061	0.897	0.465	0.366
2	0.749	0.768	0.155	0.893	0.714	0.624
3	0.834	0.731	0.407	0.894	0.679	0.657
4	0.741	0.786	0.2	0.932	0.802	0.707
5	0.836	0.814	0.251	0.943	0.823	0.767
6	0.806	0.762	0.316	0.988	0.971	0.88
7	0.892	0.893	0.234	0.947	0.936	0.881
8	0.903	0.903	0.378	0.995	0.916	0.876
9	0.845	0.924	0.43	0.95	0.971	0.935
10	0.858	0.929	0.418	0.962	0.989	0.911
Total	0.82	0.845	0.288	0.947	0.889	0.825

P(M=1/H=1)>50%
P(M=1/H=1)>mean(country)

To examine homeownership profiles across the income distribution for the whole population (Figure 6), we use a smoothing technique, which regresses homeownership on a third-order indicator for income percentiles Finland has the steepest profile and Italy is at the other extreme with the flattest profile throughout the income distribution. In terms of homeownership rates the highest are in the UK and the lowest in Germany at nearly all percentiles. This closely resembles the results for the younger population only.

Figure 6



5.2. Homeownership-income inequality measures

In order to pin point the differences in the distribution of homeownership across income we reach for a few summary inequality measures. First, we look at decile ratios for homeownership. Clearly, the highest differences between the 90th and 10th percentile are in Germany, Finland and the US**.** In Finland and the US more of the differences are taking place between the bottom decile and the median then between the top decile and the median. In Germany and the other countries it is more or less evenly distributed between the top and the bottom of the distribution.

Table 7a. Homeownership-inequality measures

Income Deciles	Finland	Germany	Italy	UK	US
P90/p10	8.57	9.81	1.34	2.52	6.60
P90/p50	1.67	3.25	1.32	1.43	2.12
P50/p10	5.13	3.02	1.01	1.77	3.11
Prob. coefficient on log income (not weighted)	1.110	0.960	0.382	0.404	0.964

Table 7b. Mortgage-inequality measures

Income Deciles	Finland	Germany	Italy	UK	US
P90/p10	14.44	20.21	8.79	2.60	13.76
P90/p50	1.83	3.59	2.16	1.45	2.51
P50/p10	7.90	5.63	4.07	1.80	5.48
Prob. coefficient on log income (not weighted)	1.170	1.025	0.511	0.490	1.108

Table 7c. Mortgage-financed home-ownership

Income Deciles	Finland	Germany	Italy	UK	US
P90/p10	1.55	2.07	7.05	1.06	2.09
P90/p50	1.01	1.14	1.71	1.01	1.18
P50/p10	1.53	1.82	4.11	1.05	1.77
Prob. coefficient on log income (not weighted)	.315	.444	.261	.268	.703

The inequality rankings in mortgage holdings follow those in homeownership. The only difference is that a majority of the inequality is taking place at the bottom of the distribution, where there is bigger homeownership variation across the income deciles compared to the top half of the income distribution.

For homeowners the inequality in mortgage holding is more or less evenly distributed across the top and bottom of the distribution in all countries except Italy. Here we find more variation among homeowners in the bottom half of the income distribution.

Further we estimate a probit model of the probability of homeownership as a function of log of income and find the strongest effect to be in Finland, Germany and the US. This is also the case when we repeat this exercise for mortgage. The strongest effect of income on mortgage for homeowners is in the US, followed by Germany, Finland, the UK and Italy. The low coefficient in Italy supports the fact that homeownership in this country relies on other means of financing besides mortgages.

5.3. Conditioning on other factors - Marginal effects

In the previous sections, we have focused on the homeownership and mortgage rates and how they are related to household income. We next take also into account other household characteristics to control for other aspects of the probability of home ownership, namely household preferences. We estimate a full probit model of the probability of home ownership and mortgage respectively, as a function of several demographic and economic characteristics of the household, as well as the set of binary indicators for household income deciles. Once again, we are primarily interested in the differences in homeownership and mortgage rates across the income deciles.[14]

Most of the effects of the demographic characteristics are similar across countries and in line with our expectations. When the household head forms a couple, household has children below 15 years old, as well as the household size increase the probability of homeownership (with only few exceptions where the effect is negative but always not significant). Probability of homeownership increases with age but in a decreasing way and the effect is often not significant. The insignificance of some of the demographic variables may be also caused by the substantial homogeneity of our sample of the young.

Education increases the probability of owning ones home. Self-employed are also more likely to own their homes, in particular in Finland, but to some extent in all the countries except for Germany where the effect is not significant. Having financial assets greater than 3000 EUR is associated with higher probability of homeownership in all countries. Interestingly, having other (unsecured) consumer debt decreases the probability of homeownership everywhere except for the US.

The key effects of interest – the marginal effects of being in income decile *n* rather than in the first income decile - are presented in the table below and in Figure 7. The size of the coefficient is the increase in homeownership probability relative to the first income decile. The extent to which they grow across the income deciles (how steep the lines in the figure are) further reveals the inter-decile differences in home ownership.

After controlling for individual specific characteristic, we observe that homeownership is distributed most unequally in the US and Germany, although all other deciles are closer to the first income decile in Germany compared to the US. Finland comes next; while Italy and the UK are have homeownership most evenly distributed across income.

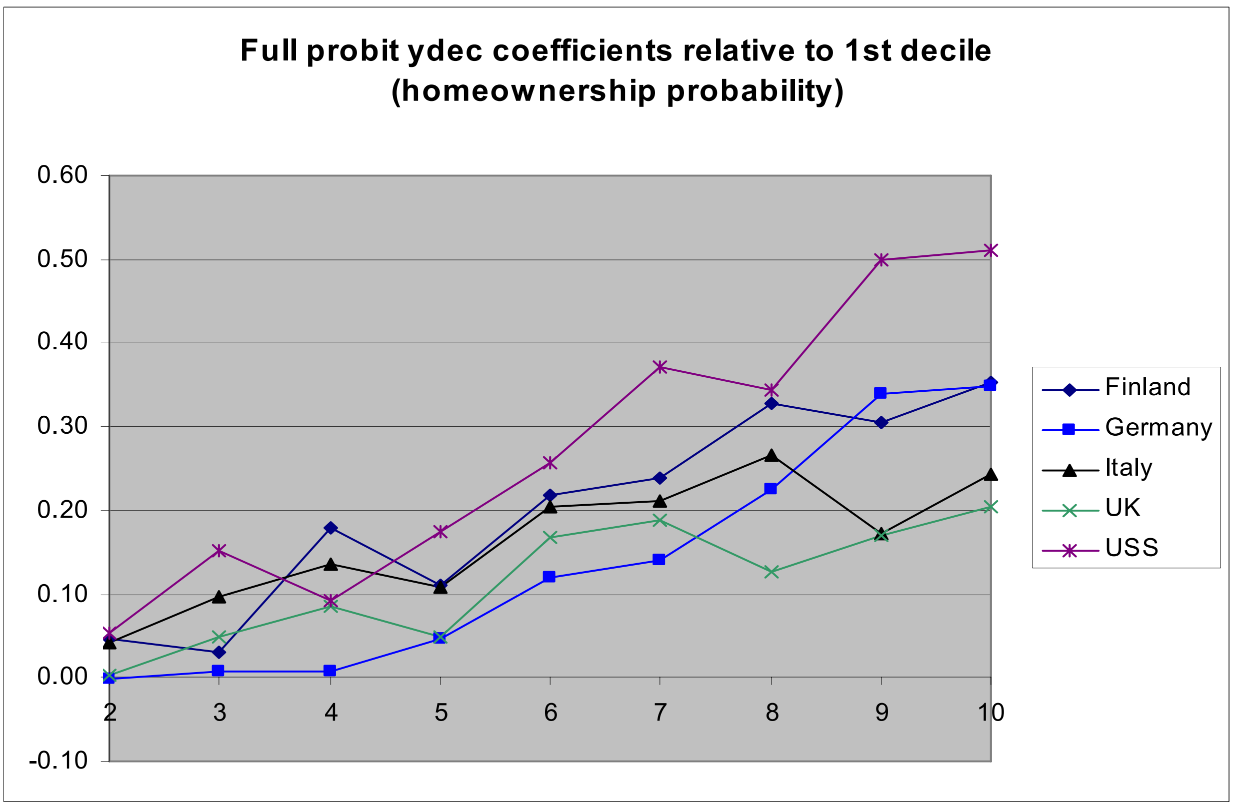
[14] Both probit regression output and marginal effects are available from the authors upon request.

Table 8a. Marginal Effects of Income Deciles - Homeownership

	Finland		Germany		Italy		UK		USS	
	ME	t-st	ME	t-st	ME	t-st	ME	t-st	ME	t-st
d2	0.05	0.65	0.00	0.04	0.04	0.62	0.00	0.05	0.05	0.56
d3	0.03	0.42	0.01	0.18	0.10	1.43	0.05	0.91	0.15	1.75
d4	0.18	2.88	0.01	0.20	0.14	2.05	0.09	1.64	0.09	1.04
d5	0.11	1.48	0.05	1.10	0.11	1.58	0.05	0.86	0.17	1.98
d6	0.22	3.50	0.12	2.64	0.20	3.16	0.17	3.68	0.26	2.96
d7	0.24	3.93	0.14	2.98	0.21	3.26	0.19	4.23	0.37	4.27
d8	0.33	7.17	0.22	4.59	0.27	4.38	0.13	2.41	0.34	3.91
d9	0.31	5.84	0.34	6.35	0.17	2.46	0.17	3.41	0.50	5.66
d10	0.35	8.67	0.35	6.33	0.24	3.56	0.21	4.22	0.51	5.15

Note: t-statistics in Germany and the US have been corrected for multiple imputations.

Figure 7



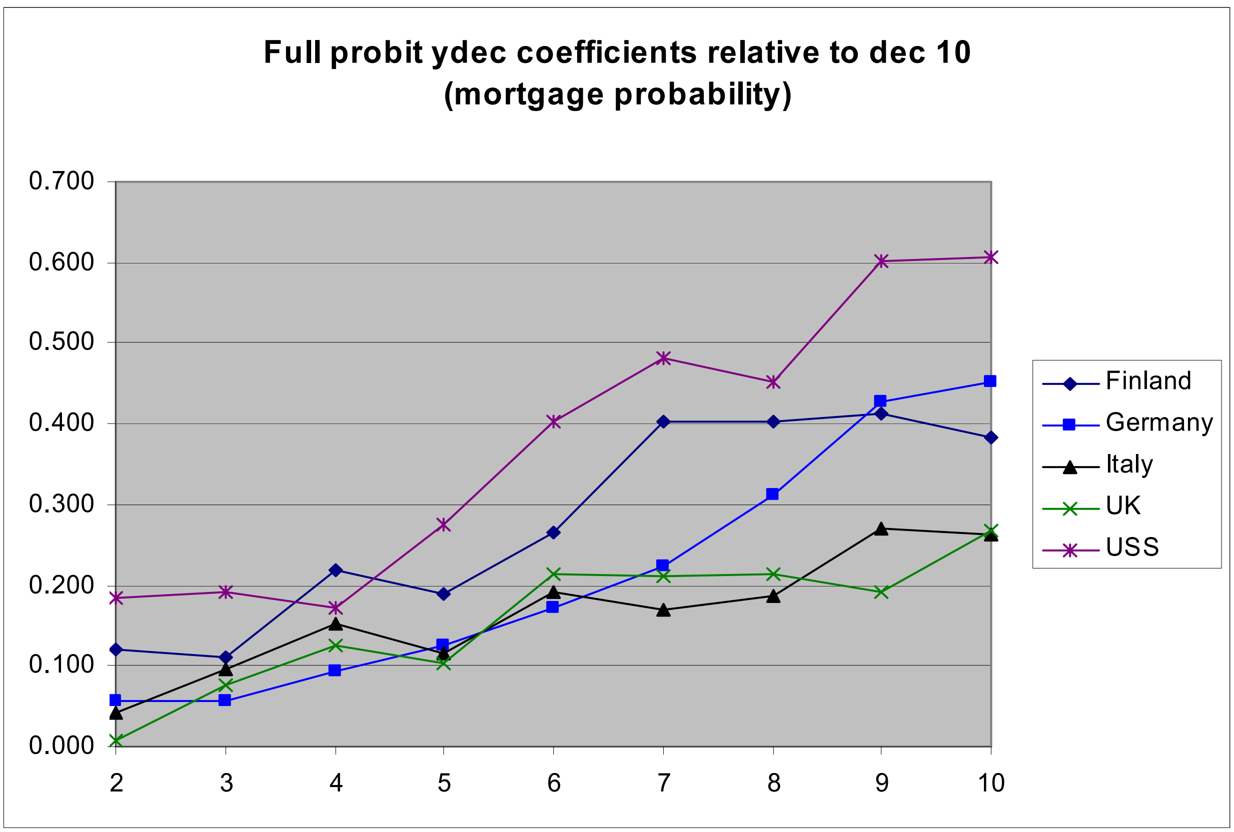
When we focus on the effects of being in particular income deciles relative to the first decile on probability of having a mortgage, the results are fairly similar. As expected, the differences between all deciles (but in particular between the first decile and the rest) increase for most of the countries, as home-ownership sponsored by other funds such as private transfers that may be less dependent on income than being granted a mortgage are ruled out. In addition, in two countries, Italy and Finland, although homeownership probability is highest in the very top decile, the mortgage probability is smaller than in the ninth decile, possibly suggesting that individuals with very high income have also greater access to other resources (wealth, private transfers) to become home owners.

Table 8b. Marginal Effects of Income Deciles – Mortgage Probability

	Finland		Germany		Italy		UK		US S	
	ME	t-st	ME	t-st	ME	t-st	ME	t-st	ME	t-st
D2	0.12	1.47	0.06	1.19	0.04	0.62	0.01	0.12	0.19	1.75
D3	0.11	1.33	0.06	1.18	0.10	1.28	0.08	1.37	0.19	1.79
D4	0.22	2.77	0.09	1.92	0.15	1.91	0.12	2.42	0.17	1.68
D5	0.19	2.25	0.13	2.57	0.12	1.51	0.10	1.89	0.27	2.70
D6	0.27	3.38	0.17	3.45	0.19	2.29	0.21	4.83	0.40	4.00
D7	0.40	6.45	0.22	4.34	0.17	2.04	0.21	4.69	0.48	4.72
D8	0.40	6.33	0.31	5.81	0.19	2.23	0.21	4.68	0.45	4.52
D9	0.41	6.52	0.43	7.44	0.27	2.97	0.19	3.78	0.60	6.09
D10	0.38	5.56	0.45	7.44	0.26	2.73	0.27	6.29	0.61	5.66

Note: t-statistics in Germany and the US have been corrected for multiple imputations.

Figure 8



5.4. Decomposition of the Key Determinants -Counterfactual Predictions

Finally, we try to identify the cross-country differences in household characteristics (right hand side variables) from the cross-country differences in the effect of these characteristics (coefficients and marginal effects), in order to reveal how the two of them contribute to explaining the cross-country variation in home ownership and mortgage rates. We do so by simulating counterfactual predictions of the home ownership rates and mortgage rates, using the household characteristics from one country and combining them with the coefficients - estimated in the full probit model – from another country. Table 9a and 9b show the results. While rows correspond to the household characteristics from the country specified in the first column, columns correspond to the respective sets of country-specific coefficients, with the exception of the first column that gives the actual homeownership rate in each of the countries for comparison. The fit of our models can be read from the table by comparing the true value with the corresponding cell where household characteristics and estimated coefficients from the same country are combined, yielding the prediction of the model.

Table 9a – Counterfactual Predictions – Home-ownership

Xs	TRUE	Xbhat(FI)	Xbhat(GE)	Xbhat(IT)	Xbhat(UK)	Xbhat(US)
Finland	0.433	0.459	0.195	0.404	0.662	0.366
Germany	0.214	0.394	0.228	0.386	0.605	0.258
Italy	0.509	0.642	0.288	0.499	0.772	0.535
UK	0.639	0.489	0.221	0.393	0.644	0.423
US	0.481	0.521	0.223	0.428	0.67	0.438

Notes: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights,

First, we observe, that although the UK has the highest actual home ownership rates, it is the household characteristics in Italy that lead to the highest predicted counterfactual rates when combined with coefficients from other countries. In other words, Italian household have the highest predicted home ownership regardless in which countries (environments, institutions, mortgage markets and housing markets) they are. US households come next (except in Germany), while the ranking of the UK and the Finish households alternate. German households, on the other hand, have the lowest predicted home ownership rate everywhere except for Germany.

In terms of the effect household characteristics have in different countries, as reflected by the estimated coefficients, we find that the predicted homeownership rates are the highest in the UK for households from all five countries. It is interesting to observe, that it is Finland that follows. It is the "unfavorable" ranking of the homeownership-enhancing household characteristics in Finland (compared to other countries) that is responsible for the observed Finish home ownership rate ranking only fourth. In terms of the environments and institutions, Finland ranks as second. The opposite holds for the US, where household characteristics are more favorable, while regime ranks as third or fourth. Germany is at the other end of the spectrum: no matter what the household characteristics are (irrespective of the country), any of the five samples reaches the lowest homeownership rate in Germany.

In addition, it is interesting to notice that in the case of Germany, favorable household characteristics do relatively better in unfavorable regime, as German households rank second in Germany after Italy.

To summarize, we find that while it is the Italian households that are –in terms of their characteristics - most likely to own their homes, it is in the UK where the regime is the most favorable. In Germany, both household characteristics and the regime is the least favorable. While household's characteristics in Finland are relatively less favorable than in the US, Finish regime fares better than the one in the US, so the ranking of the two countries vary in these two respects. The regime in Italy on the other hand is comparable to that of the US, and fares better for Finish and German households but worse for the US and the UK.

We conclude that although household characteristics play some role in explaining the observed (and predicted) variation in home ownership rates across the five countries, it is mostly the country specific effects (market evaluations) of these characteristics determined by the institutional environment as well as the functioning of the housing and mortgage markets that drive the main result (i.e. the observed ranking of the five countries).

Table 9b – counterfactual predictions – has mortgage

Xs	TRUE	Xbhat(FI)	Xbhat(GE)	Xbhat(IT)	Xbhat(UK)	Xbhat(US)
Finland	0.386	0.397	0.159	0.129	0.624	0.318
Germany	0.185	0.381	0.194	0.107	0.577	0.227
Italy	0.157	0.479	0.229	0.164	0.719	0.463
UK	0.620	0.434	0.187	0.131	0.624	0.378
US	0.429	0.46	0.187	0.149	0.646	0.391

Notes: Estimation Sample (head and spouse 18-40 years old, extremely rich individuals excluded), Weighted with sample weights,

We next look at the respective roles of household characteristics and country specific regimes in the variation in the mortgage rates. Interestingly, characteristics of the Italian households again yield the highest mortgage rates despite the fact that Italy has the lowest actual mortgage rate among the five countries. The ranking of the other countries in terms of the effect of the different household characteristics is also the same as for the home ownership rate. In terms of the regimes, the UK coefficients are again the most favorable. The second most favorable regime is again in Finland, but the unfavorable household characteristics bring the country in the ranking of the actual mortgage rate behind the US, where the regime and the characteristics rank again in the opposite way than in Finland. The Italian regime however is now the least favorable to the mortgage take up, followed by the German one. To summarize, with the exception of the Italian regime, the results in the last two tables give similar answers.

6. Policy Implications

Our findings suggest that in four out of the five countries, mortgage is the key financial tool used by young households to purchase their homes. In these countries the observed homeownership rates, as well as, the distribution of homeownership across household income levels are determined by the degree of the mortgage market development. Mortgage market development, as measured by overall mortgage take-up, and the dependence of mortgage on household income, closely corresponds to the degree of mortgage market regulation in the five countries: countries with the most regulated mortgage markets such as Italy and Germany have the least developed mortgage markets.

The legal environment, such as contract enforcement and judicial efficiency, and information sharing are also crucial for the development of the mortgage market.

Integration of the European mortgage markets, one of the topics widely discussed at the European Commission (see for example European Commission 2006), presupposes harmonization of the mortgage market regulation across its member countries. Such harmonization would require substantial mortgage market deregulation in countries like Italy or Germany, when compared to their current regulatory environment.

In the section below we will discuss possible policy implications of our findings in light of further deregulation and integration of the mortgage market on homeownership, geographical labor mobility and labor contracts.

Homeownership rates and homeownership-income inequality

It is likely that deregulation and opening up of the mortgage markets will increase the overall access and access across income levels of young households to mortgage loans. Based on our findings, we expect further mortgage market development in countries with less developed mortgage markets to increase homeownership rates and reduce homeownership income inequality among young households. Our results suggest that mortgage market integration will enhance convergence of homeownership rates and homeownership income inequality across countries. However, as our findings point out, it is not only the mortgage market regulation and legal environment which affect mortgage market development. Demand for homeownership and therefore the need for mortgages also depends on other aspects of the housing market such as alternative forms of housing and how their costs compare with the price of homeownership. The analysis of the five substantially different countries undergone in this paper enables us to lay down, discuss and assess the likely impact of these additional factors as well.

The effect of mortgage market development resulting from mortgage market integration is therefore likely to differ across countries. While in Germany, a fairly developed (and regulated) rental market offers renting as an attractive alternative to homeownership (Ditch et al 2001), this is not the case in Italy, where the major housing alternative of the young individuals is to postpone marriage and household formation and stay with parents until they accumulate necessary savings or until they acquire homes from parents in the form of transfers. As a result, as suggested by Martins and Villanueva (2006), the effect of increased mortgage availability on nest leaving is expected to be particularly high in the Southern European countries. Besides the relative cost of homeownership and renting within the considered countries, cross-country differences in housing prices relative to average income (house affordability) will be both affected by but also will itself alter the impact of the integration of mortgage markets on homeownership rates and their distribution across income particularly at the bottom of the income distribution where these differences are the greatest (see Table 4 on housing affordability and Table 6a on homeownership across income deciles).

Geographical mobility and labor market

It is not straightforward what effect would mortgage market deregulation, increased mortgage availability and a subsequent increase in homeownership have on geographical labor mobility. While a developed mortgage market and a well-functioning housing market is expected to enhance geographical mobility, as is the case in the US, there are microeconomic studies such as (Henley 1998), that find in the case of the unemployed, that homeownership may reduce mobility and therefore preserve regional variation in unemployment. The conditions of the housing market turnover also determine the relationship between homeownership and geographical mobility. High transaction costs in the housing market, for example, reduce home turnover and consequently may reduce geographical mobility.

In our five country study, we see a positive relationship between mortgage financed homeownership and geographic mobility (Table 10). Among the five countries we consider, Italy is clearly the one with the lowest across-region geographical mobility (10 %), while Finland is the highest (36 %). Germany has the second lowest mobility after Italy (19 %). The UK follows with about 25 %. These patterns are confirmed when within EU and outside EU mobility is considered. For comparison over 40% of the US population has been defined as movers (Schachter, Franklin and Perry 2003, Table 1).This shows that in countries with high homeownership rates financed through mortgages we observe high geographical mobility.

Table 10. Past mobility, by destination and by country (%)

	Within city/town or region	Across regions	Within EU	Outside EU
Finland	68	36	5	3
Italy	46	8	2	0
Germany	62	19	5	4
Luxembourg	57	21	14	3
Sweden	70	44	8	5
UK	55	25	7	6

Source: European Foundation for the Improvement of Living and Working Conditions, 2006, Table 2

The most frequent reason for geographical mobility among prime age individuals is moving to a new job. Geographical mobility therefore also reflects labor mobility which is crucial for efficient matching of job searchers to vacancies. As a result, a well-functioning housing market, i.e. market with low transaction cost and high turnover (where it is easy to buy and sell one’s home) is a key prerequisites of labor mobility. Increased access to housing and less frictions to geographical mobility could therefore also result in higher labor market efficiency. When we look at labor mobility across the five countries, they rank exactly the same as when compared to geographical mobility: over 30 % of Italians have never changed their employer after the age of 35, around 20 % of Germans, 14 % of Finns and less than 10 % of British people (see European Foundation for the Improvement of Living and Working Conditions, 2006, Figure 18 and 23). It has been well documented that US has much higher geographical and labor mobility compared to the rest of the countries in our analysis. The important finding is that it is not the homeownership per se that is positively correlated with high geographical and labor mobility but only the mortgage financed homeownership, which does not restrict the location of one’s home, as has been shown for the case of Italy-- the least mobile country, with the smallest mortgage take-up and the second highest homeownership rate in our sample. The effect of mortgage market deregulation on labor mobility and labor market efficiency is once again likely to vary across countries, depending on other housing alternatives. In the presence of high transaction cost of buying and selling one’s home, a substantial rental market (and rent subsidies (Ditch et al

2001)) in Germany may imply that renting enhances higher labor mobility than housing tenure. On the other hand, mortgage market development in Italy that enables homeownership among young individuals, is likely to be crucial for the increase in geographical and labor mobility there.

Cross-border mobility and integrated labor market

While mortgage market development is likely to increase regional mobility within countries, the integration of the mortgage markets is likely to enhance cross-border mobility as well. Immigrants are typically in a worse situation as mortgage market applicants due to for example, the lack of credit history information or shorter labor contract than natives. The latter has also been an issue for young individuals entering the job market, where temporary instead of regular contracts have been offered (see for example Blau and Kahn (2002)). As most of the cross-border mobility within EU takes place among the young households, the increase in mortgage access to the young across countries is likely to enhance the integrated European labor market as well.

7. Conclusion

This paper uses the newly constructed Luxembourg Wealth Study Database to bring detailed evidence on homeownership and homeownership-income inequality among young households in Finland, Germany, Italy, the UK, and the US. We explore the role of mortgage finance in the cross-country variation in homeownership among young households and in the distribution of homeownership across their income. We find that, with the exception of Italy, where family transfers substitute the limited access to credit, the observed patterns of homeownership among young are mostly driven by mortgage take-up as the primary source of finance for a home purchase. Our results show that countries with mature mortgage markets such as the UK, have higher homeownership rates and lower homeownership-income inequality among young households than countries with less developed mortgage markets such as Germany. Even in countries with highly developed mortgage markets, like in the US, homeownership and mortgage availability among the lower income deciles are limited (homeownership rate is distributed more unequally), compared to the UK or Finland. Policies supporting home ownership among young households may then need to target specifically the low-income groups.

Although the small number of countries does not allow us to show any quantitative evidence on the effect of institutions and policies on the homeownership among the young, the observed variation in homeownership rates, mortgage market maturity, and size of the rental market, which the five countries represent, enables us to draw the following qualitative conclusions: Mortgage market regulation hinders mortgage market development, decreases homeownership rates among the young and increases the homeownership-income inequality. As the discussed integration of the European mortgage markets would also involve mortgage market deregulation in countries with limited mortgage availability, it is likely that it will enhance the homeownership rates among the young households there, and therefore lead to further convergence of the homeownership patterns in Europe. The impact of the integration will, however, depend on the housing alternatives available to the young in these countries, namely the size and the terms of the rental market. The discussion about the mortgage market integration and deregulation should therefore also consider these alternatives, and in particular, the current country-specific rental market regulations. If low transaction costs at the housing and mortgage market are assured by the regulatory environment, mortgage market integration may also enhance labor market efficiency through increased within-country and cross-border mobility.

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Appendix

Table A. 1

Country	Home ownership	Mortgage (of all)	Mortgage financing	Sample size
Germany 2002	.408	.193	.477	12308
Finland 1998	.638	.283	.417	3893
USS 2001	.676	.434	.641	4442
Italy 2002	.688	.102	.133	8011
UK 2000	.705	.415	.571	4750

Note: Estimation Sample (Whole population), Weighted with sample weights, Sorted by home-ownership rates

Details of Table 5:

Legal Rights Index

measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index includes 7 aspects related to legal rights in collateral law and 3 aspects in bankruptcy law. A score of 1 is assigned for each of the following features of the laws:
- General rather than specific description of assets is permitted in collateral agreements.
- General rather than specific description of debt is permitted in collateral agreements.
- Any legal or natural person may grant or take security in the property.
- A unified registry operates that includes charges over movable property.
- Secured creditors have priority outside of bankruptcy.
- Secured creditors, rather than other parties such as government or workers, are paid first out of the proceeds from liquidating a bankrupt firm.
- Secured creditors are able to seize their collateral when a debtor enters reorganization; there is no “automatic stay” or “asset freeze” imposed by the court.
- Management does not stay during reorganization. An administrator is responsible for managing the business during reorganization.
- Parties may agree on enforcement procedures by contract.
- Creditors may both seize and sell collateral out of court without restriction.

The index ranges from 0 to 10, with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit.

Credit Information Index

measures rules affecting the scope, accessibility and quality of credit information available through either public or private credit registries. A score of 1 is assigned for each of the following 6 features of the credit information system:

• Both positive (for example, amount of loan and on-time repayment pattern) and negative (for instance, number and amount of defaults, late payments, bankruptcies) credit information is distributed.
• Data on both firms and individuals are distributed.
• Data from retailers, trade creditors or utilities as well as financial institutions are distributed.
• More than 2 years of historical data are distributed.
• Data on loans above 1% of income per capita are distributed.
• By law, borrowers have the right to access their data.

The index ranges from 0 to 6, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions.

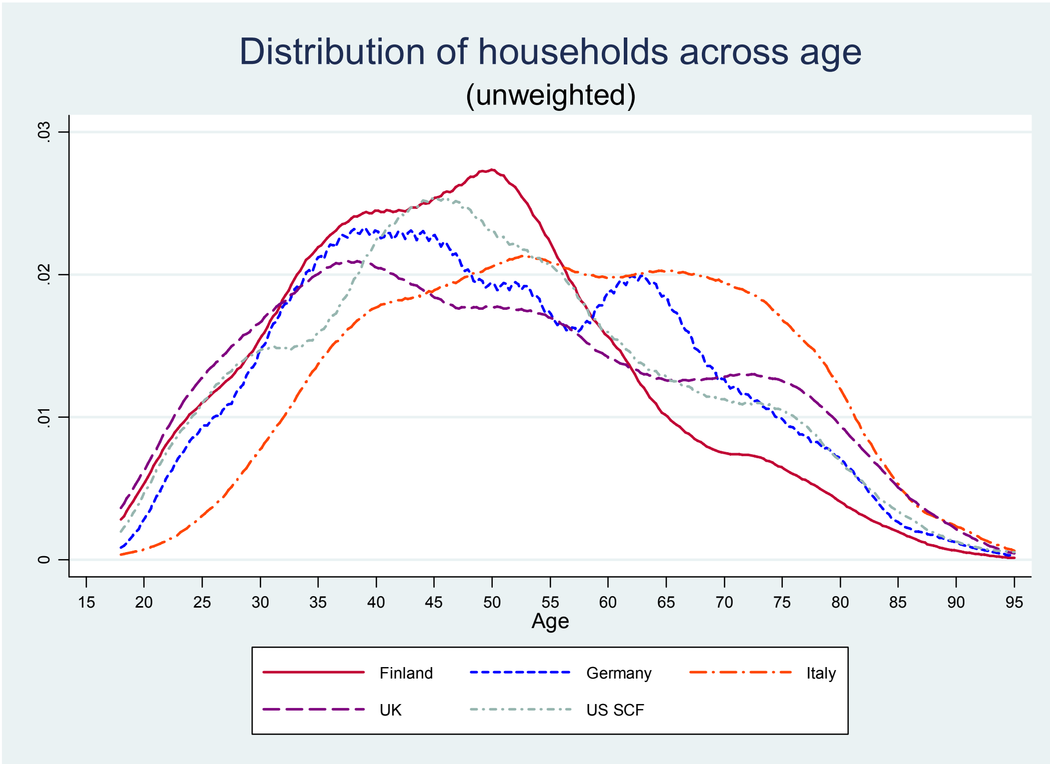
Index of Mortgage Market Regulation

The index score adds one point for fulfilling each of the following five criteria:

- Mortgage rate arrangements are primarily extended on the basis of fixed rate contracts.
- Mortgage equity withdrawal is absent or limited.
- LTV ratio does not exceed 75 %.
- Valuation methods of property is based on historical values, rather than based on market values.
- Mortgage backed securitization is absent or limited.

The index is then normalized to one.

Appendix. Figure A.1



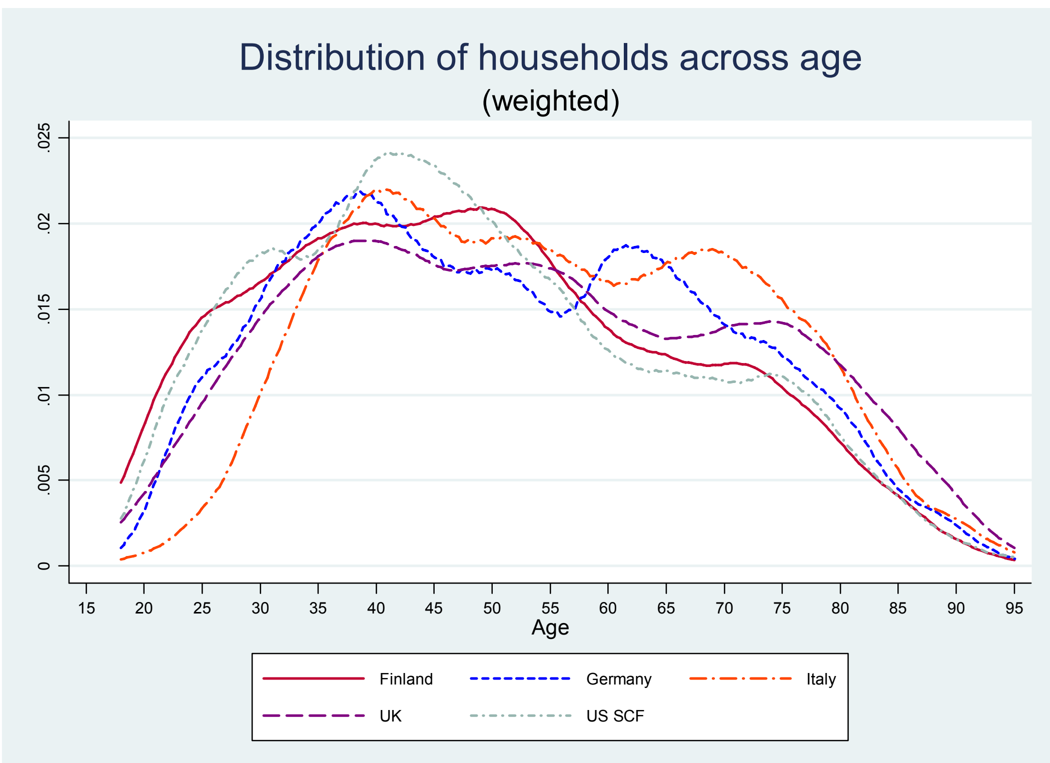
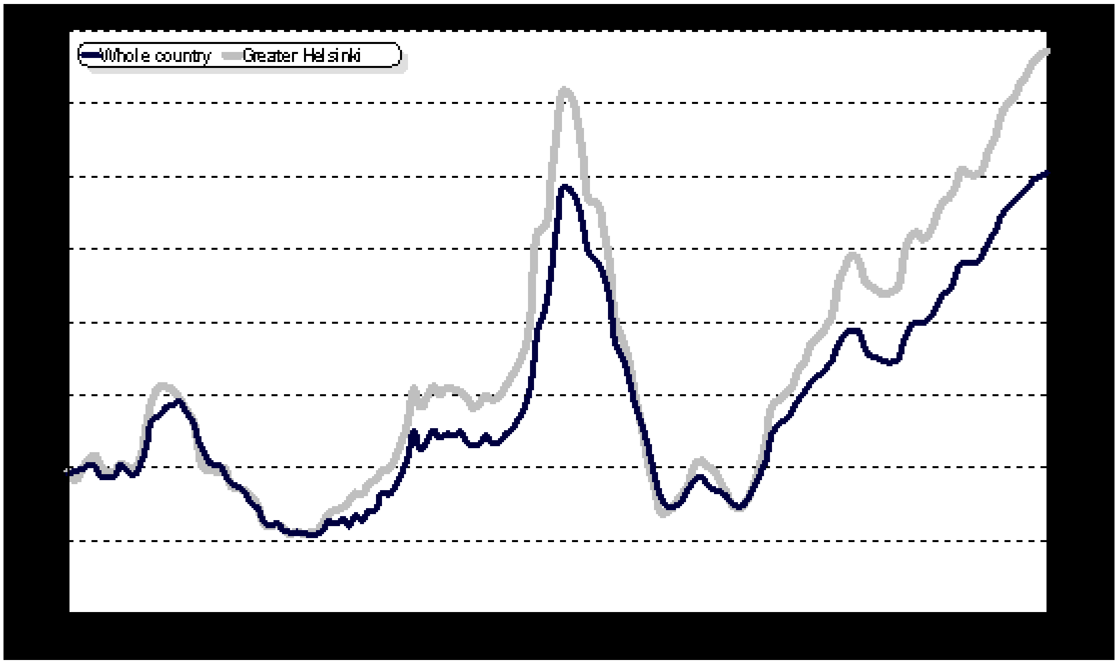
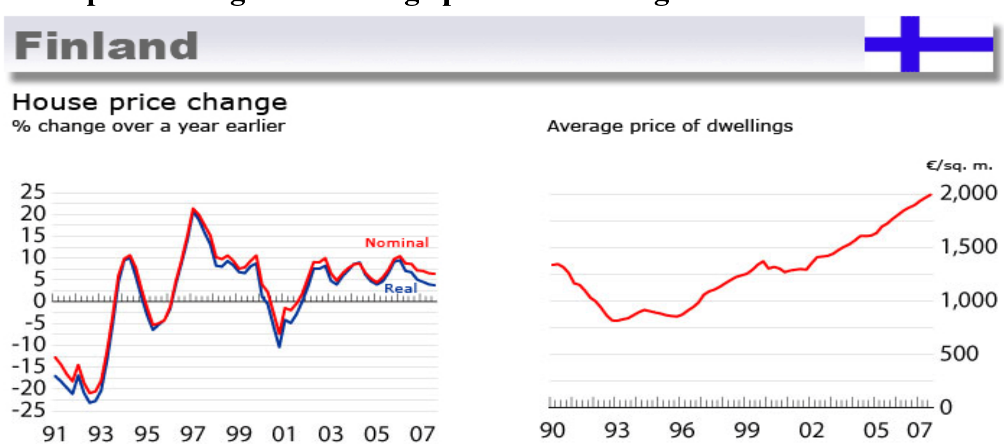


Figure A.2 Real price index of dwellings in old blocks of flats by quarter I/1970-III/2007, 1970=100 (according to the Cost-of-living index) in Finland.



Source: Statistics Finland (http://www.stat.fi/til/ashi/2007/03/ashi_2007_03_2007-10-30_tie_001_en.html)

House price change and average price of dwellings in Finland.



	Q1	Q2	Q3	Q4
2007	2.01	1.66	1.38	
2006	2.09	2.16	1.52	1.18
2005	1.49	3.73	1.59	2.61

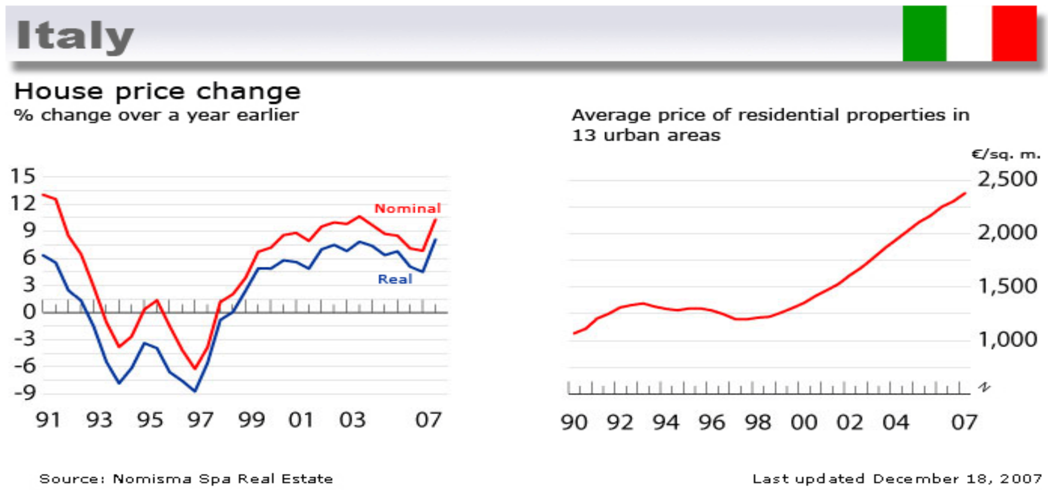
% change over a quarter

Source: StatFin- Online Service

Last updated December 18, 2007

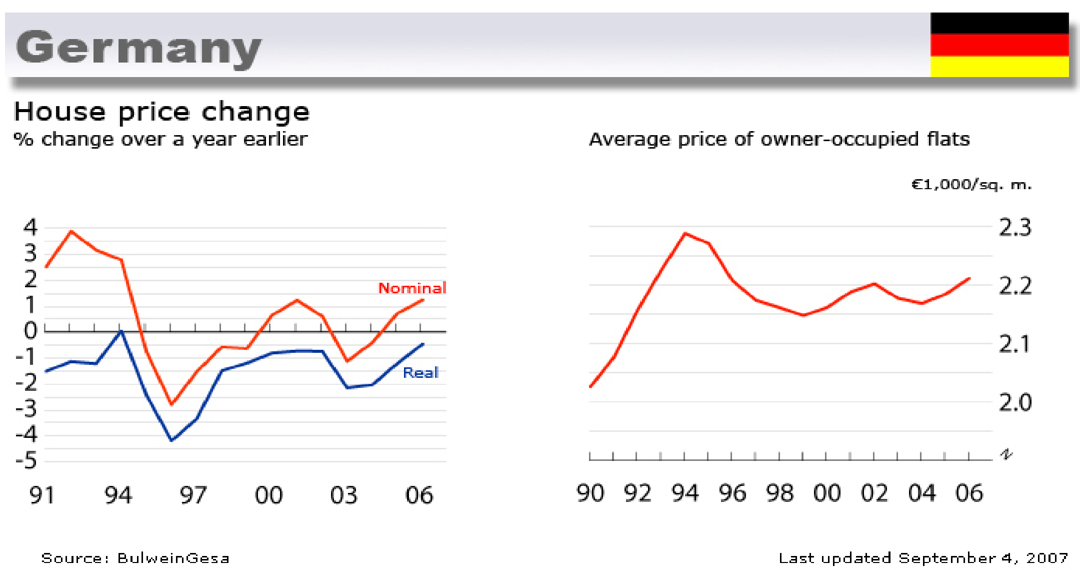
Source: Global Property Guide (http://www.globalpropertyguide.com/real-estate-house-prices/F)

Figure A. 3 House price change and average price of residential properties in 13 urban areas in Italy.



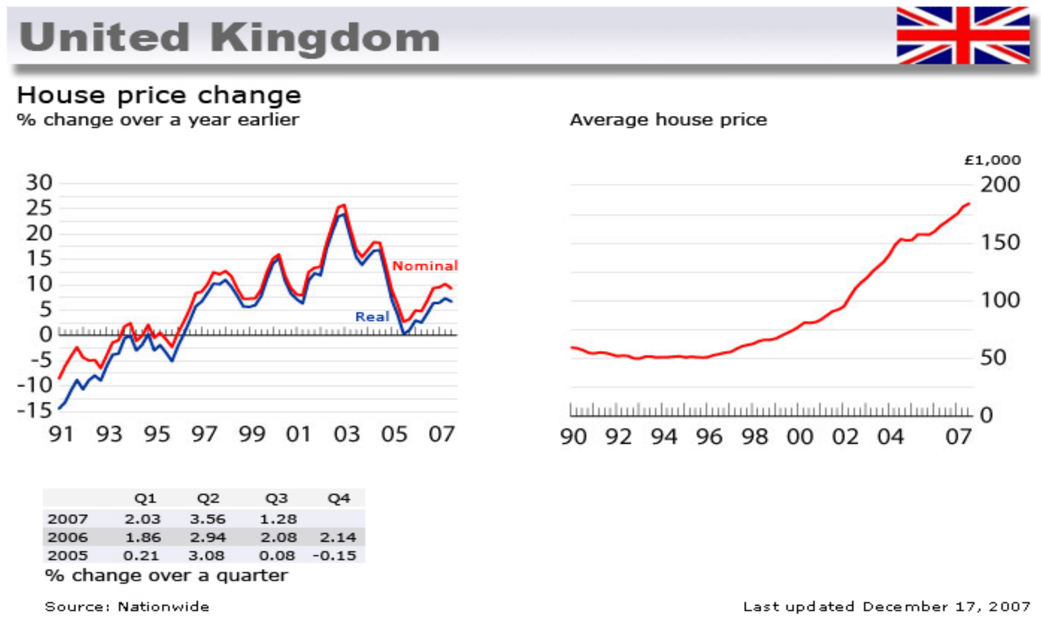
Source: Global Property Guide (http://www.globalpropertyguide.com/real-estate-house-prices/I)

Figure A. 4 House price change and average price of owner-occupied flats in Germany.



Source: Global Property Guide (http://www.globalpropertyguide.com/real-estate-house-prices/G)

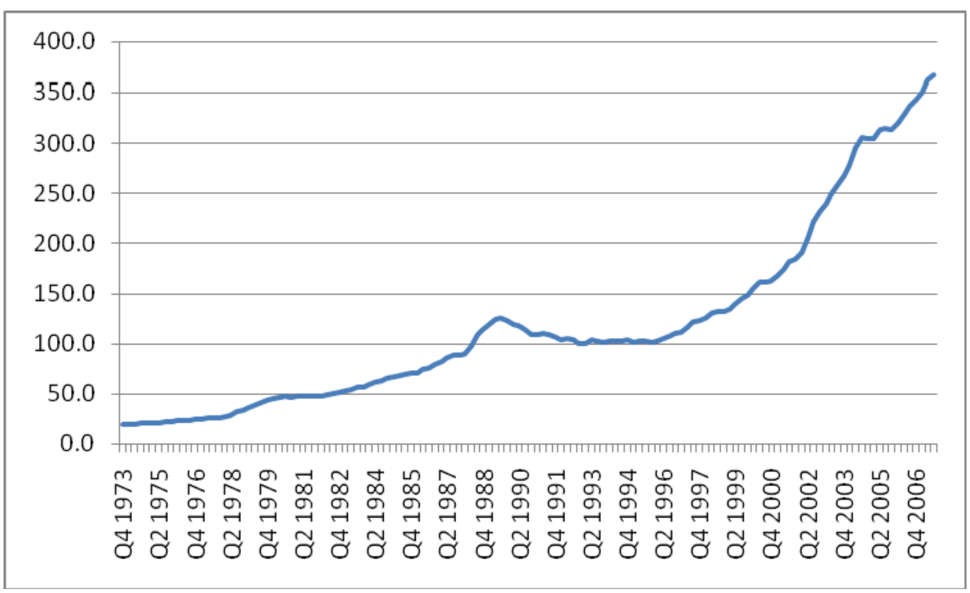
Figure A. 4 House price change and average price of homes in the UK.



	Q1	Q2	Q3	Q4
2007	2.03	3.56	1.28	
2006	1.86	2.94	2.08	2.14
2005	0.21	3.08	0.08	-0.15

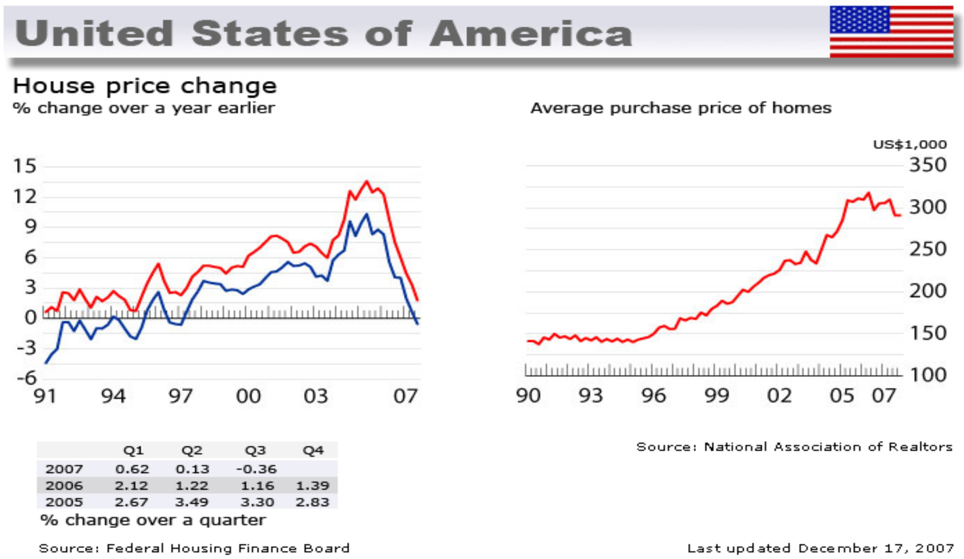
Source: Global Property Guide (http://www.globalpropertyguide.com/real-estate-house-prices/U)

Housing Price Index Series in the UK IV/1973-IV/2006.



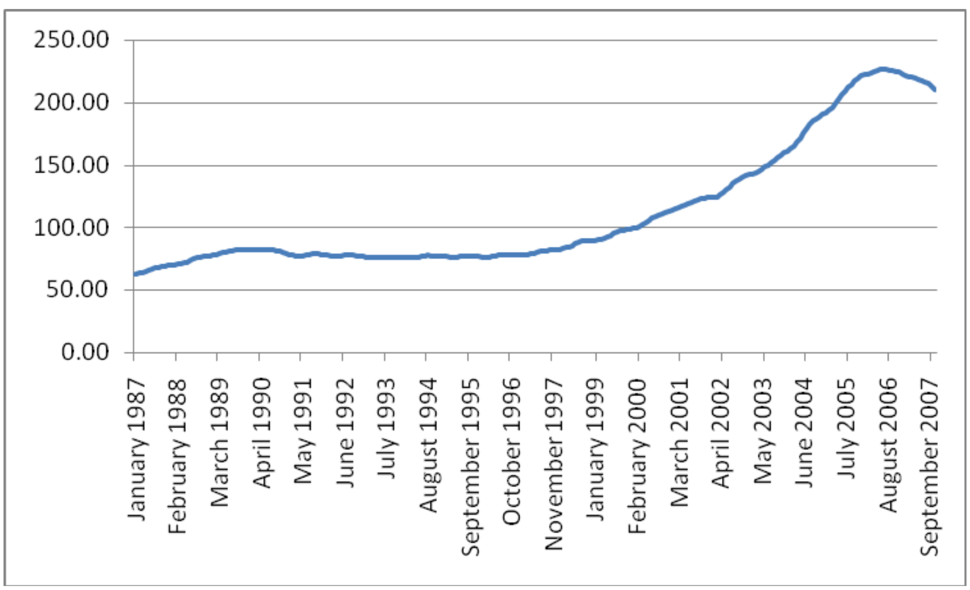
Source: Nationwide (http://www.nationwide.co.uk/hpi/default.asp)

Figure A.6 House price change and average purchase price of homes in the United States.



Source: Global Property Guide (http://www.globalpropertyguide.com/real-estate-house-prices/U)

Housing Price Index Series in the US 1987-2007.



Source: S&P/Case-Shiller® Home Price Indices (http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_csmahp/2,3,4,0,0,0,0,0,0,0,0,0,0,0,0,0.html)