Working Paper

INTERNATIONAL MONETARY FUND

IMF Working Paper

WP/97/3

INTERNATIONAL MONETARY FUND

European I Department

Do Labor Market Policies and Growth Fundamentals Matter for Income Inequality in OECD Countries? Some Empirical Evidence

Prepared by Patrick Vanhoudt[1]

Authorized for distribution by Martin Fetherston

January 1997

Abstract

Income distribution may be related to fundamentals affecting economic growth and to labor market policies. Noting that inequality is affected by unemployment. This paper presents a model in which labor market policies affect unemployment which in turn affects inequality. The model also includes the effects of changes in per capita income on inequality through the accumulation of physical capital and technological know–how. When a resulting reduced–form relationship is estimated, its explanatory power is surprisingly high: on average, it explains about three quarters of the variation in inequality measures for the OECD countries, and Granger Causality tests confirm the model's predictions.

JEL Classification Numbers:
D30, E62, H30, O40

DSE.VANHOUDT.P@ALPHA.UFSIA.AC.BE

---

[1]Patrick Vanhoudt is a fellow of the Belgian National Fund for Scientific Research at the University of Antwerp (UFSIA) and a Fulbright Scholar, at the time this paper was written he was a summer intern in the Fund European I department. The author would like to thank Martin Fetherston, Tim Lane, Ramana Ramaswamy, Bart Turtelboom, and members of the electronic discussion list on economic growth (majordomo@ufsia.ac.be) for useful comments and suggestions. The usual disclaimer applies.

Do Labor Market Policies and Economic Growth Matter for Income Inequality in OECD Countries? Some Empirical Evidence

Table of Contents

SUMMARY

Income distribution is of obvious social concern in its own right, and it obviously affects economic performance. This paper analyzes the determinants of inequality in the context of a specific model in which labor market policies and the level of economic activity affect unemployment, which in turn affects inequality. The analysis is embedded in a growth model incorporating the effects of changes in income per employed worker on inequality through the accumulation of physical capital and knowledge.

The regression results are quite remarkable given the model's simplicity. First, the reduced form resulting from a simplified model on average explains about three quarters of the variation in inequality measures for OECD countries; even up to about 90 percent of the variation in the log of the top-to-bottom income ratio. Second, growth-related fundamentals (the accumulation of physical capital and know-how), active labor market policies, and taxes appear to be statistically significant and important in magnitude in explaining differences in inequality.

This paper finds that a large part of the difference in inequality among OECD countries is due to broader economic forces whereby investment in know-how is much less harmful for inequality (different inequality measures were used) than investment in physical capital. Second, spending on labor market policies does not have a significant effect on the Gini coefficient, but it does affect other measures of inequality. Spending on active labor market policies significantly improves the income share at the bottom (partly) at the expense of the top. Third, the tax wedge has a significant effect on inequality in almost all the estimated regression equations. A decrease in the tax wedge has the predicted positive effect on the income share of the distribution. This supports the hypothesis that reducing tax distortions has a favorable effect on employment, particularly for lower-paid workers.

I. INTRODUCTION

Income distribution is of obvious social concern in its own right as well as affecting economic performance. At the same time, inequality may itself be affected by fundamentals affecting economic growth and by labor market policies. The relationship between inequality and growth is, however, not yet well understood. Modern research on this topic originated in a seminal study by Kuznets [1955]. Kuznets advanced the theoretical conjecture that a nation's income distribution becomes less, rather than more, egalitarian as its income level increases. Only after the country's income has passed some threshold level, growth brings about more equality. In other words: Kuznets argued that the evolution of income distribution follows an inverted U-shaped curve: economic expansion results in relatively more inequality in the initial stages of a nation's development, and relatively more equality at advanced stages. Unfortunately, empirical evidence supporting the existence of a "Kuznets curve" turns out to be inconclusive (see Anand and Kanbur [1993] for a recent re-examination). Persson and Tabellini [1994] showed that there is cross-country support for a robust relationship between measures of inequality and the growth rate, rather than the level of income. Recently however, Galor and Tsiddon [1996] developed a general equilibrium model in which the evolution of income inequality and output does conform to the Kuznets hypothesis. The paper presents an endogenous mechanism on the human capital accumulation side that generates the inverted U-shape relation between income inequality and per capita output.

Furthermore, unemployment seems to be one of the major sources of inequality in modern societies, with evidence of a significant correlation between unemployment and inequality. For instance, case studies such as Jenkins [1996] find that changes in overall income distribution in the United Kingdom arose from a shift away from employment towards unemployment and new forms of employment (e.g. self-employment), and wage inequality. Johnson and Webb [1993] report a strong relation between changes in the tax and benefit system and changes in inequality, and Jenkins [1995] puts emphasis on unemployment, the employment structure, wage inequality and income from capital as main contributors to the changes in aggregate income inequality in the United Kingdom.

Governments implement two types of labor market policies: passive and active. Passive labor market policies refer to income compensation schemes including unemployment compensation and early retirement for labor market reasons. These policies are generally introduced for distributional or insurance reasons, but may also distort the incentive to work—broadly defined as the effort and time devoted to a job, search or home production (including child care). Passive policies are much more prevalent and costly than active labor market policies in most OECD countries. Active policies are often introduced for, and directed at specific problems, and may either be broad–based or narrowly targeted. To this domain belong expenditures for: public employment services, labor market training, youth measures, subsidized employment and measures for the disabled. The rationale for active market policies is twofold: 1) undoing unemployment resulting from passive policies and (possibly) reducing the cost of the latter; and 2) addressing possible market failures (e.g. search externalities, capital market imperfections which may prevent workers from financing for their own (re-)training, or insider-outsider distortions).

This paper analyzes the hypothesis that inequality is affected both by such policies and by fundamentals related to economic growth. It focuses on a specific version of this relationship: Inequality (especially as reflected in the income share of the poorest) is importantly affected by unemployment. A model is then presented in which labor market policies and the level of economic activity affect unemployment which in turn affects inequality. Moreover, the model includes the effects of changes in per capita income on inequality through the accumulation of physical capital (as in e.g. Solow [1956], Mankiw, Romer, and Weil [1992]) and technological know-how (as in e.g. Romer [1990]). Furthermore, Granger Causality tests are performed to examine the causal direction suggested by the model.

Section II will present a simplified theoretical model which generates a reduced form relationship explaining inequality in terms of growth-related fundamentals and labor market policies. Empirical tests of this reduced form are the subject of section III. Section IV concludes and summarizes.

II. A SIMPLE THEORETICAL MODEL

Let us pick up on the evidence put forward in the mentioned empirical and theoretical studies and assume that the level of inequality (IE)—for the sake of simplicity—is only a function of unemployment (u, defined as the difference between the total number of people in the labor force (L) and the number of people employed (N), relative to L) and income per effective employed worker (q)

$$IE=u^{\lambda_1}\cdot q^{\lambda_2} \qquad (1)$$

The superscript coefficients denote the relative importance of both variables. Ceteris paribus, lower unemployment rates might intuitively be associated with lower levels of inequality since fewer people are dependent on the lowest guaranteed income level. Equation (1) also incorporates Kuznet's hypothesis that the level of income per worker affects the level of inequality. The formulation would be applicable to countries situated to the right of Kuznets threshold, where higher per worker income increases equality—presumably industrialized countries)—if $\lambda_2<0$.

Next, let income per employed effective worker[2] be generated by a Neoclassical production function:

---

[2] This is q=Q/(AN)=Q/[A(1-u)L], k=K/(AN)=K/[A(1-u)L] and h=H/(AN)=H/[A(1-u)L] in which A is the level of labor augmenting technology.

$$q=k^{\alpha}\cdot h^{\beta} \tag{2}$$

in which k stands for the capital stock per employed effective worker and h for the stock of technological know-how per employed effective worker (as e.g. in Nonneman and Vanhoudt [1996]). In contrast with "new" neo-Schumpeterian growth models (Romer [1990], Grossman and Helpman [1991], Aghion and Howitt [1992]), technological know-how, in the sense of blueprints for production processes and new products, is considered here as a form of capital, but just as any other input in production. Property rights on know-how are assumed complete so that there is a well functioning market in know-how. In contrast to endogenous growth models, there is no presumption of externalities, spill-overs, imperfect competition or increasing returns from technology. Hence, neoclassical assumptions hold.

A. Laws of Motion

In the following paragraph the laws of motion for the variables u, k and h will be described. As for the unemployment rate, Okun's law is a first candidate to characterize the changes in unemployment. Okun's law is a way of relating the proportional gap between actual (Q) and potential output (Q^P) to the gap between actual (u) and the so called 'full-employment' rate (a) of unemployment:

$$\frac{Q^{P}-Q}{Q}=b\cdot(u-a)=\frac{q^{P}-q}{q} \tag{3}$$

The value of 'b' is generally referred to as 'Okun's coefficient' (roughly equal to 3 in the United States), which indicates that a temporary loss of 3 percent of real output associated with a temporary increase of 1 percentage point in the unemployment rate). Noting that $x \cong \log[1+x]$ we can rewrite Okun's law as:

$$\log\frac{q^{P}}{q}=b\cdot(u-a) \quad\Rightarrow\quad u=a+\frac{1}{b}\cdot\log\frac{q^{P}}{q} \tag{4}$$

Assuming that potential output grows at a constant rate in the long-run (the rate of exogenous technological change in a Neoclassical context (x)), differentiating (5) with respect to time yields:

$$\dot{u}=\dot{a}+x-\frac{1}{b}\cdot\frac{\dot{q}}{q} \tag{5}$$

The government invests a fraction s_u of per capita income each period in order to fight structural unemployment (a) which can be achieved with an efficiency of ε ($0<\varepsilon\leq 1$). The government also decides on (changes in) the tax wedge on labor (τ) with effect ω on structural unemployment. The evolution of unemployment over time thus becomes:

$$\dot{u}=-\varepsilon\cdot s_u\cdot q\cdot u-\omega\cdot\dot{\tau}+x-\frac{1}{b}\cdot\frac{\dot{q}}{q} \tag{6}$$

The motivation for multiplying total investment in labor market policies by the actual unemployment rate comes from diminishing returns: labor market policies will probably have more effect if unemployment is high; conversely, if unemployment is close to zero, it will be difficult for any policy to reduce it further.

Each period the economy forgoes some consumption and re-invests it in either physical capital or technological know-how. Let s_k denote the fraction of output per employed effective worker that is re-invested in physical capital, and s_h be the share re-invested in technological know-how. The following set of differential equations then governs the accumulation of both types of capital per employed effective worker:

$$\begin{aligned}\dot{k}&=s_k\cdot q-(n+x+\delta_k+\gamma_{1-u})\cdot k\\ \dot{h}&=s_h\cdot q-(n+x+\delta_h+\gamma_{1-u})\cdot h\end{aligned} \tag{7}$$

in which n stands for the growth rate of the labor force, x is the exogenous rate of labor augmenting technological progress, δ denotes a depreciation rate and γ_{1-u} is the rate of growth of the employment rate.

B. Steady State

Steady state values for the linear system (8) i.e. the values for which growth rates of capital and know-how per unit of employed effective worker, and the unemployment rate are zero, are:

$$k_* = \left[\frac{s_k \cdot s_h^{\frac{\beta}{1-\beta}}}{(n+x+\delta)^{\frac{1}{1-\beta}}}\right]^{\frac{1}{1-\alpha-\beta}}$$

$$h_* = \left[\frac{s_h \cdot s_k^{\frac{\alpha}{1-\alpha}}}{(n+x+\delta)^{\frac{1}{1-\alpha}}}\right]^{\frac{1}{1-\alpha-\beta}} \qquad \textbf{(8)}$$

assuming that both forms of capital have a similar depreciation rate.

As for the unemployment rate, the steady state level is:

$$u_* = \frac{x - \omega \cdot \dot{\tau}}{\varepsilon \cdot s_u \cdot k_* \cdot h_*} \qquad \textbf{(9)}$$

Substituting these values in equation (2), and noting that

$$\log\left[\frac{x-\omega\cdot\dot{\tau}}{\varepsilon}\right] = \log\left[1 - \frac{\omega}{x}\cdot\dot{\tau}\right] + \log\left[\frac{x}{\varepsilon}\right] \approx -\frac{\omega}{x}\cdot\dot{\tau} + const$$

yields the following long-run value for inequality:

$$\log[IE] = const - \lambda_1 \cdot \log[s_u] + \frac{\alpha\cdot\lambda_2\cdot(1-\alpha+\beta)-\lambda_1}{(1-\alpha-\beta)\cdot(1-\alpha)}\cdot\log[s_k] + \frac{\beta\cdot\lambda_2\cdot(1-\beta+\alpha)-\lambda_1}{(1-\alpha-\beta)\cdot(1-\beta)}\cdot\log[s_h] \qquad \textbf{(10)}$$

$$+ \frac{1}{1-\alpha-\beta}\cdot\left[\lambda_2\cdot\left(\frac{\alpha}{1-\beta}+\frac{\beta}{1-\alpha}\right)+\lambda_1\cdot\frac{\alpha-\beta}{(1-\alpha)\cdot(1-\beta)}\right]\cdot\log[n+x+\delta] - \lambda_1\cdot\frac{\omega}{x}\cdot\dot{\tau}$$

The questions whether (i) pursuing economic growth through the accumulation of physical capital and know-how and (ii) demographic factors reduce or increase inequality thus strongly depend on the elasticity of inequality with respect to unemployment and to income and on the elasticities of output with respect to the production factors.

Finally, the restrictive assumptions of the model should be noted. In particular, it is subject to all the usual criticisms of Neoclassical growth models. Moreover, it focuses on the effect of labor market programs on unemployment, abstracting from the fact that such programs may also affect inequality directly by transferring money to the unemployed and/or working poor. Likewise, capital accumulation and technological change may affect inequality directly to the extent that relative factor abundance affects factor prices and thus wages and incomes, except in fully open economies where factor price equalization applies. Moreover important variables were left exogenous (e.g. fiscal policy and saving behavior) or even omitted (e.g. monetary and trade policy). However, the assumptions that (i) labor market policies affect inequality only through unemployment and (ii) capital accumulation affects inequality only through per capita income are restrictions on the theoretical model, but not on the empirical work.

In the next section the reduced form given by equation (10) will be estimated for a cross-section of industrialized countries (OECD).The equation which will be estimated thus is:

$$\log[IE]=c_0+c_1\cdot\log[s_u]+c_2\cdot\log[s_k]+c_3\cdot\log[s_h]+c_4\cdot[n+x+\delta]+c_5\cdot\dot{\tau} \quad \textbf{(11)}$$

The empirical work assumes that rates of exogenous technological change, the depreciation rates of capital and the efficiency of labor market policies are roughly similar across the countries under consideration. Following Mankiw, Romer and Weil [1992] the sum of the rate of depreciation and labor augmenting technological change will be set at 5 percent, so that the variation in the fifth term comes from variation in the growth rates of the labor force.

III. EMPIRICAL EVIDENCE

A. Description of the Data

Table I shows the definition and basic data sources of the data used. The data on inequality are taken from Deininger's and Squire's databank on inequality (World Bank [1996]). Investment shares in physical capital come from the Penn World Tables (Summers' and Heston's PWT5.6). For R&D investment shares the OECD Science and Technology Indicators were employed. Figures on the tax-wedge and labor force growth came from the OECD Jobs Study. Percentages of GDP spent on labor market policies were found in the OECD Employment Outlook. Data used in the regressions are in appendix I. A correlation matrix for the variables is presented in table II. From that table it is clear that there is no particular multi-collinearity problem between the independent variables (none of them exceeds 0.6, except the correlation between the different measures for inequality and between the different labor market policies).

B. Regression results

Equation (11) is tested for different measures of inequality. A first one is the Gini coefficient. Comparisons between Gini coefficients, however, do not indicate which part of the distribution is responsible for the variation in inequality. For instance the Gini coefficient may have increased either because the income share of the lowest quintile increased at the expense of the second or because the income share of the top quintile decreased to the benefit of the fourth. Therefore the share of income in the bottom (1st, poorest) and top (5th, richest) quintile were used as separate measures of inequality. The intuitively most attractive measure for this exercise is the ratio of the incomes of the top 20 percent to the bottom 20 percent, since it is a concept for which a steady state makes most sense: it means that there is a constant gap between rich and poor although the income shares of both can evolve over time. All regressions include either the total percentage of GDP spent on labor market policies (TLMP), the percentage spent on active labor market polices (ALMP) (i.e. public employment services and administration, labor market training, youth measures, subsidized employment and measures for the disabled) or the percentage spent on passive labor market policies (PLMP) (unemployment compensation and early retirement for labor market reasons). The sample consists of 21 OECD countries for which—unfortunately—only 15 countries have observations on all variables for the regressions with the Gini coefficient as dependent variable. Only 13 countries had data on all variables for the other regressions. Results are in tables III and IV.

Given the simplicity of the framework, the regression results are quite remarkable: the reduced form resulting from the simplified model on average explains about three quarters of the variation in inequality measures for OECD countries. For the log of the top-to-bottom income ratio the model explains up to about 90% of the variation. Moreover growth-related fundamentals appear to be statistically significant and important in magnitude.

At least four interesting results appear from the tables, which will be presented in detail in the remainder of this section.

A first point of interest is that accumulating physical capital increases overall inequality, and its coefficient is statistically significant at traditional levels. For the OECD countries, a high investment share in GDP for this type of capital can be associated with a high Gini coefficient, a low income share of the bottom quintile, a high income share of the richest quintile and a high ratio of richest to poorest quintile of the income distribution. These findings are consistent with earlier studies for the OECD countries. Two early publications on the relation between investment and inequality (Della Valle and Oguchi [1976] and Musgrove [1980]) also reported a positive association between investment and inequality for the OECD countries.[3] Lim [1988] finds a positive relation between inequality and aggregate savings as well, but the coefficient is significant at the conventional levels only in some sub samples.

The same conclusion holds for relation between inequality and the accumulation of technological know-how—a relationship which had not previously been tested in the literature. In the equation for the Gini, coefficient the magnitude of the coefficient for the share of investment in technological know-how is, however, less important than the coefficient for the share of investment in physical capital (about two fifth). Moreover, investment in physical capital has a significantly larger negative impact on the lower part of the distribution than investment in R&D. The gap between the top and bottom part of the distribution is also much more influenced by investment in physical capital than by investment in R&D. In consequence, economies which invest relatively more in knowledge will tend to have lower overall inequality levels than countries which spend relatively more on the accumulation of merely physical capital (machines, equipment, etc). Note, however, that income share losses for the bottom quintile due to technological progress are not comparable to the rather small gains at the top quintile. This confirms the notion of 'biased technological change': new technology makes the unskilled relatively more unskilled, reducing their employment opportunities, relative wages and hence income[4]. Since the stocks of physical capital and knowledge are disproportionately held by the upper part of the distribution, the rewards of investment are also to a greater extent reaped by those in the upper part of the income distribution, driving up income there. The signs of the coefficient for these variables should thus not surprise us for the quintiles under consideration.

Since investment in physical capital and technological know-how are engines of long-run growth, pursuing economic growth thus matters for inequality (which confirms the findings of Persson and Tabellini [1994] among others), although according to this paper's results effects from 'capital' accumulation differ across the distribution.

/3 However, they did not find a significant correlation between these variables for a sample that consisted of developing countries. Gersovitz [1988] argues that their failure to obtain a similar result for the developing countries may be due to poor quality of the corresponding data. However, more recently Cook [1995] reported a positive significant relation between inequality and savings for the LDC countries after controlling for differences which affect savings behavior such as: dependency ratios, the level and the growth rate of real income, and a measure for capital inflows.

/4 This link can of course be mitigated by evidence suggesting that distributional mobility is high. Yet studies such as the OECD [1996] Employment Outlook argue that, in spite of big differences in country's labor market policies and labor market regulations, earnings mobility is surprisingly uniform and rather low: compared to 1986 around half of those who were still employed in 1991 stayed in the same earnings band. About a third moved up or down one band. Only about 20% moved two bands or more.

A second message is that a statistically significant source of changes in inequality comes from changes in the tax wedge. The link here, of course, runs through labor supply and demand. Workers are motivated to work, at least in part, for the consumption they can finance out of the income they earn; employers take on labor insofar as the value of the output of that labor exceeds its cost. High wedge decreases are in our simple model related to lower inequality via reductions in unemployment. This link is strongly confirmed in the regression results. Moreover the reduction in overall inequality arises because a decrease in the tax wedge seems to have a positive effect on the income share of the bottom part of the distribution whereas the income share of the top quintile is negatively affected by it. A possible explanation for this is that a reduction in the tax wedge will increase the demand for relatively unskilled labor because of substitution effects between capital and labor. Therefore the demand for new R&D-intensive cost-saving equipment, and with it the demand for researchers, reduces so that the income share of this high-skilled high-income group somewhat decreases. The gains from reducing the tax wedge for the lower income group are nearly twice the magnitude of the losses at the top 20 percent level of the distribution. Changes in the tax wedge thus seem to have re-distributive effects.

A third result: the effect of variation in the growth rates of the labor force could not be estimated precisely. Higher growth rates of the labor force can be associated with higher inequality as measured by the Gini coefficient. Labor force growth has a negative impact on the income share of the lowest part of the distribution, but the opposite holds for the top quintile. It seems to increase the gap between the rich and poor income groups. Possibly the major share of the new influx in the labor force is relatively unskilled, which increases the supply and reduces the wage of this type of labor. As set out elsewhere, biased technological change reduces demand for unskilled labor, so that unemployment increases and the income share of the lowest quintile goes down as the labor force grows.

Last, but not least, is a message about the impact of labor market policies. Total spending on labor market policies does not have a significant effect on the Gini coefficient. The total share of GDP spent on labor market policies was even estimated with a positive sign, indicating that inequality increases the higher this share. Especially passive labor market policies (which include unemployment benefits and early retirement for labor market reasons) turn out to be responsible for this observation. The impact of active labor market policies, on the other hand, was estimated statistically significant at the 5 percent level in all further regressions. Active labor market policies improve the income share at the bottom at the cost of a lower income share at the top. Yet the losses in the highest quintile are much less important (about 2.5 times smaller) than the gains for the poorest ones. The effect of passive labor market policies is, in fact, very small compared to the impact of active labor market policies in all the regressions (except when log[Gini] was the dependent variable). However, the sum of the labor market policy and the tax wedge effects seems not to offset the effects of investment in both forms of capital.

C. Causality

So far I have implicitly assumed that the causal link runs from economic growth (via investment in different capital goods) along with (exogenous) labor market policy to inequality. However, this direction is the opposite to that suggested in a class of models in the political economy literature (see Persson and Tabellini [1995], Alesina and Perotti [1996]). In these models the main line of argument is that a highly unequal distribution of income and wealth causes social tension and political instability as well as pressure for distortionary redistributive measures. This, in turn, results in a discouragement of investment through increased uncertainty and hence in adverse effects for economic growth. Therefore these kind of models would suggest a negative causal relation running from income inequality to investment (and further to growth).

Consumption theory, in contrast, suggests a direct positive causal link running from inequality to investment. According to the 'bequest–augmented' life–cycle hypothesis, if the elasticity of bequests with respect to lifetime resources is greater than unity, aggregate savings, and thus investment in a closed economy model, will unambiguously decrease as inequality falls due to income redistribution from the rich to the poor. Consumption habits may have implications for the saving-investment-distribution link in a life cycle framework: consumption is relatively costlier for young households, because the habit it induces has to be fed thereafter, and relatively cheaper for old consumer. Therefore, the young will tend to save more than the old, and income redistribution from the latter to the former will raise overall saving. Given that the consumption habits early in the life cycle make it more difficult to adjust future consumption down than up, redistributing income from the rich to the poor therefore will affect overall saving: rich consumers would reduce their consumption by the full amount, while poorer consumers would be reluctant to raise their consumption with the same amount, hence aggregate saving—and thus investment in a closed economy set-up—would increase.

Causality tests in the empirics of inequality are rather scarce. In this section I use a Granger-causality test on a panel of data. The vectors consist of the available observations between 1985 and 1991 for the OECD countries. Because not all countries report annual inequality measures, the number of useful observations remains—in spite of the panel data approach—rather low (data are in appendix I). The following equations are estimated:

$$\begin{aligned} IE &= \omega_0 + \omega_1 \cdot IE_{-1} + \omega_2 \cdot INV_{-1} \\ IE &= \omega_0 + \omega_1 \cdot IE_{-1} \\ INV &= \phi_0 + \phi_1 \cdot INV_{-1} + \phi_2 \cdot IE_{-1} \\ INV &= \phi_0 + \phi_1 \cdot INV_{-1} \end{aligned} \qquad (12)$$

in which IE stands for the ratio of the top to the bottom quintile of the distribution as a measure of income inequality and INV stands for either the share of GDP invested in physical capital, or active or passive labor market policies. An F-test then is performed to decide whether or not Granger Causality holds. Results of the test are in table V. The lower part of table V reports "reverse" causality tests.

The Granger Causality tests confirm this paper's suggestion: a higher investment share in the previous period widens the gap between rich and poor, but, although the sign of the lagged expenditure shares on labor market policies seems intuitively correct, these variables do not Granger cause (in)equality. This should not surprise us, though: due to a 'bureaucratic lag' most labor market policies are only introduced after the unemployment problem occurs.

The data also strongly support the causal link implied in the political economy literature. From table V.b. it can be seen that a higher gap between rich and poor is negatively causally related to the investment share. The tests, however, reject the causal direction suggested by consumption theory.

IV. CONCLUSION

This paper analyzes whether inequality differences between OECD countries can be explained in terms of differences in growth-related fundamentals and labor market policies. Therefore a simple testable model exploring the link between per capita income and inequality as posited by Kuznets and in a Neoclassical growth framework was fit to the data. The explanatory power of the regressions is high. On average the model explains about three quarters of the variation in inequality measures.

The source of inequality is important in evaluating policy options. The results here indicate that a large part of the difference in inequality are due to broader economic forces. Inequality in OECD countries is negatively affected by the engines of economic growth: the accumulation of physical capital and technological know-how. The results for the relation between aggregate investment in physical capital and inequality reconcile with earlier findings. The relationship between inequality and R&D—a key factor in the theory of economic growth—had not been previously tested.

The estimations indicate that the gains for the upper part of the distribution from investments in capital significantly outweigh the losses of the bottom quintile. Moreover, the impact of accumulating either kind of capital differs: investment in physical capital has a larger negative impact on the bottom part than investment in knowledge, and the income gains of accumulating technological know-how are smaller for the richest quintile compared to the gains from investment in physical capital. Accumulating technological know-how widens the gap between rich and poor less seriously than accumulating physical capital. According to growth theory, investment in R&D is the most important factor generating long-run growth. This paper suggests that it is also the least harmful growth fundamental for the income distribution.

The tax wedge has a significant effect on inequality in almost all of the estimated regression equations. A decrease in the tax wedge has the predicted positive effect on the income share of the bottom part of the distribution. This supports the hypothesis that reducing tax distortions has a favorable effect on employment, particularly for lower-paid workers.

The effect of changes in the labor force growth could not be estimated precisely, but higher labor force growth seems to widen the gap between the top and bottom quintile, via a decrease in income at the lower and an increase at the upper part of the distribution. Possibly the major share of the new influx in the labor force is relatively unskilled, which increases the supply and reduces the real wage for of this type of labor. Biased technological change moreover increases unemployment so that the income share of the lowest quintile goes down as the labor force grows.

Spending on labor market policies does not have a significant impact on the Gini coefficient, but does affect other measures of inequality: especially active labor market policies significantly improve the income share at the bottom and reduce the gap between the top and bottom quintile income shares. The resulting reduction in the income share at the top of the distribution due to this type of policy (presumably financed by redistributive taxes) can be ignored. In contrast, passive labor market policies have only a small impact which could not be estimated precisely, moreover, this kind of labor market policy tends rather to increase increase inequality as reflected in the Gini coefficient. In total, the sum of the labor market policies and the tax wedge effects seems not to offset the effects of investment in physical capital and 'knowledge'.

Causality tests confirm the causal relation in this model as well as the causal direction implied in the political economy literature, but rejects the causality suggested by the consumption theory.

Caution is needed in interpreting the reported results, given the small sample size as well as compromises dictated by the limitations of the data set. Incomplete panel data estimations and/or estimations of a system including equations for unemployment and per capita GDP as well as inequality with tests for the resulting cross-equation restrictions may complete this paper's findings. Taking these caveats into account, the estimates provide an initial assessment of the determinants of inequality in a broader macroeconomic context. The results suggest that labor market policies and taxation are important in accounting for income inequality, but that the underlying determinants of economic growth—accumulation of capital and know-how—are more important in explaining cross-country differences in income distribution for industrialized countries.

Table I: Description of the Data

variable	description	source
Gini	Gini coefficient, latest observation (1991 for most countries except for: Australia (1990), Belgium (1992), Denmark (1992), France (1984), Germany (1984), Greece (1988), Ireland (1987), Japan (1990), New Zealand (1990), Spain (1989), Sweden (1990), Switzerland (1982). (Results do not change very much if the average Gini for the available country-observations was used).	Deininger and Squire, World Bank, 1996
q1, q5	First (poorest) and fifth (richest) quintile of the income distribution, latest observation (same years as for Gini, but fewer observations were available)	same
sk	Average investment share in physical capital 1965-1991	Penn-World Tables, PWT 5.6
sh	Average investment share in R&D, 1975-1985 for the available observations	OECD, Science and Technology Indicators
n	Average growth rate of the work force, 1985-1991	OECD, Employment Outlook
ALMP	Average share of GDP spent at financing active labor market policies (1985-1991). Active labor market policies include financing: public employment services and administration, labor market training, youth measures, subsidized employment and measures for the disabled	OECD, Employment Outlook
PLMP	Average share of GDP spent at financing passive labor market policies (1985-1991). Passive labor market policies include financing: unemployment compensation and early retirement for labor market reasons	OECD, Employment Outlook
TLMP	ALMP+PLMP	
% chng τ	percent change in the tax-wedge 1985-1991	OECD, Jobs Study

Table II: Correlation Matrix

	log gini	log q1	log q5	log q5/q1	log s_k	log s_h	log tlmp	log almp	log plmp	log n+5%	%Δ tax wdg
log Gini	1	*-0.80*	*0.94*	*0.87*	0.08	0.56	-0.47	-0.35	-0.42	0.24	-0.56
log q1		1	*-0.85*	*-0.99*	-0.28	-0.40	0.51	0.46	0.39	-0.28	0.34
log q5			1	*0.92*	0.10	0.48	-0.51	-0.43	-0.41	0.17	-0.52
log q5/q1				1	0.24	0.44	-0.52	-0.47	-0.40	0.25	-0.41
log s_k					1	-0.37	0.01	0.11	-0.04	-0.24	0.31
log s_h						1	-0.15	0.15	-0.29	-0.07	-0.30
log tlmp							1	*0.77*	*0.89*	-0.20	0.22
log almp								1	*0.41*	-0.51	0.16
log plmp									1	0.02	0.23
log n+5%										1	-0.14
%Δ tax wdg											1

Table III: Estimation Results.

• Dep. Variable▹ • Indep. Variable ▿	log of gini	log of gini	log of gini	log of quintile 1's income share	log of quintile 1's income share	log of quintile 1's income share
constant	1.852 (0.713)++	2.000 (0.620)++	1.800 (0.757)++	6.054 (1.096)++	5.959 (0.854)++	6.435 (1.259)++
log s_k	0.317 (0.133)++	0.291 (0.127)++	0.334 (0.145)++	-0.909 (0.176)++	-0.989 (0.158)++	-0.935 (0.210)++
log s_h	0.129 (0.071)++	0.122 (0.069)+	0.137 (0.073)+	-0.236 (0.079)++	-0.295 (0.063)++	-0.239 (0.087)++
log [n+5%]	0.295 (0.233)	0.267 (0.219)	0.291 (0.238)	-0.0672 (0.326)+	-0.363 (0.243)	-0.786 (0.374)+
log TLMP	0.013 (0.040)	______	______	0.137 (0.102)	______	______
log ALMP	______	-0.002 (0.040)	______	______	0.202 (0.034)++	______
log PLMP	______	______	0.022 (0.039)	______	______	0.056 (0.112)
% change in τ	-0.030 (0.010)++	-0.034 (0.015)++	-0.035 (0.015)++	0.030 (0.015)+	0.029 (0.013)+	0.033 (0.019)
# obs	15	15	15	13	13	13
R^2	64.1%	63.7%	64.8%	74.6%	84.8%	68.4%
SER	0.09	0.09	0.09	0.14	0.11	0.16

Standard errors in parenthesis.
+ : significant at the 10% level
++ : significant at the 5% level or better
All regressions have heteroskedasticity consistent covariance matrices

Table IV: Estimation Results (continued).

• Dep. Variable▹ • Indep. Variable ▿	log of quintile 5's income share	log of quintile 5's income share	log of quintile 5's income share	log of quintile 5's to quintile 1's income share	log of quintile 5's to quintile 1's income share	log of quintile 5's to quintile 1's income share
constant	2.560 (0.571)⁺⁺	2.596 (0.464)⁺⁺	2.404 (0.688)⁺⁺	-3.494 (1.441)⁺⁺	-3.363 (1.017)⁺⁺	-4.030 (1.783)⁺
log s_k	0.263 (0.124)⁺	0.296 (0.116)⁺⁺	0.273 (0.140)⁺	1.172 (0.236)⁺⁺	1.285 (0.206)⁺⁺	1.208 (0.297)⁺⁺
log s_h	0.086 (0.029)⁺⁺	0.111 (0.023)⁺⁺	0.088 (0.034)⁺⁺	0.322 (0.103)⁺⁺	0.406 (0.075)⁺⁺	0.327 (0.117)⁺⁺
log [n+5%]	0.147 (0.141)	0.022 (0.102)	0.195 (0.176)	0.819 (0.433)⁺	0.385 (0.282)	0.981 (0.519)⁺
log TLMP	-0.057 (0.032)⁺	———	———	-0.194 (0.119)	———	———
log ALMP	———	-0.082 (0.031)⁺⁺	———	———	-0.284 (0.045)⁺⁺	———
log PLMP	———	———	-0.024 (0.036)	———	———	-0.080 (0.138)
% change in τ	-0.019 (0.010)⁺	-0.019 (0.010)⁺	-0.021 (0.011)⁺	-0.049 (0.024)⁺	-0.047 (0.023)⁺	-0.054 (0.029)⁺
# obs	13	13	13	13	13	13
R^2	69.7%	80.0%	63.4%	76.4%	87.3%	69.7%
SER	0.06	0.05	0.07	0.18	0.14	0.21

Standard errors in parenthesis.

⁺ : significant at the 10% level

⁺⁺ : significant at the 5% level or better

All regressions have heteroskedasticity consistent covariance matrices

Table V:Granger Causality Test Results.

a: Causality

Granger Causes ▷ △	Q5/Q1
inv	yes
(direction)	(+)
(F-test)	(4.928)
ALMP	no
(direction)	(-)
(F-test)	(1.114)
PLMP	no
(direction)	(-)
(F-test)	(1.723)

b: Reverse Causality

Granger Causes ▷ △	inv	ALMP	PLMP
Q5/Q1	yes	yes	yes
(direction)	(-)	(-)	(-)
(F-test)	(8.935)	(6.114)	(22.843)

F-test value at the 5-% significance level (4.12) used as cut-off rate

Appendix 1: Data

Data for Cross-Section Regressions

Country	gini	quint1	quint2	quint3	quint4	quint5
UK	32.4	.0764	.1261	.1596	.2295	.4084
Australia	41.72	.046	.097	.155	.238	.464
Austria	31.78	.0723	.1244	.1746	.2405	.3882
Belgium	30.01	.072	.13	.183	.2442	.3708
Canada	27.65	.0768	.1368	.1896	.2484	.3484
Denmark	34.57					
Finland	31.28	.0569	.1156	.1779	.2519	.3977
France	37.76	.0595	.1125	.1628	.2271	.4381
Germany	36.18	.0567	.112	.1725	.2429	.4159
Greece	35.19	.0619	.1159	.1704	.24	.4118
Ireland	34.6	.0493	.0971	.1584	.2492	.446
Italy	32.19	.0841	.1317	.1771	.2328	.3743
Japan	35.					
Netherlands	34.55	.0582	.1174	.179	.2463	.3991
New Zealand	40.21	.0458	.1052	.1631	.2386	.4473
Norway	33.31	.054	.1117	.1701	.2487	.4155
Portugal	35.63	.0614	.1197	.1718	.2429	.4042
Spain	25.91	.0839	.1432	.1868	.2333	.3528
Sweden	32.52	.074	.127	.167	.25	.382
Switzerland	40.87	.0493	.1096	.1598	.2192	.4621
UK	32.4	.0764	.1261	.1596	.2295	.4084
USA	37.94	.045	.107	.166	.241	.441

Data for Cross-Section Regressions: continued

Country	% TLMP	% ALMP	% PLMP	% sk	% sh	% n	taxwchng
Australia	1.5243	.3243	1.2	30.1145	1.05	2.1778	- .0275
Austria	1.3271	.31	1.0171	27.6388	1.1	1.0889	
Belgium	4.2229	1.21	3.0129	25.4182	1.4	.1333	.0013
Canada	2.3814	.5643	1.8171	25.6248	1.25	1.6111	.0444
Denmark	5.49	1.23	4.26	27.7091	1.1	.8222	- .0067
Finland	2.5171	1.0286	1.4886	36.84	1.2	.0444	.0023
France	2.8729	.7743	2.0986	28.8642	2.05	.4889	.0019
Germany	2.3971	1.0271	1.37	29.5909	2.45	.8444	- .0091
Greece	.8586	.36	.4986	26.6545	.2	.4333	
Ireland	4.8257	1.5586	3.2671	27.1642	.8	.1778	
Italy	1.5417	.6833	.8583	29.8861	.95	.6778	.0033
Japan	.456	.14	.316	36.3448	2.4	1.2667	- .0044
Netherlands	3.72	1.0886	2.6314	26.577	2.05	2.4333	- .0035
New Zealand	2.1757	.79	1.3857	26.2727	.95	1.6	
Norway	1.4457	.7	.7457	32.9345	1.45	.7111	.0373
Portugal	.955	.5717	.3833	24.306	.35	.7667	
Spain	3.23	.6729	2.5571	27.643	.45	1.3222	.0013
Sweden	2.8357	1.92	.9157	25.4685	2.25	.5333	- .0201
Switzerland	.4357	.2129	.2229	31.7127	2.3	1.1333	
UK	2.1671	.7271	1.44	20.1188	2.25	.8444	- .0128
USA	.76	.2514	.5086	23.3097	2.55	1.4444	- .0333

Data for Panel Regressions

Country	year	gini	quint1	quint5	%ALMP	%PLMP
Australia	1985	37.58	.051	.422	.42	1.3
Australia	1986	40.6	.048	.4525	.38	1.31
Australia	1989	37.32	.056	.3988	.25	.86
Australia	1990	41.72	.046	.464	.26	1.11
Canada	1985	32.81	.0627	.3912	.63	1.87
Canada	1986	32.5	.0637	.389	.62	1.86
Canada	1987	32.28	.0675	.387	.55	1.64
Canada	1988	31.91	.068	.3835	.5	1.57
Canada	1989	27.41	.0777	.3469	.51	1.58
Canada	1990	27.56	.0754	.3385	.53	1.92
Canada	1991	27.65	.0768	.3484	.61	2.28
Italy	1986	33.58	.0808	.3813	.69	.86
Italy	1987	35.58	.0788	.3989	.77	.81
Netherlands	1985	29.1	.0757	.3669	1.09	3.24
Netherlands	1986	29.68	.0721	.3683	1.12	2.99
Netherlands	1987	29.4	.101	.347	1.1	2.84
New Zealand	1985	35.82	.0552	.4111	.84	.64
New Zealand	1986	35.53	.0543	.4079	.71	.86
New Zealand	1987	36.45	.0548	.4175	.7	1.07
Norway	1985	31.39	.0818	.3688	.66	.51
Norway	1986	33.11	.051	.402	.5	.38
Portugal	1990	36.76	.057	.424	.72	.42
Portugal	1991	35.63	.0614	.4042	.81	.52
Spain	1985	25.19	.0966	.3442	.34	2.89
Spain	1986	26.	.0891	.3478	.64	2.59
Spain	1987	25.79	.0914	.3428	.66	2.53
Spain	1988	24.42	.0949	.3371	.76	2.42
Spain	1989	25.91	.0839	.3528	.79	2.3
Sweden	1985	31.24	.0704	.3816	2.11	.86
Sweden	1986	31.72	.0697	.3866	2.01	.88
Sweden	1987	31.65	.076	.38	1.88	.81
Sweden	1988	32.22	.074	.383	1.77	.68
Sweden	1989	31.33	.081	.378	1.54	.64
Sweden	1990	32.52	.074	.382	1.69	.88
UK	1985	27.1	.089	.3785	.74	2.11
UK	1986	27.8	.0841	.3919	.86	2.
UK	1987	29.3	.0832	.4061	.86	1.61
UK	1988	30.8	.0819	.4059	.76	1.14
UK	1989	31.2	.0812	.3985	.67	.86
UK	1990	32.3	.0778	.4099	.62	.95
UK	1991	32.4	.0764	.4084	.58	1.41

Country	year	gini	quint1	quint5	%ALMP	%PLMP
USA	1985	37.26	.047	.435	.28	.56
USA	1986	37.56	.046	.438	.26	.52
USA	1987	37.56	.046	.438	.25	.47
USA	1988	37.76	.046	.44	.24	.4
USA	1989	38.16	.046	.446	.24	.44
USA	1990	37.8	.046	.442	.24	.49
USA	1991	37.94	.045	.441	.25	.68

References

Aghion, P. and Hiwutt, P., 1992 "A Model of Growth Through Creative Destruction", *Econometrica,* LX , 323-351.

Alesina, A. and Perotti, R., 1996, "Income Distribution, Political Instability, and Investment", *European Economic Review*, XL, 1203-28.

Anand, S. and Kanbur, S., 1993, "The Kuznets Process and the Inequality-Development Relationship", *Journal of Development Economics*, CIX, 465-90.

Barro, R. and Sala-I-Martin, X., 1992, "Convergence", *Journal of Political Economy,* C, 223-251.

Barro, R. and Sala-I-Martin, X, *Economic Growth,* MacGraw-Hill, London, 1995.

Cole, J. and Towe, C., 1996," Income Distrubution and Macroeconomic Performance in the United States", *IMF Working Papers,* WP/96/97.

Cook, C. ,1995, "Savings Rates and Income Distribution: Further Evidence from LDC's", *Applied Economics,* XXVII, 71-82

Deininger, K.and Squire, L., 1996, Measuring Income Inequality: A New Database, Washington DC, The World Bank

Della Valle, P. and Oguchi, N., 1976, "Distribution, the Aggregate Consumption Function, and the Level of Economic Development: Some Cross-Country Results", *Journal of Political Economy,* 84, 1325-34.

Galor, O. and Tsiddon, D., 1996, "Income Distribution and Growth: the Kuznets Hypothesis Revisited", *Economica,* LXIII, S103-S117

Gerzovitz, M., 1988, "Savings and Development" in H. Chenery and T Srinivasan (eds): *Handbook of Development Economics,* Amsterdam, North-Holland, 381-424.

Grossman, G. and Helpman, E., "Trade, Innovation and Economic Growth", *American EconomicReview,* LXXX, 1990, 797-815.

Grossman, G. and Helpman, E., "Quality Ladders in the Theory of Growth", *Review of Economic Studies,* LVIII, 1991, 43-61.

Greene, W. Econometric Analysis , MacMillan, New York, 1993.

Jenkins, S., 1995, "Accounting for Inequality Trends: Decomposition Analyses for the UK: 1971-86", *Economica*, LXII, 29-63.

Jenkins, S., 1996, "Recent Trends in the UK Income Distribution: What Happened and Why?", *Oxford Review of Economic Policy*, XXII, 29-46. Johnson, P. And Webb, S., 1993, "Explaining the Growth in UK Income Inequality: 1979-1988", *The Economic Journal*, CIII, 429-435.

Kuznets, S., 1955,"Economic Growth and Income Inequality", *American Economic Review*, VL,1-28.

Lim, D., 1980, "Income Distribution, Export Instability and Savings Behavior", *Economic Development and Cultural Change*, XXVI, 359-64.

Lucas, R., 1988, "On the Mechanics of Development", *Journal of Monetary Economics*, XXII, 3-42

Mankiw, N., Romer, D. and Weil, D., "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, CVII, 1992, 407-437.

Musgrove, P., 1980, "Income Distribution and the Aggregate Consumption Function", *Journal of Political Economy*, LXXXVIII, 504-25.

Nonneman, W. and Vanhoudt, P. , 1996, "A Further Augmentation of the Solow Model and the Empirics of Economic Growth for OECD Countries", *Quarterly Journal of Economics*, CXI, 943-53.

OECD, *Jobs Study*, various issues.

OECD, *Unemployment Outlook*, various issues.

OECD, *Science and Technology Indicators (report) III*, 1989, technical annex, 95 -132. Persson, T. and Tabbellini, G., 1994, "Is Inequality Harmful for Growth?", *The American Economic Review*, LXXXIV, 600-621.

Romer, P., "Endogenous Technological Change", *Journal of Political Economy*, XCVIII, 1990, S71-S102.

Schmidt-Hebbel, K. and Serven, L. , 1996, "Income Inequality and Aggregate Saving: The Cross-Country Evidence", *World Bank Policy Research Working Paper*, #1561.

Solow, R., 1956, "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, LXX, 65-94.