15. Economic Growth and Income Distribution in the OECD countries.

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1. Introduction

Economists have traditionally tried to answer the following question: Why are some countries rich and others are poor? Many answers may be provided to this interrogation, crucially depending upon the assumptions employed in order to describe the production function of the economy. It is not strange, then, that the different schools of thought have developed alternative models intending to identify the main factors that, in their view, affect growth.

In Neoclassical models, based mainly upon Solow (1956), the long-term rate of growth of per capita income is exogenously determined by technological progress. In this case the policy maker has only capacity to design measures that modify the rate of growth of the economy in the transition to the steady state. As regards the situation in the steady state, economic policy may only alter the *level* of per capita income, but not its rate of growth.

In contrast, more recent approaches within the New Growth Theory (Romer, 1986, 1987 and 1990, Lucas, 1988, Rebelo, 1991, Grossman and Helpman, 1991, among others) have developed models in which the long-term growth rate is endogenous; the drive engines of growth in those types of settings are a number of different variables that refer not only to technical progress but also to public capital, human capital, financial efficiency and so forth. In particular, in this framework, fiscal variables and the behaviour of human capital, among others, are relevant factors that can affect growth. It follows that the policy maker has a broader scope of influence since he may alter long-term growth - therefore causing a *rate* effect - by means of modifying public investment, tax structures or education expenditure.

In addition, during the last decades economists have been interested in analysing the relationship between inequality and growth. However, from our point of view it is also interesting to consider the impact of welfare- understood in a broader sense, not only as inequality- on growth. Of course, the reverse mechanism is also

interesting: i.e. to ascertain whether welfare is affected by the economic growth process in a noticeable way. The answer does not need to be necessarily affirmative. If income distribution is uneven, it is possible for a country to grow in such a way that only a few economic agents benefit from the economic growth process.

The main goal of this paper is to estimate the relation between economic growth and welfare for a sample of countries. In the following section we shall provide some preliminary ideas about the interaction between these two aspects. In Section 3 we will present an economic growth model and a social welfare function introducing the main variables that can affect welfare. In Section 4 we will estimate the model for a set of OECD countries and we will identify the main variables that affect growth, according to our results. Finally, we will underline the main conclusions of our study in Section 5.

2. Overview of the Relationship between Inequality and Growth

For some decades economists have accepted the idea that income inequality was an unpleasant precondition for growth (Clarke, 1995, p. 403). Insofar as income inequality provides incentives for individuals in order to improve their life standards, it could be considered as being growth-enhancing[1].

Kaldor (1956), for instance, showed a causal effect of income distribution on capital accumulation and finally on growth[2]. A reverse relationship, however, was stated by Kuznets (1955), who claimed that development and growth should reduce inequality.

More recent contributions have also studied the effects of inequality on growth, with mixed results. As regards a positive relationship between inequality and development, Aghion and Howitt (1997, pp. 280-281) point out to three feasible situations in which inequality may improve growth:

1.- If there are important investment indivisibilities, it will be desirable that wealth be concentrated in a few hands in order to defray the relevant costs of the new industrial activity.

2.- In a moral hazard context, where employees are risk averse and therefore discouraged to invest, they will lack the necessary incentives in order to support new projects. Therefore a greater degree of equality may jeopardise the growth process.

3.- In the specific case of the transition economies in Central and Eastern Europe, as emphasised by policy advisers, the need for concentrated asset ownership and controlling majorities in firms is specially important for the dynamism of the economy.

But there is also another literature that states a less positive connection between inequality and growth. For example Fields (1989) states that in a country with different propensities to save, the transfers from rich to poor reduce capital accumulation and slowdown growth. The new literature could be grouped into two main categories (Saint Paul and Verdier, 1996, pp. 719-720):

1.- Some studies have provided foundations for a better understanding of the externalities and market imperfections that affect income distribution and output (Aghion and Bolton, 1992, Durlauf, 1992, Benabou, 1993, Banerjee and Newman, 1993 and Galor and Zeira, 1993).

2.- Taking mainly into account voting models and introducing the taxation effects, some papers have analysed how income distribution endogenously determines policy and the latter affects economic growth (Bertola, 1993, Perotti, 1993, Saint Paul and Verdier, 1993, Alesina and Rodrik, 1994, Persson and Tabellini, 1994, Alesina and Perotti, 1996, Benhabib and Rustichini, 1996, and Perotti, 1996). In these kind of settings, higher inequality leads to higher redistribution taxation and this sort of fiscal structure causes adverse effects on growth. In particular, Fields (1989) states that in a country with different propensities to save, the transfers from rich to poor - that bring about a higher degree of equality - reduce capital accumulation and slowdown growth. On the other hand, Barro (1991) and Mauro (1993) find an inverse relationship between political instability and growth or investment. Venieris and Gupta (1986) identify an inverse relationship between political instability and the savings rate. Alesina and Perotti (1996) test the hypothesis that income inequality and investment are inversely related. Since they accept investment as a main determinant of growth, this paper successfully identifies an inverse relationship between income inequality and growth.

Chang (1998) designs a model in which taxes determine economic growth and income distribution and emerge from negotiations between political parties. The parties represent different social classes and negotiate the magnitude and allocation of taxes. According to this paper, taxes may increase growth when used to redistribute income classes. The resulting conflict is resolved through tax negotiations between political parties. An empirical negative relation between income inequality and growth is obtained provided that cross country variation in population composition dominates variation in preference parameters or production parameters. No evidence exists that redistributional government policies can simultaneously increase growth and reduce inequality.

But it may also be argued (Saint Paul and Verdier, 1996, pp. 725-726) that income redistribution is not necessarily negative for growth. Firstly, it can improve public education that has positive effects on human capital and therefore on growth[3].

Secondly, if the economy is rich enough, redistribution could facilitate investment by poor and will not affect investment by the rich that enhances growth. Thirdly, redistribution could create an important middle class, that has a relevant role as consumers and could favour growth. Finally, redistribution could reduce crime and social strains, creating a positive environment to invest that will facilitate the growth process[4]. In effect, Herce *et al*. (1998) find some evidence pointing to a beneficial impact of social protection on economic growth for a number of European countries.

As we can see, there is an important literature on the inequality effects on growth. Much of it is based on microeconomic models. In our case, we are trying to expand this issue in two ways. Firstly, we will introduce a wider welfare effect, considering not only inequality but other variables that could improve the growth conditions, such us the living standard index and the political index[5].

Secondly, we will focus in the macroeconomic effects, developing a growth model and introducing the welfare behaviour in it[6]. In the following section we will develop such a model.

3. Economic Growth and Income Distribution: An Stylised Model

In order to analyse more in detail the connections between economic growth and income distribution, we shall present a highly stylised economic growth model, following the Mankiw, Romer and Weil (1992) approach. The starting point is a traditional Cobb-Douglas production function, encompassing physical capital, human capital and a welfare index that includes income distribution:

$$Y = A K^{a} H^{b} W^{g} L^{1-a-b-g} \quad (1)$$

$$0 < a < 1$$

$$0 < b < 1$$

$$0 < g < 1$$

where Y represents income, K is physical capital, L is, A captures a technology indicator, H is human capital, and W is a welfare index. The corresponding inputs' elasticities are ",$ and (. There are constant returns to scale in all inputs, and marginal productivity is decreasing for each factor. We also suppose that $\dot{L}/L = n$, n being the constant and exogenous population growth rate.

Dividing (1) by L in order to operate in per capita terms we have:

$$y = Ak^{a} h^{b} w^{g} \quad (2)$$

Taking natural logs and differentiating the variable with respect to time[7:]

$$\dot{y}^{*} = \dot{a}^{*} + a\dot{k}^{*} + b\dot{h}^{*} + g\dot{w}^{*} \quad (3)$$

In this case y, k, h and w mean output per worker, physical capital per worker, human capital per worker and welfare per worker, respectively.

The laws of accumulation of physical and human capital are determined by the following equations:

$$\dot{k} = s_k \, y - (n + d_k)k \quad (4)$$

where s is the propensity to save and d is the depreciation rate, both in the case of physical and human capital.

$$\dot{h} = s_h \, y - (n + d_h)h \quad (5)$$

With respect to the effects of welfare, we have computed an aggregate index made up of three indicators : the Gini index, a measure of the standard of living and an indicator of political rights (for details, see Appendix 1). The three variables that have been chosen represent a higher level of welfare. An improvement in the Gini index means that income is better distributed. Therefore, it is expected that the social welfare will improve. The same can be said in the case of the political aspects and the standard of living.

Of course, it is also possible that the standard of living increase could be concentrated in a few economic agents. But this would mean that the Gini index will worsen, affecting welfare negatively. This is the main reason why both variables have been introduced in the equation.

a* can be thought of as technological catch-up, meaning by it a technological diffusion process from a country named leader towards other countries considered as followers. It is supposed that this process favours the convergence mechanism among countries, because the less developed countries that capture technology may achieve a faster growth rate than the developed ones. In other words, since it is cheaper to imitate than to innovate, less developed countries grow faster than the developed ones.

By dividing between k, h, and w, respectively, and introducing the result in (3) we get:

$$\dot{y}^* = \dot{a}^* + \alpha\left[s_k \frac{y}{k} - (n + \delta_k)\right] + \beta\left[s_h \frac{y}{h} - (n + \delta_h)\right] + \gamma w \quad (6)$$

This is the final economic growth equation that we will estimate. Different variables that have an effect on economic growth are included in it. As we can see, population growth and depreciation have negative effects on growth.

4. Empirical Analysis.

In this section the proposed extended Cobb-Douglas production function, (equation (2)), and the economic growth equation, (equation (6)), are estimated.

As expected, results are sensitive to the specification of the model, and the coefficients present different signs and levels of significance. According to the estimated models, weak empirical evidence seems to exist about the positive relationship between technological catch up, private capital, human capital and the proposed social welfare variables.

The information available to estimate this models is encompassed by a panel of nineteen OECD countries (United States, Belgium, Canada, Germany, Denmark, Spain, Finland, France, United Kingdom, Ireland, Italy, Japan, Nederland, Norway, New Zealand, Portugal, Greece, Sweden, Australia), between 1970 and 1989.

Regarding estimation, albeit cointegration techniques could be used for a long run relationship such as an extended production function including welfare variables, ordinary least squares (OLS) and generalised least squares (GLS) have been preferred[8] in this work. The main reason is that available series are twenty years long only, and therefore, asymptotic cointegration tests may not be very useful for these data.

The estimated panel data models are as follows:

1. A multivariate regression model,

$$y_{it} = \alpha + X_{it}\beta + u_{it}$$

where i is for the country and t refers to a year. In this model, the intercept and the coefficients are the same for all countries.

2. A fixed effects model,

$$y_{it} = \alpha_i + X_{it}\beta + u_{it}$$

In this model we accept that the coefficient is common to all the countries, but the constant term may differ. Constant term should include omitted variables with a different impact in each of the countries. We assume that these effects are constant.

3. A random effects model,

$$y_{it} = \alpha_i + X_{it}\beta + \varepsilon_i + u_{it}$$

In this model omitted variables in each country present a random effect. Thus, specific random variables e_i will be included. The mean of e_i is 0, and its variance is s^2_e All equations are specified in logarithms, in order to circumvent the heteroskedasticity problem. The definition and theoretical foundation of the variables can be found in Appendix I

Extended Cobb-Douglas production function

The catch-up process appears to be the main determinant of production (table I). It seems that improvements in US technology are clearly extended to the rest of OCDE countries, and that a convergence process might exist. Catch-up coefficients present the expected positive sign and appear to be significant in all estimated equations. Social welfare, although significant and with the expected positive sign in all equations, exhibits a small impact on production. Both human capital and, mainly, private capital display a greater impact on growth than the proposed welfare index seems to induce.

Table 1: Extended Cobb-Douglas Production Function

Dependent Variable: Average per capita income growth rate (Equation 2)

	Model 1	Model 2	Model 3	Model 4
	None	Common	Fixed	Random
Constant		0.0197		0.010022
t		19.365		34.7
a*	0.495	0.338	0.291	0.581
t	11.708	11.041	9.655	4.526
k*	0.151	0.371	0.415	0.145
t	4.46	14.127	15.848	1.104
h*	0.142	0.105	0.0978	0.114
t	6.501	6.844	6.576	0.766
w*	0.0365	0.02005	0.0207	0.0269
t	3.793	2.9601	3.187	3.535
Adjusted R-squared	0.215	0.616	0.65	0.546
S.E. of regression	0.0238	0.0166	0.0159	0.0277
Sum of squared residuals	0.202	0.0986	0.0854	0.274
DW	0.946	1.0929	1.141	1.756
n	361	361	361	361

Economic growth

Durbin Watson contrasts seem to indicate that equation (6) is a better specification for the growth process than equation (2). In equation (6), propensity to save related to social welfare, private capital and human capital have been endogenously considered. Depreciation rates related to this variables are endogenously considered as well.

Although the main conclusions are maintained in the estimated models, some comments and precisions should have to made. In particular, and although evidence on the main positive influence of catch-up process on growth is basically maintained, some unexpected results appear in the fixed effects model (table II). In addition, unexpected signs appear as well in the common, fixed and random models for the human capital, and welfare variables present low significance levels in these models.

Table 2: Final Economic growth equation

Dependent Variable: Average per capita income growth rate (equation 6)

	Model 1 None	Model 2 Common	Model 3 Fixed	Model 4 Random
Constant		0.0265		0.0266
t		0.254		0.255
a*	0.0238	0.0217	-0.0137	0.0217
t	3.786	2.0767	-0.452	2.0738
y/k	0.0066	0.00703	0.0884	0.00707
t	1.172	1.194	5.605	1.198
y/h	0.000655	-0.00171	-0.00805	-0.00172
t	0.679	-0.183	-0.473	-0.183
y/w	0.000459	0.000405	0.0149	0.000405
t	0.394	0.342	1.618	0.341
Adjusted R-squared	0.0464	0.0439	0.116	0.0442
S.E. of regression	0.0262	0.0262	0.0252	0.0263
Sum of squared residuals	0.246	0.246	0.216	0.246
DW	1.566	1.569	1.579	1.569
n	361	361	361	361

The main conclusions we can derive from this model are that strong evidence seems to exist about the positive relationship between economic growth and the catch up process, and that the most common measures for social welfare in OCDE countries present a positive although small influence on economic growth.

Another important insight is that the final growth equation, when considering saving propensities and depreciation rates as endogenous, provides better specification results than the former extended Cobb-Douglas production function. Nevertheless, some unexpected results appear in the signs and levels of significance of some variables that might weaken this empirical evidence.

A caveat is in order here. In these estimated models we have only allowed for

changes in the intercept for each country, or for modifications in the variance of the constant term, since the model imposes restrictions on the equality of coefficients. The validity of our results would be reduced, however, if coefficients are very different among countries. More specifically, the presence of United States and Japan - with a different external behaviour than most European countries, which follow EU rules - may distort our findings. Anyhow, and due to the fact that economic structure is fairly similar in all countries included in the sample, we can tentatively accept the estimation technique carried out in the paper.

5. Conclusions

This paper presents some empirical research about the relationships between social welfare variables and economic growth, using a panel of nineteen OECD countries. An extended Cobb-Douglas function including technological catch up, private capital, human capital and an empirical social welfare index has been used to describe the economic growth process.

The main conclusion of this paper is that strong evidence exists about the positive influence of technological catch up and social welfare on economic growth in the countries of the sample, although some difficulties appear when transforming the growth equation and endogenously considering saving propensities and depreciation rates. Private capital and human capital also appear to be relevant determinants of economic growth.

APPENDIX 1: DEFINITIONS OF THE VARIABLES AND DATA SOURCES.

Definitions of the variables.

All the variables are expressed in US$ (PPP) 1990 price.

y_{it} : Gross domestic product for each country, per unit of labour. Source: Summers and Heston (1994).

a_{it}: USA Gross domestic product in relation to the gross domestic product of the rest of OCDE countries. This variable has been used as a proxy for the catch up process. Source: Summers and Heston (1994). The expected sign is positive.

w_{it} : Social welfare empirical index, per unit of labour. The expected sign of this index is positive.

The index is calculated as an average of these three indexes:

Gini index. Source: Deininger, K. and L. Squire (1996).

Standard of living index. Consumption plus government consumption minus military expenditure, percent of GDP. Source: Summers and Heston (1994).

Index of political rights. Source: Barro and Lee (1994).

k_{it}: capital stock per worker. Source: Summers and Heston (1994). The expected sign is positive.

h_{it}: Percentage of secondary school attained, per unit of labour. Source: Barro and Lee (1994).

The expected sign is positive.

Notes

1. More recently this idea has also been formulated by Rebelo (1991).
2. In this sense Adelmann and Robinson (1989, p. 951) state that it has been argued that inequality is necessary for accumulation and favours the increase of the economic agent´s income.
3. On this topic see O´Neill (1995). See also Birdsall et al. (1995) for the analysis of the East Asian case, that supports this idea.
4. On this topic see Sala-i-Martin (1992).
5. On the political index see Alesina and Perotti (1996). On the effects of political instability effects see Barro (1991) and Alesina et al (1996), among others. Stockhammer et al. (1997) propose an index of sustainable economic welfare (ISEW) as an alternative to GDP in measuring economic welfare. ISEW index takes account of GDP, unpaid household labour, social costs, environmental damage and income distribution.
6. An AK model considering inequality can be found in Aghion and Howitt (1997, Ch. 9).
7. * means variation rates
8. Although the fixed effects model can be estimated by OLS, random effects model requires GLS.

References

ADELMANN, I. AND ROBINSON, S. (1989), "Income Distribution and Development", in H. Chenery and T.N. Srinivisan (Eds.), *Handbook of Development Economics*, North-Holland, New York.

AGHION, P. AND BOLTON, P. (1992), "Distribution and Growth in Models of Imperfect Capital Markets", European Economic Review, 36, pp. 603-611.

AGHION, P. AND HOWITT, P. (1997), *Endogenous Growth Theory*, The MIT Press, Cambridge, Mass.

ALESINA, A. AND PEROTTI, R. (1996), "Income Distribution, Political Instability, and Investment", European Economic Review, 40, pp. 1203-1228.

ALESINA, A. AND RODRIK, D. (1994), "Distributive Politics and Economic Growth", Quarterly Journal of Economics, pp. 465-490.

ALESINA, A., OZLER, S., ROUBINI, N. AND SWAGEL, P. (1996), "Political Instability and Economic Growth", *Journal of Economic Growth*.

BANERJEE, A. AND NEWMAN, A. (1993), "Occupational Choice and the Process of Development", *Journal of Political Economy*, 101, pp. 274-298.

BARRO, R. J. (1991), "Economic Growth in a cross-section of Countries", *Quarterly Journal of Economics*, 106, pp. 407-444.

BARRO, R. and LEE, J. (1998). "Data set for a panel of 138 countries", Revised January , 1994. Mimeo.

BÉNABOU, R. (1993), "Heterogeneity, Stratification and Growth", MIT, Cambridge, Mass., Working Paper, nº 93-4.

BÉNABOU, R. (1996), "Inequality and Growth", NBER Macroeconomics Anual, 11, pp. 11-74.

BERTOLA, G. (1993), "Market Structure and Income Distribution in Endogenous Growth Models", *American Economic Review*, 58, pp. 1184-1198.

BIRDSALL, N., ROSS, D. AND SABOT, R. (1995), "Inequality as a Constraint on Growth in Latin America", in D. Turham, C. Foy and G. Larrain (eds.), *Social Tensions, Job Creation and Economic Policy in Latin America*, OECD, Paris.

CHANG, R. (1998). "Political party negotiations, income distribution and endogenous growth", *Journal of Monetary Economics*, 41, pp. 227-255.

CLARKE, G.R.G. (1995), "More Evidence on Income Distribution and Growth",

European Economic Review, vol. 47, pp. 403-427.

DEININGER, K. AND L. SQUIRE (1996). A new data set measuring income inequality, *World Bank Economic Review*, 10(3), September, 565-91.

DURLAUF, S. (1992), "A theory of Persistent Income Inequality", MIT, Cambridge, Mass., Working Paper, nº 4056.

FIELDS, G.S. (1989), "Changes in Poverty and Inequality in Developing Countries", *World Bank Research Observer*, 4, pp. 167-185.

GALOR, O. AND ZEIRA, J. (1993), "Income Distribution and Macroeconomics", *Review of Economic Studies*, 60, pp. 35-52.

GROSSMAN, G.M. AND HELPMAN, E. (1991), *Innovation and Growth in the Global Economy*, MIT Press, Cambridge.

HERCE, J.A., SOSVILLA, S. AND LUCIO, J.J. (1998), "Growth and the Welfare State in the EU : A causality analysis". Documento de Trabajo FEDEA number 98-12.

KALDOR, N. (1956), "Alternative Theories of Distribution", *Review of Economic Studies*, 23, pp. 83-100.

KUZNETS, S. (1955), "Economic Growth and Income Inequality", *American Economic Review*, 45, pp. 1-28.

LUCAS, R.E. Jr. (1988), "On the mechanics of economic development", *Journal of Monetary Economics*, 22, pp. 3-42.

MANKIW, N.G., ROMER, D. Y WEIL, D.N. (1992), "A contribution to the empirics of economic growth", *Quarterly Journal of Economics*, 100, pp. 225-251.

MAURO, P. (1993). Political instability, growth and investment, Unpublished manuscript. Harvard University, Cambridge, MA.

O´NEILL, D. (1995), "Education and Income Growth: Implications for Cross-Country Inequality", *Journal of Political Economy*, 103, pp. 1289-1301.

PEROTTI, R. (1993), "Political Equilibrium, Income Distribution, and Growth", *Review of Economic Studies*, 60, pp. 755-776.

PEROTTI, R. (1996), "Income Distribution, Democracy and Growth: What the Data Say", *Journal of Economic Growth*

PERSSON, T. AND TABELLINI, G. (1994), "Is Inequality Harmful for Growth?", *American Economic Review*, 84, pp. 600-621.

REBELO, S. (1991), "Long-run policy analysis and long-run growth", *Journal of Political Economy*, 99, pp. 500-521.

ROMER, P.M. (1986), "Increasing returns and long-run growth", *Journal of Political Economy*, 94, pp. 1002-1037.

ROMER, P.M. (1987), "Growth based on increasing returns due to specialisation", *American Economic Review*, 77, pp. 56-62.

ROMER, P.M. (1990), "Endogenous technical change", *Journal of Political Economy*, 98, Part II, pp. 71-102.

SAINT PAUL, G. AND VERDIER, T. (1993), "Education, Democracy and Growth", *Journal of Development Economics*, 42, pp. 399-407.

SAINT PAUL, G. AND VERDIER, T. (1996), "Inequality, Redistribution and Growth: A Challenge to the Conventional Political Economy Approach", *European Economic Review*, 40, pp. 719-728.

SALA-I-MARTIN, X. (1992), "Transfers", NBER, Working Paper, nº 4186.

SOLOW, R.M. (1956), "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, pp. 65-94.

STOCKHAMMER, E; HOCHREITER, H; OBERMAYR, B. AND STEINER, K. (1997). "The index of sustainable economic welfare (ISEW) as an alternative to GDP in measuring economic welfare. The results of the Austrian (revised) ISEW calculation 1955-1992, *Ecological Economics*, 21, pp. 19-34.

SUMMERS, R. AND HESTON, A.(1994). Penn-World tables mark 5.6.

VENIERIS, Y and GUPTA, D. (1986). "Income distribution and socio-political instability as determinants of savings: A cross-sectional model", *Journal of Political Economy*, 96, pp.873-883.