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**Inequality Dynamics:
Evidence from Some European Countries**

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**INEQUALITY DYNAMICS: EVIDENCE
FROM SOME EUROPEAN COUNTRIES**

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Abstract

Using year-by-year measures of income distribution provided by the LIS dataset for eight continental Europe countries, this paper considers the recent literature on income inequality and growth to test the following propositions: does inequality converge during the process of economic growth? What are the variables that can influence this process? Are there any joint dynamics in income inequality and income levels, and which variable causes the other? On the one hand, the results seem to show mean-reversion in Gini coefficients in the analysed sample, not only when “absolute convergence” is taken into account, but also when other determinants of movements in income inequality, suggested by the literature, are added to the base regression. On the other, they point out that shocks to income can yield interesting short run dynamics in income distribution, whereas the reverse link, from inequality to income, is not well supported by the specification.

JEL CLASSIFICATION: O40

KEYWORDS: Inequality, Growth, Convergence, Panel Data.

0 Introduction

To introduce the theme of this paper we will start from a question raised by Bénabou (1996) in his paper on inequality and growth. Do countries converge to a steady state level of income inequality, and what is the role of income growth during this process?

This question may seem unusual, and the answer not clear at all, as in the real world we do not seem to observe any common trend in the movements of inequality across countries and over time. Yet ascertaining the facts, and trying to give these facts an interpretation, may be of sure interest.

From a theoretical point of view, the concept of convergence in inequality closely follows that of conditional convergence of per capita incomes, as described, for instance, in Mankiw, Romer and Weil (1992): after all, we just wonder if there is convergence not only in the first moment of individual income (as measured by the GDP per worker), but also in its second moment, namely the income distribution (as measured, for instance, by Gini index).

Today there is a vast empirical literature examining international convergence in per capita incomes, following the predictions of conditional convergence in the neoclassical models of growth à-la Solow-Swan: the lower the starting level of real per-capita GDP, relative to the long-run or steady-state position, the faster is the growth rate. This convergence is “conditional” because the steady-state levels of capital and output per worker depend, in this class of models, on the saving rate, the growth rate of population, and the position of the production function – characteristics that might vary across economies. But this is only the beginning of our story.

In recent times, in fact, a lot of empirical work has been carried out in testing the convergence predictions of the neoclassical growth model by looking at the behaviour of regions within countries¹. Actually, when we test convergence in per capita incomes not

across countries, but across regions, we are moving a step along a way which might lead us to the following question, at a more “microeconomic” level: are poor people’s incomes growing faster than rich people’s ones? In a sense, this is equivalent to wonder whether there is convergence in income inequality².

This paper tries to answer this intriguing question by looking at a panel of eight continental European countries for which the Luxembourg Income Study provides internationally comparable measures of income inequality. The choice of the dataset is, of course, endogenous to the ideas in the paper, but is justified with the observation that the countries in question may have experienced, over the decades for which the data were available, similar policies and other shocks that allow a reliable panel analysis.

We start in the next section with a brief review of the main models in which there is endogenous determination of income distribution during the process of economic growth. At the end of the section, we look at the main conclusions of Benabou’s model of endogenous income distribution, which we use as a basis, without taking it too literally, in our empirical analysis.

In section 3 we present the estimation results for convergence in income distribution: in this context, we discuss the issues of absolute and conditional convergence, as they appear from the data. Section 4 presents the results of the estimation of a dynamic system in which income level and income inequality are assumed to follow a vector autoregressive process. The results seem to provide some interesting insights with respect to the joint comovements of the two variables. Section 5 summarises and concludes.

1 Review of the literature

In the neoclassical models of growth income distribution plays no role in determining aggregate savings, and aggregate savings have no influence on the long-term growth rate of the economy. These results directly stem from a linear relationship between savings and income. Along this framework, Stiglitz (1969) shows the existence of an intrinsic tendency of wealth (and incomes, inasmuch the elasticity of substitution of the production function is equal to one) to become more evenly distributed when the economy moves toward the steady state.

The model developed by Stiglitz first shows the possibility of an intrinsic tendency of an economy to converge to an egalitarian distribution of incomes. In other words, Stiglitz shows that there is convergence not only in country's average levels of income – GDP per capita – but also in their entire income distribution³.

This idea of convergence also appears in many of the new theories linking inequality and growth⁴. Yet it is not the bulk of this new literature: nonetheless, the issue is extensively tackled, among the others, by Galor and Zeira (1993), who show that, as the economy converges to its own steady-state (depending on the initial distribution of wealth), inequality tends asymptotically to a positive value, the sign of the long-run tendency being dependent on the initial degree of concentration⁵. One of their conclusions is that wealth and equality are highly correlated and affect one another. On one hand, they argue that countries with a more egalitarian distribution of wealth grow more rapidly and have a higher income level in the long run - we do not investigate in detail this prediction, which has already been tackled by the empirical literature⁶ -. On the other hand, they demonstrate that countries with greater income per capita have a more equal distribution of income, along the lines suggested at least by Kuznets (1955).

As pointed out by Bénabou (1996), the endogenous evolution of the wealth distribution is at the core of a more general class of incomplete markets models linking inequality and growth: (re)distribution is endogenized either through a decentralised market outcome or through a given political outcome, given its initial level. In this way, distributional dynamics become explicit, and therefore of considerable interest. There is also a literature, surveyed by Aghion and Bolton (1992), which studies the endogenous evolution of income distribution in a growth model, abstracting from policy interventions. Nevertheless, we will not delve into this issue more deeply: for our purposes, what seems striking is that, notwithstanding the interest of the theory, the above mentioned dynamics have not been analysed deeply by the empirical literature. Recent work on inequality-growth relationship has been mainly concentrated on reduced-form regressions from inequality to growth, whereas the opposite link, from income to distribution, has been mainly tackled by development economists trying to verify the famous Kuznets's inverse U-curve predictions⁷.

Only recently, a first step towards the line of research above indicated has been made by Bénabou. That is why that, in what follows, we shall refer to his work, which makes a first pass at the issue of convergence in distribution. It is worth pointing out once again, however, that dynamics in income inequality are possible in many of the models linking inequality and growth. Distributional dynamics may easily arise in Persson and Tabellini's (1994) model, as well as in Saint-Paul and Verdier (1993), where it is shown that, because of the egalitarian aspect of public education, and because of the persistence of its effects through human capital, there is a long-run tendency towards homogenisation of incomes.

Starting from Bénabou's observations and setting the problem in a more precise way, we can observe that, when movements in income distribution are endogenised in theoretical models, two major possibilities seem to arise:

1. If the median voter or some agent located at a lower percentile chooses the tax rate in every period, the economy converges to a unique steady state growth path. During the convergence process, inequality follows a first-order autoregressive process, whose size depends, in Bénabou's model, positively on the elasticity of output to capital (β) and negatively on the tax rate preferred by the pivotal group (τ). Formally, it is shown that (Bénabou 1996, page 24)⁸:

$$VAR(Y_{t+k}) = f(VAR(Y_t), \beta, \tau)$$

where the variance of incomes can reasonably be regarded as a proxy for income inequality.

2. If the pivotal agent is of higher rank than the median, there can be multiple steady-states: in this case, economy may move towards increasing inequality, by worsening, for instance, the credit constraints of poor agents.

What do this brief survey suggest us about convergence in inequality? For a given group of countries, we could observe, to the extent permitted by the data, convergence in income distribution, provided that human capital spillovers, educational investment or endogenous redistribution act together as a stabilising effect on inequality: this is what happens in Galor and Zeira's model and in Bénabou's possibility one⁹.

2 Empirical findings I: on convergence of income inequality

As earlier suggested, any equation seeking to test convergence in inequality has to relate the change in inequality between two units of time to the initial level of inequality¹⁰. The model by Bénabou, for instance, specifies a transition equation that could be linearized in the following form:

$$1. \ln(\text{VAR } Y_{i,t} - \text{VAR } Y_{i,t-k}) = \beta_I \ln(\text{VAR } Y_{i,t-k}) + \beta_Z \mathbf{Z}_{i,t-k} + u_{it}$$

where the dependent variables include, together with initial inequality, a subset \mathbf{Z} of variables, like those seen in possibility one, to be identified as potentially important explanatory variables of movements in income distribution. In this sense, just like the first moments convergence, even the convergence in distribution should be regarded not as absolute, but as conditional, and depending on a set of variables that could help us to explain the movements in income dispersion.

No theory seeking to explain convergence in income distribution should refer to a specific time unit. Normally, the logical time span is a generation, both in Bénabou and in Galor and Zeira. Nonetheless, we might miss the point if we had to consider very long time intervals, as we would lose the theoretical timescale during the process of aggregation across generation, taking long-run average dynamics to filter the short run ones'. It follows that, if convergence in distribution occurs, it should arise, just like first-moments convergence, in data at any frequency (Islam, 1995).

These observations drive us to test empirically the convergence hypothesis extending the typical observations drawn from cross-sectional data in a direction that allows us to consider a panel of time series cross-sectional data; by this approach, we can exploit the wealth of information embodied in high-frequency data, also determining the significance of country-specific effects that are assumed away in the traditional approach. This practice is particularly important in our context, as international panels of inequality measures are likely to be uneasily compared across countries and over time, thus rendering at least hazardous any attempt to throw everything in pell-mell.

We report least squares dummy variable¹¹ regressions of the yearly change in Gini coefficient¹² - throughout the years 1950-1990 in eight continental Europe countries - on the initial value of Gini coefficient, with and without controlling for other determinants of the

dynamics in income distribution, like the initial level of income, the short-term variations of government consumption out of GDP, and of a proxy for the human-capital transmission effect (as measured by the share of the relevant age group attending secondary school)¹³. Before looking at the results, however, some preliminary observations about the nature of the data set and its implementation appear necessary.

All the data other than distributional and educational indicators have been drawn from the Penn World Tables, version 5.6¹⁴. With regard to the inequality measure, we adopted the Gini index, using data drawn from different national sources - as reported in Atkinson, Rainwater and Smeeding (1994) - for which it proved possible to use the available information constructing consistent yearly time-series spanning over the periods indicated in the appendix. All the inequality measures refer to post-tax income¹⁵, thus making possible to investigate the significance and the extent of government intervention in the economy. Where missing, the year-by-year figures were replaced by estimates based on a linear time trend.

With regard to the continental Europe nations over which the analysis was conducted, we chose a panel of homogeneous countries, provided that they may have experienced, over the time interval in question, similar shocks and similar policies undertaken by homogeneous institutions (Eichengreen, 1994).

In Table 1 the initial level of Gini index appears alone on the right-hand side, as in Bénabou's regression. Allowing for country-specific effects, the coefficient is negative (like in Bénabou) and statistically significant, and the adjusted R^2 is strongly different from zero. The result also implies some hazardous quantitative predictions, suggesting mean-reversion in inequality (or, equivalently, a steady-state value in inequality) for an average value of post-tax and transfer Gini coefficient of around one-third¹⁶.

This result, which rests on the assumption of different intercepts (thanks to the fixed effects) but a common slope for all the countries, does not prove that these countries have

been converging to the same level of income inequality. Yet it suggests that, once we control for the country specific heterogeneity, these countries are converging to their steady state level of inequality at similar rates. This finding, in our opinion, is also coherent with the results obtained by Sala-i-Martin (1996), showing β -convergence and σ -convergence across regions within some European countries (included Italy and Germany, also present in our sample). In Sala-i-Martin (1996), the overall pattern shows declines in dispersion of incomes over time for each country, and also indicates that the speeds of convergence are extraordinarily similar across countries.

Moreover, the year-by-year approach rules out the possibility of measurement error in the initial level of the Gini index, which could lead to a negative bias in the OLS estimation of the convergence coefficient. In other words, if temporary measurement error in Gini was important, one would have very little convergence in a high-frequency data approach, and this does not seem to be the case.

Table 2 adds to the right-hand side of the specification other variables that can reasonably be regarded, given the predictions of the theoretical models, as candidate explanatory of the movements in income distribution. On one hand, the logarithm of GDP per worker and the human capital effect, whose dynamics are likely to influence the movements in income distribution. On the other, the short-term movements of the share of government consumption out of GDP, which can be seen, in this context, as a proxy for the level of government intervention in the economy, for instance from a redistributive point of view (either exogenous or endogenous).

All the coefficients are statistically significant and have the expected sign. The mean reversion effect is strongly confirmed; in addition, the results indicate that the variation in Gini index negatively depends on the variation of government consumption, on the level of income per worker and on the human capital variable. Most importantly, the new variables do

not lower the coefficient on the initial level of inequality, and improve substantially the fit of the regression.

Finally, Figure 1, following an analogous exercise undertaken, in a slightly different context, by Mankiw, Romer and Weil (1992), presents a graphical demonstration of the effect of adding measures of income per worker movements, government consumption and human capital spillover to the absolute convergence picture shown in the top panel (this picture has been obtained after removing the group means both from the level and the variation of the Gini index). In the first figure, evidence of mean-reversion in inequality does not show up clearly. Nevertheless, as soon as we net out government consumption, income per worker and human capital from both the inequality level and inequality variation, the second panel shows that, if countries had had the same income dynamics, (redistributive) policies and educational investment rates, there would have been a stronger tendency towards mean-reversion in inequality¹⁷.

3 Empirical findings II: A simultaneous equations analysis

Finally, in order to take into account the joint determination of income distribution and income levels, we try a simple VAR specification that obviates a decision as to what variables are exogenous or not and can tell us which variable causes, in a Granger sense, the other. Also, it can help us to disentangle the effects of a shock in the system, thus allowing us to analyse the joint dynamics of the variables included in the specification.

After a correction for the country specific effects, we consider the simple specification:

(2)

$$\mathbf{y}_{it} = \begin{bmatrix} LNGDPW_{it} \\ GINI_{it} \end{bmatrix} = \begin{bmatrix} m_1 \\ m_2 \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} LNGDPW_{i,t-1} \\ GINI_{i,t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{LNGDPW,it} \\ \varepsilon_{GINI,it} \end{bmatrix} = \mathbf{m} + \mathbf{A}\mathbf{y}_{i,t-1} + \boldsymbol{\varepsilon}_{it}$$

i.e., we run least squares dummy variable regressions of the income level on its initial level and on the level of income inequality, and likewise for the Gini index. The results are shown in Table 3.

Of course, the risk of such a specification, which abstracts from the issue of nonstationarity in the two variables, is clear. Nevertheless the simple AR(1) regression for income produces (t-ratios are given in parentheses)

$$LNGDPW - LNGDPW1 = .3478 - 0.0325LNGDPW1 \\ (9.725) \quad (-8.930)$$

The t-ratio for the lagged value of income is far from the (-3.12) value suggested by Dickey and Fuller, so we can reject the hypothesis of a unit root for income. This allows us to investigate the static equilibrium of the system implied by the specification (2).

The eigenvalues of the \mathbf{A} matrix of the dynamic system

$$\begin{bmatrix} 0.949 & 0.031 \\ -0.038 & 0.826 \end{bmatrix}$$

are both less than unity, 0.95 and 0.82, thus confirming the stability of the system and allowing us to make some speculative comments.

The first one is that, at least looking at the results of this specification, it seems, if any, that income level causes (in a Granger sense) the income distribution, but the reverse is not immediately true, as suggested by the low significance level of the Gini index in the first equation, (at least in this sample and given the admittedly meagre specification we have allowed for) unlike many of the theories on income distribution and growth would suggest.

A second comment can be drawn by studying the impulse response functions implied by this specification. Consider, for simplicity, an orthogonal innovation in $\varepsilon_{LNGDPW,it}$, the error

term in the first equation, such as an exogenous shock affecting all the countries in the sample at some date t^{18} (for instance, the adoption of a single currency by all the countries in the panel). Impulse response functions, by calculating the chain reactions in all the variables in the sample, help us to disentangle the dynamic paths of the two variables during their new adjustment towards the steady state. The plot of the response of the Gini index following an innovation in $\varepsilon_{LNGDPW,it}$ is given in Figure 2. It shows that, following a one-period innovation in income, inequality first decreases then increases¹⁹, describing over the very short run an inverted U-curve which is at odds with the traditional Kuznets's predictions.

In sum, therefore, the above exercise shows, despite its limitations and its potential pitfalls, that inequality, as many of the recent theories on inequality and growth suggest, follows an autoregressive path similar to that of income; that this “convergence property” can be reasonably be regarded not only as absolute, but also as conditional; and that shocks on income are likely to have potential effects on income inequality, while the reverse mechanism, from inequality to income, is not well supported by our specification.

This evidence drives us to the conclusions outlined below.

4 Discussion and conclusions

Obviously, one might object a discrepancy between the explanatory variables added to the base regression and the ones influencing distributional dynamics in Bénabou's model, which we adopted as a benchmark throughout the first part of our empirical analysis. The variety of the models briefly surveyed in the first section of this paper, however, does not seem to have reached a consensus about the exact nature of the relationship linking income and inequality movements; in this sense, the choice of the appropriate regressors still remains a puzzle.

For this reason, since a regression like that shown in Table 2 still seems an unexplored topic for empirical research, the main conclusion we can draw from it is that we could look at convergence in the second moment (and even higher, as suggested by Bénabou) with an approach very similar to the standard one, concerning convergence in per capita incomes. We have not discussed the plethora of possible problems arising from regressions like those reported above, in particular in the analysis of convergence in inequality, like reverse causation (from GINI to growth) leading to simultaneity bias or omitted variables correlated with GINI or other regressors.

Nonetheless, we may observe that in the observed countries, characterised by a relatively homogeneous nature of their political institutions and a similar placing in per capita income scale, a given set of forces tend to suggest mean-reversion in inequality. This conclusion, in our opinion, is particularly reinforced by the particular nature of the econometric approach adopted, which has taken into account a restricted set of countries observed over a relatively long period of time, thus permitting to overcome one of the most serious problems concerning the econometrics of income-inequality relationship: the paucity and the low degree of comparability (both over time and cross-country) of the distributional data.

The rest of the empirical analysis, on the other hand, does not seem to lend much support to the opposite view, from income inequality to income, like the first equation of our dynamic system tends to suggest.

Overall, this way of dealing is nothing else but a courageous and preliminary attempt towards a relatively recent field, mainly stimulated on one hand by Bénabou's suggestions and on the other from recent panel data approaches on growth (Islam, 1995) and growth and inequality (Brandolini and Rossi, 1997). We need to remark that the empirical work upon this topic is only at its early stages; moreover, we still have not a state-of-the-art model for

dynamics in income inequality coherent with our specification - something like, for instance, log-linear approximations of the evolution of labour productivity around its steady-state path in the (augmented) Solow model -; last but not least, we have to “deal with a host of statistical and methodological issues plaguing the measurement of inequality, its comparability across countries and, within the same country, over time” (Brandolini and Rossi, 1997). In this sense, we have probably just moved a first pass towards a new, still unexplored, line of research.

We believe that one of the most urgent tasks should be to understand why different countries, less homogeneous than the ones we considered in our sample, seem to follow different trajectories of inequality over time. We do think, in this context, that issues like social mobility, endogenous growth leading to different steady states and endogenous redistribution are crucial to give a first answer to this question.

Appendix

Inequality Measures

National studies on income inequality are based on different definitions, sources and timing and are uneasily comparable across countries. For eight European countries, we used the available information on distributional indicators to construct year-by-year time series for post-tax Gini (with the exception of Belgium, for which measures refer to pre-tax income) index spanning over the periods indicated in the table below (Table 4). This was made possible using the information provided by Atkinson, Rainwater and Smeeding (1995), whose work extensively reviews the available evidence contained in national studies. Whenever needed, we replaced missing figures with a linear time trend.

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Fixed-effects(within) regression						
sd(u_cd)	=	.010303			Number of obs =	161
sd(e_cd_t)	=	.0089146			n =	8
sd(e_cd_t + u_cd)	=	.0136243			T-bar =	20.125
corr(u_cd, Xb)	=	-0.9309			R-sq correct =	0.1345

DGINI		Coef.	Std. Err.	t	P> t	[95% Conf. Interval]

GINI1		-.1374796	.0309262	-4.445	0.000	-.1985802 -.076379
constant		.0413501	.0096696	4.276	0.000	.0222459 .0604543

cd			F(7,152) =	3.946	0.001	(8 categories)

Table 1 : TEST FOR UNCONDITIONAL CONVERGENCE. dependent variable: variation of Gini index (DGINI); independent variable: initial value of Gini index (GINI1); fixed effects

Fixed-effects (within) regression						
sd(u_cd)	=	.0140518			Number of obs =	157
sd(e_cd_t)	=	.0081479			n =	8
sd(e_cd_t + u_cd)	=	.0162432			T-bar =	19.625
corr(u_cd, Xb)	=	-0.9478			R-sq correct =	0.2021

DGINI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
GINI1	-.2098239	.039453	-5.318	0.000	-.2878012	-.1318465
DLNSG1	-.0477528	.0222495	-2.146	0.034	-.0917281	-.0037774
LNSH1	-.0118443	.0053188	-2.227	0.027	-.0223566	-.0013319
LNGDPW1	-.0096748	.0035804	-2.702	0.008	-.0167513	-.0025983
constant	.1574141	.0440969	3.570	0.000	.0702583	.2445699

cd		F(7,145) =	5.016	0.000	(8 categories)	

Table 2 :TEST FOR CONDITIONAL CONVERGENCE. Dependent variable: variation of Gini index (DGINI); independent variables: lagged Gini index (GINI1), rate of change of the share of government consumption (DLNSG1), initial log of school enrolment ratio (LNSH1), initial log of GDP per worker (LNGDPW1); fixed effects.

R-squared		0.9923				
LNGDPW	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
LNGDPW1	.9488537	.0098362	96.466	0.000	.9294151	.9682923
GINI1	.0310622	.1069939	0.290	0.772	-.1803828	.2425071
_cons	.5266238	.1214236	4.337	0.000	.2866625	.7665851
cd	F(7,147) =		0.314	0.947	(8 categories)	
R-squared		0.9845				
GINI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
LNGDPW1	-.0081011	.0034402	-2.355	0.020	-.0148993	-.0013029
GINI1	.8260056	.037139	22.241	0.000	.7526145	.8993968
_cons	.1336042	.0424163	3.150	0.002	.0497844	.217424
cd	F(7,148) =		4.539	0.000	(8 categories)	

Table 3: VAR estimation of the equation 2. Dependent variables are, respectively, the log of GDP per worker and the Gini index.

Country	Period	Main source
Belgium	1965-1981	Atkinson, 1983
Denmark	1981-1990	Pedersen and Smith, 1995
Finland	1966-1992	Uusitalo, 1989
Germany, West	1950-1990	Guger, 1989
Italy	1967-1993	Brandolini and Sestito 1994
Netherlands	1981-1989	Atkinson, Rainwater and Smeeding
Norway	1970-1990	Ringen 1991
Sweden	1975-1991	Gustafsson and Palmer 1994

Table 4: National sources

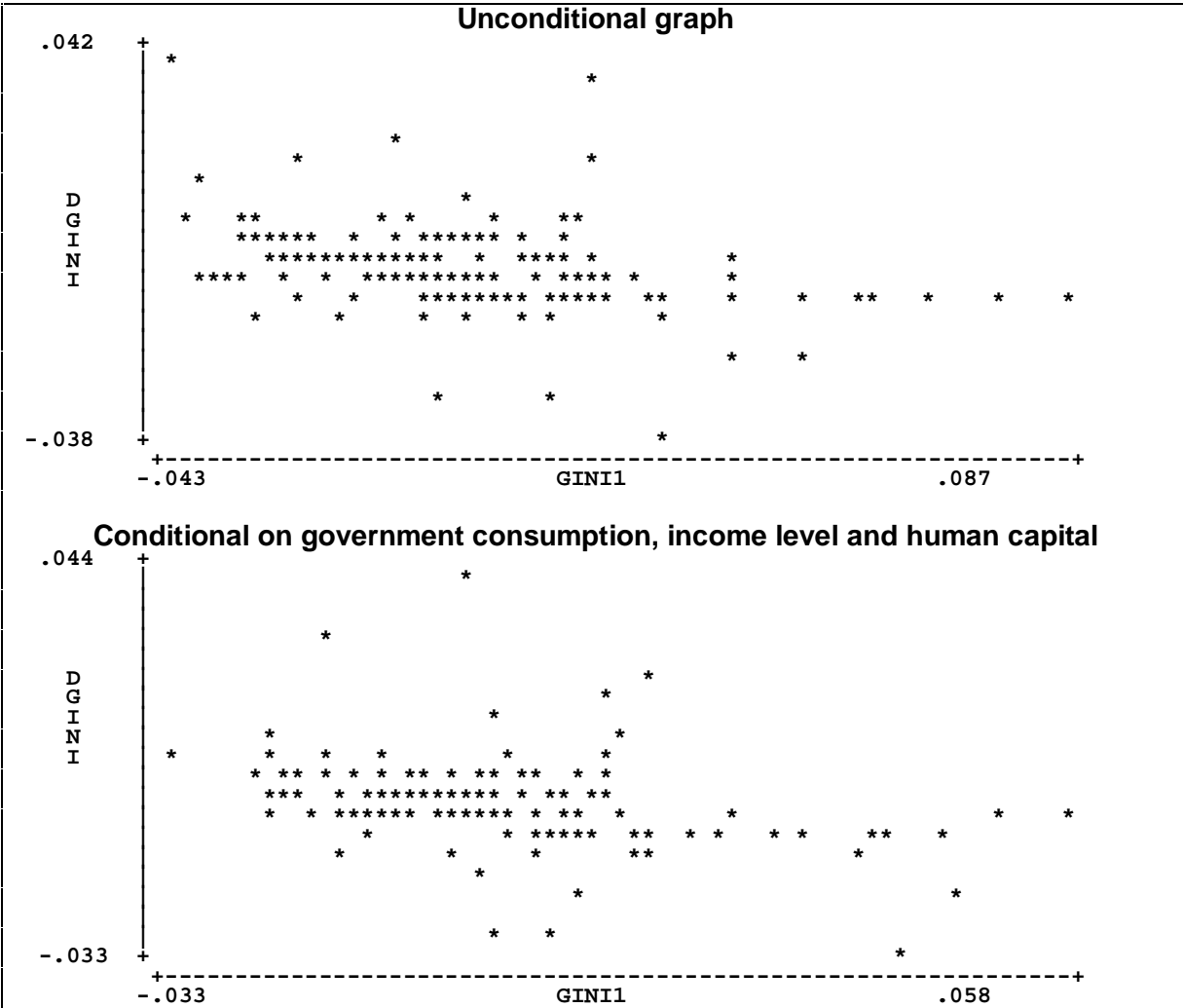


Figure 1: UNCONDITIONAL VERSUS CONDITIONAL CONVERGENCE (values appear in deviation from their group (country) means)

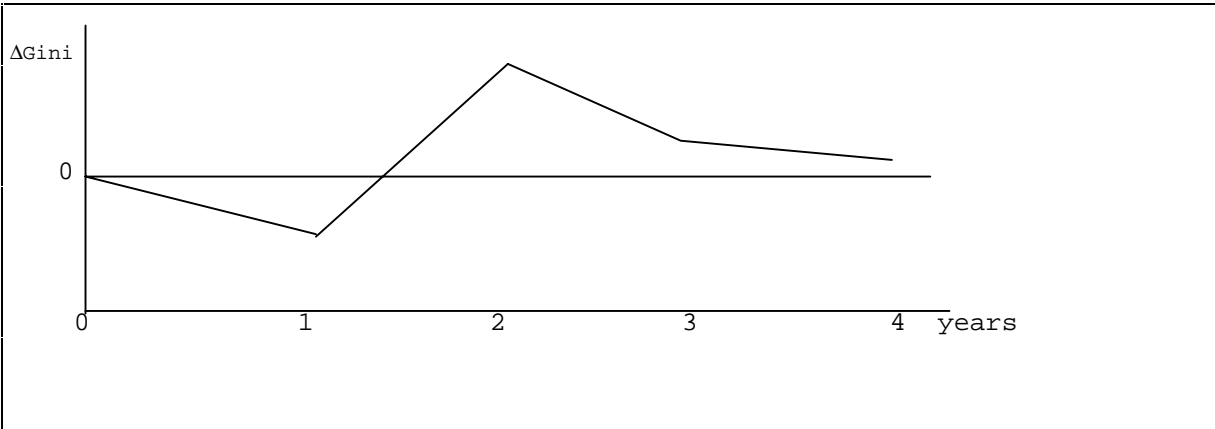


Figure 2: Impulse response functions for the Gini coefficients after one innovation in income: inequality first decreases, then increases, then decreases again towards its new steady state level.

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¹ See Sala-i-Martin (1996) for a recent review of this issue as well as some new evidence, which lends support to the idea that interregional distribution of incomes (across United States, Japan and five European countries) tend to shrink over time.

² This is true only if the so-called “ β -convergence” (growth level of income negatively related to its initial level) and “ σ -convergence” (reduction in the dispersion of incomes) move in the same direction. we shall turn to this issue below.

³ Tamura (1991) develops a model of endogenous growth that predicts convergence in both growth rates of income and the level of per capita income.

⁴ For a survey of these theories, see, for instance, Alesina and Perotti (1994) and Bénabou (1996).

⁵ Galor and Zeira also show in their model that the speed of convergence depends on the saving rate and on the interest rate.

⁶ See, for instance, Clarke (1995).

⁷ For a recent review, see Adelman and Robinson (1989).

⁸ [For another transition equation for income distribution similar to the one shown above, see, for instance, Saint-Paul and Verdier \(1993\).](#)

⁹ Human capital spillover and educational investment effect affect inequality through the parameter β .

¹⁰ Strictly speaking, we might observe β -convergence in individual incomes without observing variations in Gini coefficients. Consider, for example, two economies composed at time 0 by two people only, one (A) earning 100 and the other (B) earning 200; if at time 2 the situation is reversed, with A earning 200 and B earning 100, we would observe convergence in individual incomes, but the economy as a whole would not show convergence in income inequality. The example illustrates that income inequality convergence and individual incomes convergence are conceptually different. Reduction in Gini coefficient implies convergence in individual incomes, but the converse is not necessarily true. Therefore, our test for convergence in inequality is somehow “stronger” than the usual cross-sectional tests of the first moment convergence.

¹¹ Using OLS and allowing for fixed effect may result in inconsistent estimators, because of the presence of a lagged dependent variable in the right-hand side of the regression equation. The asymptotic bias of the fixed-effects estimator typically shows up in panels with a large number of individuals (or, in our case, countries), but only a few time observations. Yet this is not the present case, and the bias might well be ignored (Islam, 1995).

¹² We chose the Gini rather than other distributional indicators because it relates more directly to a specification like that embodied in the equation (1) and because it was available for more observations across countries and over time in my panel. Moreover, it can be shown (Cowell, 1977) that for a lognormal the Gini is a monotonic function of the variance of the logarithm of income, thus justifying the choice of this index on a theoretical basis as well. However, as pointed out by Clarke (1995), the most commonly used measures of inequality are very highly correlated.

¹³ For the inequality variables, the simple levels were considered. We also ran regressions with the logarithms of the Ginis instead of the levels. This led to similar results.

¹⁴ Barro and Lee's (1993) dataset was used to construct year-by-year measures of human capital.

¹⁵ With the only exception of Belgium (see appendix).

¹⁶ To get this result, it suffices to set DGINI equal to zero in steady state and solve the resulting expression for the GINI level.

¹⁷ In practice, the second graph is the plot of the estimated residuals of a regression of DGINI against DLNSG1, LNSH1, LNGDPW1 and a constant versus the residuals of an analogous regression of GINI1 against the same variables, as stated by the Frisch-Waugh theorem.

¹⁸ An objection to this procedure for the computation of the impulse response functions is that innovations in income cannot, in general, be considered independent from innovations in income inequality. In other words, the error terms of the two equations are not necessarily orthogonal each other. Also, we are forced to rule out idiosyncratic shocks, that would make the empirical framework richer, but much more complicated.

¹⁹ And finally decreases.