Convergence in the OECD: Transitional Dynamics or Narrowing Steady State Differences?*

Javier Andrés, José E. Boscá and Rafael Doménech
University of Valencia

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Abstract

The empirical literature on growth has steadily improved the econometric methods used mainly to address the effect of cross-country heterogeneity in the estimated convergence rate. In this paper, we highlight an important implication of this process of econometric refinement that has so far received little attention. We show that the picture that emerges from models that allow for generalized heterogeneity changes our view of the process of convergence within the OECD. Estimation methods that allow for non or partial heterogeneity stress the importance of transitional dynamics in the process of convergence. Thus, the observed reduction in the dispersion of per capita income within the OECD ($\sigma-$convergence) is mostly explained by transitional dynamics. On the contrary, when generalized parameter heterogeneity is (tested and) allowed for, we find that the observed narrowing of incomes in the OECD has little bearing on transitional dynamics. $\sigma-$convergence in this case happens because the long run features of these countries are becoming increasingly similar (convergence in steady states). There are also striking differences across estimated models as regards the evolution of the relative position of the average country with respect to its steady state income per capita level.

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1. Introduction

Research on growth and convergence has proceeded through several stages that can be described as a process of accommodating cross-country heterogeneity into the convergence equation. In the first stage, the world could be described as countries approaching to equal (absolute convergence) or to different (conditional convergence) steady states. In both cases (see Baumol, 1986, Barro and Sala i Martín, 1992 or Mankiw, Romer and Weil, 1992) the assumption of parameter homogeneity of the underlying production function was assumed and not tested. Later, some researchers (Knight, Loayza and Villanueva, 1993, Islam, 1995, Durlauf and Johnson, 1995 or Caselli, Esquivel and Lefort, 1996, among others) began to challenge the view that the productivity shift parameter of the underlying production function is homogeneous across countries. From an econometric point of view, the transition from the first to the second stage made researchers resort to panel data methods that exploit the time dimension of data sets. A natural extension to accommodate heterogeneity was developed in Lee, Pesaran and Smith (1997). In this third stage, these authors extended the use of panel data methods to allow for differences not only in the initial conditions (the constant term) but also in other coefficients of the production function and in the rate of technological progress itself.

If there is widespread heterogeneity, there are substantial econometric difficulties in obtaining precise estimates of the speed of convergence. In particular, the estimated rate of convergence is biased downwards in cross-section regressions (see Lee, Pesaran and Smith, 1997, or Caselli, Esquivel and Lefort, 1996), suggesting a slower convergence rate than is actually the case.[1] The pooled fixed-effect estimator would partially solve the problem of accommodating level effects across countries through heterogeneous intercepts, but in dynamic panels heterogeneity in speeds of convergence renders this estimator inconsistent too. Pesaran and Smith (1995) show that the mean group estimator (i.e. estimating the convergence equation separately for each country using annual data and averaging the coefficients) is appropriate in this case. Nevertheless, as recognized by these authors, this procedure may also be subject to a small sample bias that can be important even for time dimensions as large as 30 years.

In this paper, we do not discuss further the advantages or shortcomings of these different econometric methods to estimate convergence equations.[2] Our aim is not pre-

[1] However, in a recent paper, Bond, Hoeffler and Temple (2001) show that the GMM estimator used by Caselli, Esquivel and Lefort (1996) does not perform well in first-differenced growth equations, producing upward biased estimates of the speed of convergence.

[2] A far from exhaustive list of papers that describe the most relevant problems with cross-country growth regressions includes Pack (1994), Temple (1999), Brock and Durlauf (2000), Durlauf (2001) or Bond, Hoeffler and Temple (2001).

senting an alternative econometric method to estimate consistently the parameters in growth regressions, but rather focusing on some implications of the different econometric techniques that so far have been extensively used in the convergence literature, and that have been largely unexplored. To this end, we present in the following pages three well-established estimation approaches, as a benchmark of the way the literature has estimated convergence equations in some fundamental contributions, and explore the implications of parameter heterogeneity within the standard Mankiw, Romer and Weil's theoretical framework. Cross-section and fixed effects models lead us to conclude that the observed reduction in the dispersion of per capita incomes that has taken place among OECD countries since the sixties is mostly a process of transitional dynamics. According to this interpretation, the dispersion of the long-run (steady state) features of OECD economies has remained fairly stable during the last forty years. If the dispersion of incomes has narrowed, it is because these countries started from very different initial conditions and have been approaching their own steady state. This is in accordance with the predictions of the standard exogenous growth model. Mean group estimates tell us a different story, namely that the process of transitional dynamics has been negligible. OECD countries have never been too far from their steady states, and the reduction of dispersion is mostly explained in terms of convergence in steady sates themselves, i.e., in the long-run determinants of per capita income (savings rates, human capital accumulation, etc). Whether convergence has been a matter of transitional dynamics or otherwise, might have different policy implications for the design of growth promoting policies.

The paper is organized as follows. Section 2 compares the results of different econometric approaches used in the literature to estimate the convergence equation: cross-section, fixed-effects and mean group estimates. In section 3, we show that the estimated steady states implicit in these convergence equations are quite different, implying alternative explanations behind the sigma convergence process in the OECD. Finally, section 5 concludes.

2. Estimating the convergence equation

The great majority of empirical studies that have analyzed economic growth across countries in recent years have made use of some version of the so-called convergence equation, which follows a general specification like this

$$\ln y_{it} - \ln y_{it-\tau} = a_i + \rho_i \ln y_{it-\tau} + \gamma_i X_{it} + \varepsilon_{it} \quad (1)$$

where y_{it} is per capita GDP in country i in period t, X_{it} is a vector of determinants of economic growth that usually includes a time trend and time varying accumulation rates which control for differences in the steady states, a_i is a country specific effect, and ε_{it}

is an error term. An equation like (1) can be derived from different variants of the neoclassical exogenous growth model, although it may also be consistent with endogenous models that predict different forms of convergence to a steady state. The consensus view that has emerged from the empirical work is one in which countries experience a slowdown in growth while approaching their own steady-state. The reason for this is that most researchers obtain significant negative estimates of ρ for quite different samples, although its concrete value depends on the particular econometric method used. However, the implications of these methods on steady states estimates and the interpretation of the sigma convergence process are less known.

To develop our arguments, let us rewrite equation (1) as:

$$\ln y_{it} = a_i + (1+\rho_i)\ln y_{it-\tau} + \gamma_i X_{it} + \varepsilon_{it} \tag{2}$$

In a dynamic equation like (2), the mean of $\ln y_{it}$ converges to $(a_i + \gamma_i X_{it})/\rho_i$ as t becomes large, provided that $0 < (1+\rho_i) < 1$. So, computing the steady state income per capita is straightforward

$$\ln y_{it}^{*} = -\frac{a_i + \gamma_i X_{it}}{\rho_i} \qquad if \qquad 0 < (1+\rho_i) < 1. \tag{3}$$

In Table 1 we present estimates of the convergence equation applying different econometric methods. The sample consists of 24 OECD countries from 1960-1993. Most series in our data set (all but the human capital series) come from the OECD National Accounts. All variables have been homogenized using the 1990 purchasing power parities published by the OECD and are expressed in 1990 international dollars. The dependent variable is the log-difference of per capita GDP between t and $t-\tau$. The right-hand side variables include the logarithm of the percentage of total investment (both private and public) with respect to real GDP ($\ln s_k$), the logarithm of the population growth rate plus 0.05 to account for the sum of the depreciation rate and the rate of technical progress ($\ln(n+0.05)$), the logarithm of the secondary enrollment rates from UNESCO Statistical Yearbooks ($\ln s_h$), and a time trend to capture the effect of exogenous technological change. As it is readily apparent, our exercises have to be understood as explorations of the implications of heterogeneity within the standard Mankiw, Romer and Weil's type of framework, given that we use the same variables to estimate the growth regressions. Nonetheless, the inclusion of investment in physical and human capital may cause a problem of exogeneity or reverse causation (see, for example, Attanasio, Picci and Scorcu, 2000, or Caselli, Esquivel and Lefort, 1996). However, as we stressed in the introduction, our aim is not to deal with consistency issues, but to estimate the convergence model in the same way the literature has done in recent years and to investigate the role played by transitional dynamics.[3]

In column 1, we report standard cross-section OLS estimates on time series averages. In column 2, we pool the annual data for all the OECD economies, and partially relax the assumption of parameter homogeneity allowing for a different constant term across countries.[4] The individual effect is assumed to be correlated with the right-hand side variables, and removed using the within groups estimator. Finally, models in columns 3 and 4 report mean group estimates of the convergence equation. Following Pesaran and Smith (1995), in column 3, we compute the mean group estimates running separate regressions of the convergence equation for each country and calculating non-weighted averages of the country-specific coefficients and standard deviations. In column 4, we estimate a system of 24 country equations using a SUR method. Although this method without restrictions across equations is similar in spirit to the mean group estimation in column 3, it presents the advantage of using the information about the correlation between the disturbances of the country equations.[5] Additionally, this approach allows to formally test cross-country parameter heterogeneity. In this case, we can compute the mean coefficients and their standard deviations similar to the ones in column 3.

All coefficients have the expected sign and are significant at the 5 per cent level in the cross-section model (column 1), which is our benchmark specification of the convergence equation imposing full parameter homogeneity. The coefficient of the initial per capita income is negative and significant, and yields an implicit convergence rate of 2.4 per cent. This is the standard cross-section specification for OECD countries that can be found in the pioneering work by Mankiw, Romer and Weil (1992). These results were interpreted as solid proof of the adequacy of the augmented Solow model to describe the growth process of countries.

The fixed effects specification in column 2 is the most straightforward way to account for the existence of differences across countries in the constant term of the equation. Our results display the most common features that can be found in this literature.

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[3] In fact, our main results remain unchanged when we take into account the potential endogeneity problem, estimating our models using instrumental variables.

[4] The human capital variable has been annualized by simple extrapolation between available observations.

[5] A different possibility consists in using Swamy's (1971) generalized least squares estimator, which uses in addition the sampling variation of the estimated coefficients. Nonetheless, since all three procedures are consistent in the presence of slope heterogeneity, SUR estimations are an easy and natural way for computing the slope homogeneity tests (see Pesaran and Smith, 1995). In fact, this is the main advantage of our estimation in column 4, given that by performing a likelihood ratio test we can safely accept the hypothesis of a diagonal covariance matrix.

Table 1

	Cross-Section (1)	Fixed-Effects (2)	Mean-Group (3)	MGE-SUR (4)
Constant	-0.079	$-$	-0.660	-0.213
	(3.18)		(1.15)	(0.80)
$\ln y_{t-\tau}$	-0.017	-0.069	-0.327	-0.338
	(6.89)	(7.12)	(3.00)	(6.47)
$\ln s_k$	0.014	0.036	0.129	0.097
	(3.22)	(4.83)	(2.68)	(22.0)
$\ln(n+0.05)$	-0.020	-0.047	-0.146	-0.102
	(2.07)	(2.56)	(1.60)	(2.50)
$\ln s_h$	0.010	0.002	0.138	0.086
	(2.17)	(0.23)	(1.08)	(0.48)
Trend		0.084	0.450	0.573
		(2.81)	(1.44)	(3.91)
$\overline{R}^2$	0.782	0.227	$-$	$-$
Obs. $(N \times T)$	24×1	24×33	24×33	24×33

White's heteroskedasticity corrected t-statistics in parenthesis. Trend coefficient $\times$ 100.

First, enrollment rates lose their significance when the time dimension and the individual effects are incorporated into the equation.[6] Second, the implicit convergence rate increases to 6.9 per cent, which is in the range estimated in previous papers. Third, regardless of the econometric method employed to account for the individual effect (or for endogeneity of the set of explanatory variables), the estimated equation is consistent with the existence of a process of conditional convergence. Fourth, as Caselli, Esquivel and Lefort (1996), we also find that the increase in the estimated rate of convergence is due to the estimation of heterogeneous intercepts and not to changes in the length of the period.[7]

[6] In Caselli, Esquivel and Lefort (1996) the human capital variable is even negative and significant. The robustness of human capital in growth equations has been extensively discussed in the literature in recent years. De la Fuente and Doménech (2001) discuss some of the reasons behind the human capital puzzle, advocating for improving data quality on human capital and further augmenting the neoclassical model to allow for technological diffusion across countries.

[7] Estimating the convergence equation with annual data and imposing homogeneous intercept and slope parameters yields the standard 2% convergence rate. Estimating the fixed-effects model with five-year time spans also yields results that resemble those in column 2.

In column 3, we present the result of running separate convergence regressions for each of the 24 countries in the OECD sample, computing the mean group estimates as the average coefficients over all countries. The coefficients have the same sign as in the more conventional estimation methods, although the population growth and the trend coefficients are less precisely estimated and the human capital coefficient is again not significantly different from zero. Overall, the model performs well and the most noticeable result is the high mean rate of convergence implicit in this estimated model (around 32 per cent). This high value is fully in accordance with other papers that have used this approach to estimate convergence equations,[8] although the concept of convergence implied in these estimations has not the standard interpretation in terms of the evolution of the cross-country income distribution.[9]

The greatest advantage of using what Quah (1993) called a data-field, i.e. a data set characterized by reasonable large time and cross-section dimensions, is the possibility of testing the homogeneity of parameters across countries. The most straightforward way to test the hypothesis of common constant and slope coefficients in the growth equation is to estimate a system of 24 country equations using SUR estimation methods. A formal likelihood ratio test unambiguously rejects the null that all six coefficients are equal across countries, and so we carried out a sequence of tests on the homogeneity of one coefficient at a time.[10] The null of parameter homogeneity is overwhelmingly rejected in five out of the six coefficients, and the only coefficient that appears to be homogeneous across countries is that of the investment rate ($\chi(23) = 32.2$ and $p-$value equal to 0.10). For this reason, in column 4, we present the SUR estimates of the convergence equation in a specification in which the investment coefficient is restricted to be homogeneous for all countries, while the remaining five coefficients are computed as averages across countries. The sign and size of the coefficients are quite similar to those of the mean group estimations in column 3; the mean coefficient of initial income implies an average speed of convergence of 33 per cent. The only significant difference is that the mean coefficients are now more precisely estimated, possibly because of the efficiency

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[8] Estimating separate regressions for each country by the exact maximum likelihood method, Lee, Pesaran and Smith (1997) obtain convergence rates between 24% and 30%, depending on the sample of countries (see their results in Table I, p.370). For the OECD sample, Bassanini and Scarpetta (2001) obtain values between 11% and 48%, depending on the conditioning set (see their results in Table 3, p.13).

[9] In this respect, see the arguments in Lee, Pesaran and Smith (1997) and the excellent discussion in the comment by Lee, Pesaran and Smith (1998) and the reply by Islam (1998).

[10] Restricting all parameters to be homogeneous across countries produces results that overwhelmingly resemble those of the cross-section estimates. The implicit convergence rate is 2.2% and all the other coefficients are well signed and significant.

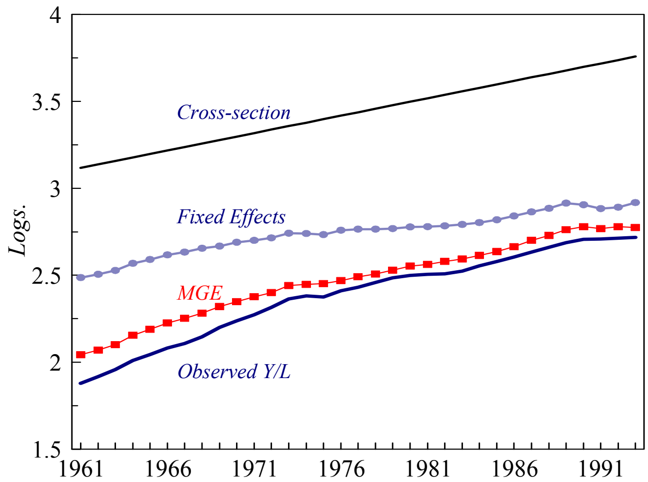

Figure 1: *Steady states and GDP per capita (Y/L) for the average OECD country.*

gains associated with the SUR estimation.

3. Heterogeneity, steady states and convergence.

The overall picture we obtain from the results in Table 1 is that the convergence model performs well. Moving from more to less restricted models leads to a steady increase in the estimated rate of convergence. This result is well known in the literature and has led many researches to the conclusion that conditional convergence has been faster than was previously thought. In this section, we take a closer look at these different models to highlight other implications that have received less attention in the literature. What we find is that the differences in the dynamics of growth, implicit in these alternative econometric specifications, are far greater than what a mechanical interpretation of the speed of convergence would suggest. In fact, they tell us completely different stories about the reduction in the cross-country dispersion of per capita income that the OECD has gone through since the sixties. To have a first approximation to these differences in Figure 1, we have depicted observed per capita income and steady state per capita income (both in logs) under different homogeneity assumptions for the average OECD country. In all cases, we compute the steady state per capita income for each individual country using equation (3).

The steady state estimated for the cross-section model has very little to do with the true long-run prospects of the average economy.[11] The distance between observed per capita output and steady state output is striking: at the beginning of the sample period the average economy had a per capita income around 6,500 international dollars, while the steady state income was 22,600 dollars, and these figures are approximately 15,100 and 42,800 dollars at the end of the period; even the wealthier countries in the OECD at the end of the sample period (USA and Luxembourg) had incomes of no more than 24,000 dollars.

The picture changes considerably when the convergence model is estimated allowing for heterogeneity in the constant term (fixed-effects model). In this case, the estimated steady state series for the average economy is closer to the average per capita income. The homogeneous 6.9 per cent convergence rate obtained with fixed-effects implies that the average country has moved from a per capita GDP that was around 56 per cent of its steady state value in 1960 to approximately 82 per cent in 1993. In other words, it has closed in per capita terms approximately half of the gap, given that at the beginning of the sample period the steady state per capita income was around 12,000 international dollars that grew to a value near 18,500 dollars at the end of the period.

Things change dramatically when we address heterogeneity in full, i.e. when the steady states are computed using the mean group estimates. In this case, the steady state of the average economy becomes something closer to a long-run attractor of current GDP per capita.[12] Thus, the average country has spent most of the time in the neighborhood of the steady state, moving from 86 per cent to 94 per cent of its long-run per capita output level.

To get a better image of these important differences in the relative position of each country with respect to its own steady state output, in Figure 2 we have depicted a scatter plot of per capita output versus steady state output in 1960 for each OECD country using the three different estimation methods. As can be appreciated, accounting for the existence of heterogeneity matters not only because of its effect upon the estimated convergence rate, but also because it gives us a different picture of how the relative position of each country with respect to its own steady state has evolved. For example, Japan's per capita income was approximately 13 per cent of its steady state output in 1960 ac-

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[11] The steady state for the cross-section model has been obtained after estimating a convergence equation with annual data in which savings rates and population growth are constant over time at their mean values for the whole period. We have restricted the convergence coefficient to be exactly the same as in the standard cross-section equation in column 1 of Table 1, and the rate of exogenous technological change to be 2 percent.

[12] In this case, we are using our results in column 4 of Table 1, i.e. the SUR estimates, to compute the steady state values. Nevertheless, these results are almost indistinguishable from those corresponding to column 3, i.e. the simple mean group estimates.

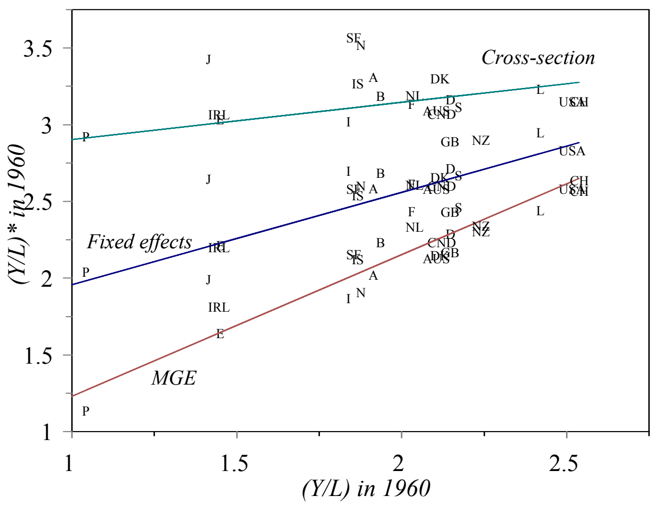

Figure 2: *Steady states and GDP per capita (Y/L) in 1960.*

cording to the cross-section estimates, while this figure rises to 29 per cent if we consider the results of the fixed-effects model, and to values around 56 per cent if mean group estimates are taken into account.[13] As Figure 2 makes clear differences of such a magnitude are common to all countries in the OECD sample.

The natural question to ask then is how do these different models explain the process of narrowing dispersion in per capita incomes that has taken place within the OECD. The answer is given in Figure 3, which depicts the $\sigma-$convergence of observed per capita income against measures of $\sigma-$convergence of the steady states computed by each of the three econometric methods. Therefore the difference between the observed line and that corresponding to one particular method of computing the steady state is an approximate measure of the contribution of transitional dynamics to the observed pattern of $\sigma-$convergence implied by that econometric method.

As expected, in the cross-section model, the whole process of $\sigma-$convergence observed in the OECD is accounted for by the transitional dynamics or, in other words, the dispersion of the steady states has remained constant during the sample period. This is also very much the picture that emerges from the fixed-effects model, since the dispersion of the steady states displays no significant trend along the sample period.

The landscape is completely different when we look at the results from the mean

[13] These figures are 53, 73 and 93, respectively for the United States.

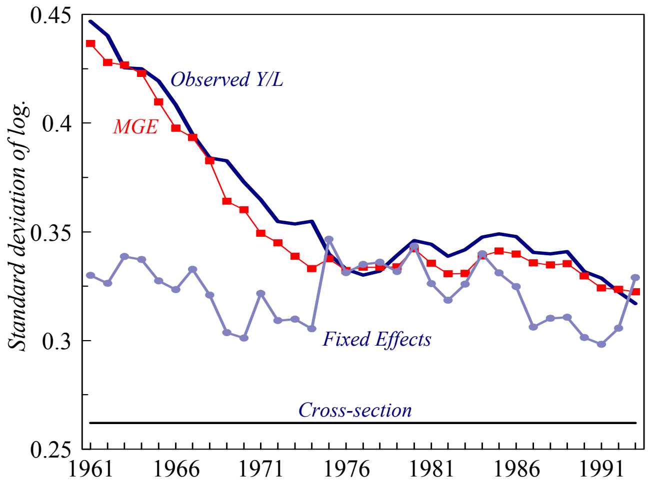

Figure 3: *Sigma convergence in GDP per capita (Y/L) and three steady states estimates. OECD, 1961-1993.*

group estimates. As Figure 3 makes clear, the process of sigma convergence is mostly explained by the reduction in the dispersion in the steady states. As can be seen, the patterns of standard deviation of the steady states and real income display a very similar downward sloping evolution. Thus, in this model, the observed pattern of sigma convergence in the OECD is explained by the fact that countries are becoming similar in their choice variables (savings rates, human capital accumulation, etc.). Hence, the bulk of the explanation of the process of catching-up that has taken place among OECD countries since 1960 ($\sigma-$convergence) lies in the falling dispersion of the steady state determinants with very little weight to be attached to transitional dynamics.[14] In fact, the standard deviation of the log of investment in physical and human capital has decreased from 0.25 and 0.41 at the beginning of the sixties to 0.21 and 0.17, respectively, at the beginning of the nineties. Furthermore, this process of reduction in the dispersion of accumulation rates has been more intense from 1960 to the mid seventies, coinciding with the period when the process of σ-convergence in the OECD was more intense.

Besides their implication on the interpretation of the $\sigma-$convergence process, these

[14] Additionally, we have estimated the fixed effects model, incorporating both year and country specific intercepts, and the mean-group model (SUR model) in deviations from the means of the variables for each year. The conclusion of these exercises gives full support to our previous findings regarding the evolution of the standard deviation of steady states presented in Figure 3 and, thus, on the conclusions about convergence.

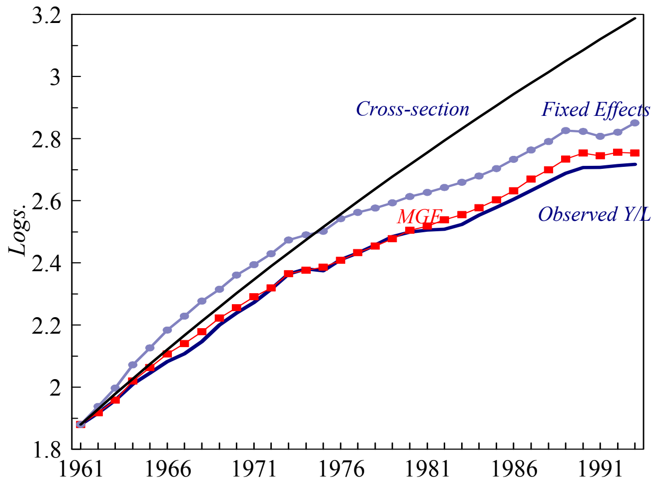

Figure 4: *Simulated and observed GDP per capita for the average OECD country.*

alternative econometric methods also provide very different simulations of the time pattern of the average per capita income for OECD countries. In Figure 4, we have depicted the observed GDP per capita for the average country and values simulated for this variable using the estimated models in columns (1), (2) and (4) in Table 1. In particular, let y^*_{it} be the steady state for country i in period t and $\widehat{y}_{it}$ the simulated GDP per capita, then

$$\ln \widehat{y}_{it} = \Delta \ln y^*_{it} + \ln \widehat{y}_{it-1} + \rho_i \left(\ln y^*_{it-1} - \ln \widehat{y}_{it-1} \right) \tag{4}$$

where the initial simulated value in 1961 is equal to the observed GDP per capita.

The log-difference between the observed and the simulated per capita income that derives from the 2.4 per cent convergence rate obtained with our cross-section estimates has grown steadily along the sample period. Putting it slightly differently, if cross-section estimates were reliable, income per capita in the average OECD economy would have been around 30 per cent of its steady state value at the beginning of the sixties. Then, according to our simulation, we should have expected that per capita income were approximately 55 per cent of the steady state value at the beginning of the nineties. However, at the end of the sample period, GDP per capita for the average economy was only 36 per cent of the steady state.

Although the fixed-effects model allows for heterogeneity in the constant term and for time variations in the steady state determinants, thus capturing some of the idiosyncratic features of countries in a better way, the simulated income is still above the observed per capita all along the sample period. Nonetheless, the discrepancy is not that big in this case. The 6.9 per cent convergence rate obtained with fixed-effects implies that the average country, which displayed a per capita GDP of around 56 per cent of its steady state value in 1960, should have ended at 93 per cent of the long-run attainable level, while it has reached only 82 per cent of it. Thus, the intuition behind conditional convergence estimates that countries will close a given portion of their gap to the steady state, which is determined by the estimated speed of convergence, is not so straightforward. Both in the cross-section and the fixed-effects cases, the portion of the gap closed is smaller than expected. In other words, transitional dynamics have not operated as intensively as the face value of the estimated rate of convergence would suggest.

Finally, we allow for full parameter heterogeneity, employing the mean group estimator. As can be seen in Figure 4, observed output converges to the steady state income per capita level according to the simulated pace (differences between observed and simulated income are always in the interval between -0.5 and 3.5 percentage points). If we looked at the difference between per capita income and the steady state implied by mean group estimates for all countries, we could observe that more than half of the countries have spent most of the time in the neighborhood of their steady state. As a result, we have a world where countries are either close to their own long-run attainable output levels, or converging to them at high speeds. This is again consistent with observed $\sigma-$convergence being explained almost exclusively by the falling dispersion of the steady state determinants with very little weight being attached to transitional dynamics.

4. Conclusions.

The aim of this paper has been to look in depth at one of the dimensions that has been a subject of considerable debate in recent years, i.e., the effect of relaxing the assumption of parameter homogeneity in the estimation of convergence equations. Using the standard Mankiw, Romer and Weil's framework, our estimates first confirm some well-known results in the literature, which show that moving from more to less restricted models generates an increase in the estimated rate of convergence. Next, using these estimates, we have focussed in an often neglected economic implication of these econometric approaches to growth empirics.

The main result that emerges from our analysis is that the process of accommodating parameter heterogeneity into the convergence equation implies quite different explanations behind the process of $\sigma-$convergence experienced by OECD countries. There is a clear cut-off between cross-section and fixed effects types of regressions, where convergence is due only to the existence of transitional dynamics, and mean group estimates, that imply a scenario where the only source of convergence is due to the reduction in the dispersion in the steady states, with almost no room for transitional dynamics. It is interesting to notice that models allowing for partial heterogeneity are closer to models that assume homogeneity than to those that permit across the board heterogeneity. This suggests that heterogeneity in the slopes is at least as important as heterogeneity in the constant term, which the literature has usually focussed on. We have also shown that this process implies striking differences across estimated models in the distance of per capita income of the average country to its steady state, since in both the cross-section and in the fixed-effects models transitional dynamics have not operated as intensively as the estimated rate of convergence would suggest.

Have countries converged because of transitional dynamics or simply because their steady state levels have become much closer than they were back in the sixties? In other words, what is behind the $\sigma-$convergence process among OECD economies? This paper shows how very different explanations come out by using alternative econometric methods. To complete the answer, we need a proper evaluation of the relative merits of each of these methods, which is beyond the scope of this paper. In fact, we have deliberately left aside issues related to the consistency of the estimated parameters in the different econometric approaches, and the ability of these econometric methods to validate the neoclassical growth model. Models allowing for generalized parameter heterogeneity seem the most natural approach to the issue at hand, and indeed our formal SUR tests in section 2 suggest that the mean group estimator statistically dominates the others for the OECD sample. Unfortunately, as Pesaran and Smith (1995) and Lee, Pesaran and Smith (1997) have pointed out, this method is not free from some of the potential biases that plague the empirical growth literature.

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