The Wealth of Regions. Evidence and Theories of Regional Growth and Convergence

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Abstract

This paper provides a short overview of some of the results found in the recent empirical regional growth literature. It is argued that, in a variety of data sets, there are string forces leading towards convergence.

Introduction

During the last ten years, there has been a revival of interest in forces that lead to economic convergence. This revival has been partly spurred by the renewed interest in the general topic of economic growth. A significant contribution to this revival has been the proposal that the convergence hypothesis be used as the main test to differentiate the two main current approaches to economic growth: The neoclassical model and the models of endogenous growth.

In this paper we will provide a short overview of some of the results found in the recent empirical literature. We will argue that, in a variety of data sets, there are strong forces leading towards convergence. We will then analyze different ways to account for these results. We will start with the neoclassical model and discuss closed and open economy implications. We will then argue that measurement errors and policies of the central government are not likely to be the main reason behind the observed convergence. We will then see whether the one sector model of endogenous growth can be modified to predict convergence. We allow for migration, endogenous fertility, capital mobility and technological diffusion and note that only the latter is a potential candidate to explain the data. Finally, we interpret the empirical evidence in the light of the two-sectors of endogenous growth.

Concepts of Convergence

β–convergence versus σ–convergence

The first thing we shall do is define what we mean by convergence. In trying to do this, we note that there are many definitions used in the growth literature (see for example Quah (1993a)). We will use two concepts which will be called σ–convergence and β–convergence (1).

We will say that there is β–convergenmce in a cross section of economies if we find a negative relation between the growth rate of income per capita and the initial level of income (2). In other words, we say that there is β–convergence if poor economies tend to grow faster than wealthy economies. This concept of convergence is often confused with an alternative definition of convergence, where the dispersion of real per capita income across groups of economies tends to fall over time. This is what we call σ–convergence.

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1 This terminology was first introduced by Barro and Sala-i-Martin [1992],

2 This phenomenon is sometimes called 'regression to the mean'.

We will argue later that, although not identical, the two concepts of convergence are related. Some people have argued that the concept of β–convergence is irrelevant and the only thing of interest is whether economies move closer together as time goes by (Quah (1993a) makes this point forcefully in the context of Galton's fallacy; see also Friedman (1992)). We tend to disagree with this assessment, for we believe that both concepts of convergence are interesting. Let us illustrate why β–convergence is interesting with an example where σ–convergence is eliminated by construction. Consider the ordinal rankings of the NBA teams over time. The dispersion of rankings is constant by definition. Sports analysts and NBA owners are interested in questions such as «how quickly the great teams revert to mediocrity» or «how long dynasties last in basketball». For example, how long did it take for the great Boston Celtics of the 1950s and 1960s and the Los Angeles Lakers of the 1980s to become average teams? How long will it take for the Chicago Bulls to go back to mediocrity now that the great Michael Jordan has retired (at least temporarily)?

The reverse is also interesting: How quickly do mediocre teams become great teams? For example, how long did it take to create the Celtics of the 1950s, the Lakers of the 1980s, or the Bulls of the 1990s? One could even be interested in the type of policies the NBA could introduce to transform bad teams into great teams in as little time as possible. For instance, we could ask whether the introduction of the draft accelerated the convergence process.

To put an example closer to home, we could ask what mechanisms of the Spanish Soccer League let two teams (Barcelona and Real Madrid) win the overwhelming majority of the titles. Once we identified those mechanisms, we could think about ways to increase the competitiveness of the other teams, and as a result, increase the aggregate interest on the league. I believe that these are all interesting questions. But note that all of them refer to the concept of β-convergence, not σ-convergence. In fact, reducing the cross-sectional variance in a sports league would probably not make any sense (consider how interesting the league would be if all teams tied for first plaace every single year!).

Similar questions can be asked about economies. For example, it is interesting to know whether poor countries are predicted to grow faster than rich ones. It is also interesting to know how fast the average poor country becomes rich and how fast the average rich country becomes poor, independent of whether the aggregate cross sectional variance is falling or rising. For instance, if we knew that poor countries will become rich in just a few years, then we could even not care about whether the variance is large or small as long as we knew that poor countries would escape poverty in very little time. Similarly (and unfortunately), the analysis summarized below suggests that poor economies will be poor for a long time. Given this, knowing whether the overall world dispersion falls or not is of secondary importance. Hence, if pressed to say which of the two concepts of convergence I find more interesting, I would probably choose -convergence (although I emphasize that both concepts of convergence convey useful information and, as a result, should be studied).

The relation between β–convergence and σ–convergence

Although they are different animals, the two concepts of convergence are related. Suppose that β–convergence holds for a group of regions i=1,...,N. In discrete time, corresponding say to annual data, the real per capita income for economy i can be approximated by

$$[1] \quad \log(y_{it}) = a + (1 - \beta).\log(y_{i,t-1}) + u_{it},$$

where a and b are constants, with $0<\beta<1$, and u_{it} is a disturbance term. The condition $\beta>0$ implies β-convergence because the annual growth rate $\log(y_{it} / y_{i,t-1})$ is inversely related to the $\log(y_{i,t-1})$. A higher coefficient β-corresponds to a higher tendency toward convergence (3). The disturbance term picks up temporary shocks to the production function, the saving rate, and so on. We assume that u has zero mean, the same variance, σ^2_u, for all economies, and is independent over time and across economies.

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[3] The condition ß>1 rules out leapfrogging or overshooting, where poor economies are systematically predicted to get ahead of rich economies at future dates

As a measure of the cross-sectional dispersion of income, we take the sample variance of the log of income

$$[2] \qquad \sigma^2_t = (1/n) \sum_{i=1}^{N} [\log(y_{it}) - \mu_t]^2 ,$$

where μ_t is the sample mean of $\log(y_{it})$. If N is large, then the sample variance is close to the population variance, and we can use [1] to derive the evolution of σ^2_t over time:

$$[3] \qquad \sigma^2_t \cong (1 - \beta)^2 . \sigma^2_{t-1} + \sigma^2_u .$$

This is the first-order difference equation, which is stable if $0< \beta <1$. If there is no β–convergence so that $\beta<0$, then the cross-sectional variance increases over time. That is, if there is no β–convergence, there cannot be σ-convergence (in other words, β–convergence is a necessary condition for σ–convergence). The steady-state value of σ^2_t is given by

$$(\sigma^2) * = \sigma^2_u [1-(1-\beta^2]$$

The steady-state dispersion falls with β but rises with the variance σ^2_u of the disturbance term. Note that the steady-state dispersion is positive even if β is positive as long as $\sigma^2_u>0$. We can solve the difference equation [3] to find an expression of σ^2_t over time:

$$[4] \qquad \sigma^2_t = (\sigma^2) * + (1 - \beta)^2 . [\sigma^2_0 - (\sigma^2)*].$$

If β-convergence holds so that $\beta>0$, then σ^2_t approaches its steady-state value (σ^2)* monotonically. The key point, however, is that σ^2_t can increase or decrease toward the steady-state depending on whether the initial value of σ^2 is above or below the steady-state. Note in particular that σ could be rising along the transition even if $\beta>0$. In other words, β-convergence is not a sufficient condition for σ-convergence. Summarizing, β-convergence is a necessary but not a sufficient condition for σ-convergence.

In the final section we will analyze empirical evidence on β-convergence and σ-convergence separately. In a series of recent papers, Danny Quah has proposed new ways of jointly analyzing and using stochastic kernels for the dynamics of the distribution of output or income per capita (see for example Quah [1993b]). [4]

Conditional β-convergence

Following Barro and Sala-i-Martin (1991,1992) and Mankiw, Romer and Weil (1992), we can also distinguish conditional from absolute convergence. We say that a set of economies display conditional β-convergence if the partial correlation between growth and initial income is negative. In other words, if we run a cross-sectional regression of growth on initial income, holding constant a number of additional variables, and we find that the coefficient on initial income is negative, then we say that the economies in the data set display conditional β-convergence. If the coefficient on initial income is negative in a univariate regression then we say that the data set displays absolute convergence.

In the regional data sets studied in this paper, we ignore the conditioning issue. There are two reasons for this. First, unlike the regressions involving cross-sections of countries, we find convergence in regional data sets, even in the abscence of conditioning variables. Second, and perhaps more importantly, a variety of studies have found that the estimates of β in regional data sets do not change substantially when the sets of variables that are usually held constant in cross-country studies are included in the analysis (see for example Barro and Sala-i-Martin [1991, 1992].)

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[4] Although Quah (1993) suggests that the convergence results found using his techniques across large cross-sections of countries differ substantially from the results found in our cross-sectional analysis of σ and β, his regional results for the States of the U.S. are not very different from ours (I thank Danny Quah from communicating (orally) this result to me while we were drinking beer at a bar in Brussels).

Regional Data Sets

In a number of papers, Barro and Sala-i-Martin (1991, 1992a, 1992b, 1994) have analyzed the convergence properties of the regions within various countries. The results, extended to 1990, are reported in Table 1 and Figures 1 to 10. Table 1 provides evidence on β-convergence for the regions of the United States (48 contiguous states), Canada (10 provinces), Japan (47 prefectures) and Europe (nuts 2) (5). The dates for which data are available for the different countries differ somewhat. For the United States we have personal income annual data computed by the U.S. Commerce Department beginning in 1929 (See Bureau of Economic Analysis (1986)). The concept of personal income used in these regional accounts corresponds to the concept used in the national accounts. Thus, if we add personal income for each of the states, we would get (at least theoretically) the U.S. aggregate figure for personal income (6). We use the figures that exclude transfer payments. We expanded the data set with Easterlin's estimates of state personal income for 1880 (47 states and territories), 1900 (48 states and territories), and 1920 (48 states). These data also exclude transfer payments.

We do not have measures of price levels or price indexes for individual states. Therefore, we deflate the nominal values for each state by the national consumer price index. Given that we use the same price deflator for all states in a single year, the particular deflator that we use affects only the constant term in the empirical analysis. Population data are from the Bureau of the Census (1990).

The data on income across Japanese prefectures are collected by the Economic Planning Agency (EPA) of Japan and start in 1955. The prefectural income accounts are made by the respective prefectures on the basis of the «1983 Standardized System of Prefectural Accounts» so that income for all prefectures is standardized. The data are collected annually (so there is no interpolation) by the EPA and published in the «Annual Report on Prefectural Accounts.» The concepts of income used are adopted from the national income statistics so the aggregate of prefectural incomes of all 47 prefectures are theoretically identical to Japan's *national income*. As was the case of the United States, we use national price indexes to deflate each prefecture's income.

The data on population are prepared by the Statistics Bureau at the Management and Coordination Agency. The principal source of these data are the quinquennial Population Censuses taken by the Statistics Bureau. Data for intercensal years are computed by interpolation and use data on vital statistics and interprefectural migration. The estimates correspond to the stock of population as of October 1st each year.

We have data on GDP for regions in seven European countries (Germany, United Kingdom, France, Italy, Netherlands, Belgium and Denmark), totaling 73 regions. Data for 1950, 1960, and 1970 are taken from Willem Molle. Data for 1966 (missing France and Denmark), 1970 (missing Denmark), 1974, 1980, and 1985 are from Eurostat. The nominal figures on GDP are expressed using current exchange rates in terms of a common currency unit. For the later years, the population data are collected by Eurostat.

We have expanded the European data set to include 17 regions (Comunitats Autònomes) of Spain. We have Spanish data on personal income and gross domestic product by province for 50 provinces. The data were then aggregated up to the level of the Comunitats, using the latest definition (the regional distribution of provinces changed somewhere during the 1970s). Starting in 1955, the data were collected (almost) biannually by the Banco de Bilbao and published in the «Spanish National Income and its Provincial Distribution» (Renta nacional española y su distribución provincial).

Provincial population data are taken from the Spanish Statistical Abstract (Anuario estadístico de España), published by the Instituto Nacional de Estadística.

This enormous data set is further expanded to include provincial personal income data for 10 Canadian provinces for the period 1961-1990. The data were provided to us by Coulombe and Lee (1993). The main source of data for Canada is Cansim, which reports on annual personal income, as well as population for the 10 provinces. The provincial personal income data is supposed to aggregate up to the national totals. Unlike any of the other countries, Canada collects price data by provinces. Hence, provincial rather than national prices were used in this case.

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[5] For Spain, nuts 2 refers to Comunitats Autònomes, not Províncies.

[6] Note, however, that we exclude Alaska, Hawaii and the District of Columbia from our analysis.

International Evidence on Regional Convergence

We now use the regional data for the various countries to analyze regional convergence in income per capita. We can estimate the speed of convergence β by regressing the average growth rate of a set of regions between times t_0 and $t_0 + T$ on the initial level of income. In order to estimate the speed of convergence precisely, we estimate the nonlinear equation

$$[5] \qquad (1/T) \log (y_{it_0+T} / y_{i,t_0}) = a - [(1-e^{-\lambda T})/T].\log (y_{i,t_0} 1) + u_{it_0, t_0+T}.$$

where u_{it_0,t_0+T} represents the average of the error term, u_{it}, between the dates t_0 and t_0 +T.

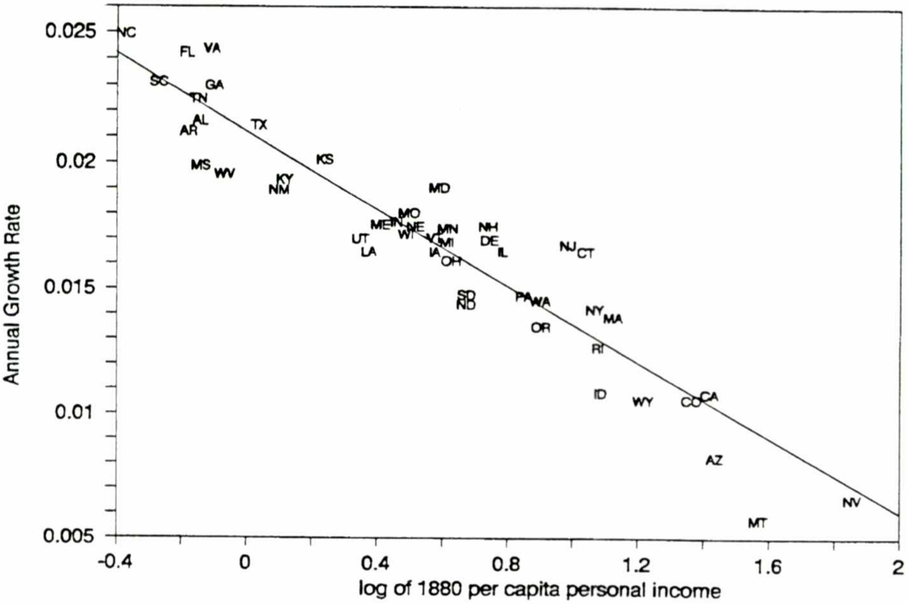
Table 1 shows non-linear least-squares in the form [5] for 48 U.S. states for the period 1880 to 1990. Each cell contains four numbers. The first is the estimate of β. Underneath (in parenthesis) we report its standard error. To its right we report the adjusted R^2 of the regression and below the R^2, the standard error of the regression (all equations have been estimated with constant terms, which are not reported in Table 1).

The first column reports the estimate of β for a single long sample (1880-1990). The point estimate is 0.0174 (s.e.=0.0026) [7]. The large value of R^2 can also be appreciated by looking at Figure 1, which is a scatter plot of the average growth rate of income per capita between 1880 and 1990 versus the log of income per capita in 1880.

The second column reports a panel data of 10 year regression (20 years for 1880 to 1990 and 1900 to 1920). We restrict the estimate of β over time, but we allow for time fixed effects. We also hold constant the shares of income originated in agriculture and industry to proxy for sectoral shocks taht affect growth over the short run. These variables turn out not to affect the estimates of β over the long run. The restricted point estimate of β is 0.022 (s.e.=0.002).

Figure 2 shows the cross-sectional standard deviation for the log of per capita personal income net of transfers for 48 U.S. states from 1880 to 1992. We observe that the dispersion declined from 0.54 in 1880 to

Figure 1: Convergence of Personal Income across U.S. States. 1880 Personal Income and Income Growth from 1880 to 1990



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[7] This regression includes 47 states or territories. Data for the Oklahoma territory was unavailable for 1880.

Table 1

Countries	Long-Run Single Regression		Panel Estimates
	β (s.e.)	R^2 (s.e. Reg.)	β (s.e.)
United States 48 states (1880-1990)	0.017 (0.002)	0.89 (0.0015)	0.022 (0.002)
Japan 47 prefectures (1955-1990)	0.019 (0.004)	0.59 (0.0027)	0.031 (0.004)
Europe 90 regions (1950-1990)	0.015 (0.002)	– –	0.018 (0.003)
Germany 11 regions	0.014 (0.005)	0.55 (0.0027)	0.016 (0.006)
UK 11 regions	0.030 (0.007)	0.61 (0.0021)	0.029 (0.009)
France 21 regions	0.016 (0.004)	0.55 (0.0022)	0.015 (0.003)
Italy 20 regions	0.010 (0.003)	0.46 (0.0031)	0.016 (0.003)
Spain 17 regions (1955-1987)	0.023 (0.007)	0.63 (0.004)	0.019 (0.005)
Canada 10 provinces (1961-1991)	0.024 (0.008)	0.29 (0.0025)	– –

Notes to Table 1: The regressions use non linear squares to estimate equations of the form:

$$(1/T)\ln(y_{it}/y_{i,t-T}) = a - [\ln(y_{i,t-T})](1-e^{\lambda T})(1/T) + \text{other variables},$$

where $y_{i,t-T}$ is the per capita income in region i at the beginning of the interval divided by the overall CPI. T is the length of the interval. 'Other variables' are regional dummies and sectoral variables that hold constant temporary shocks that may affect the performance of a region in a manner that is correlated with the initial level of income (recall that when the error term is correlated with the explanatory variable, then the OLS estimate of β is biased.)

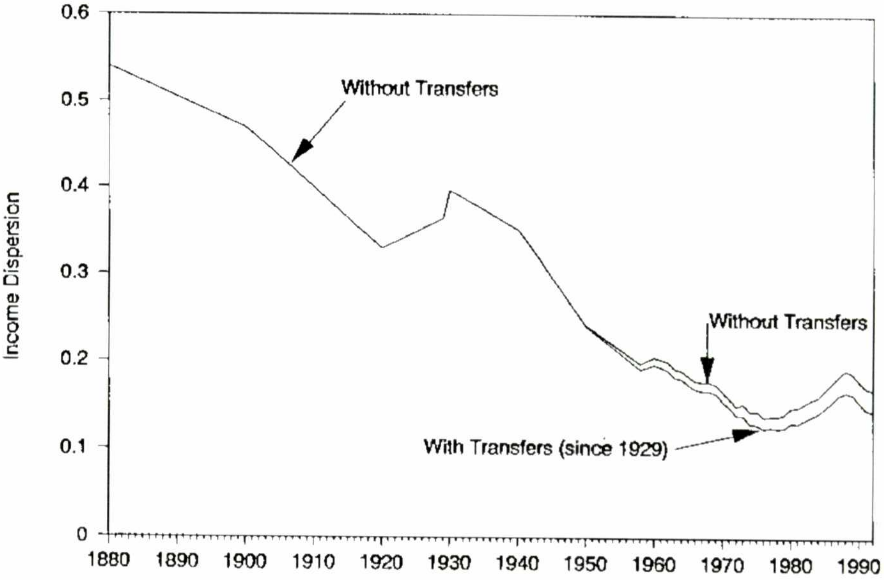
Each column contains four numbers. The first one is the estimate of β. Underneath (in parentheses) its standard error. To its right, the adjusted R^2 of the regression and below the R^2, the standard error of the equation. Thus, constant, regional dummies and/or structural variables are not reported in the Table. The coefficients for Europe include one dummy for each of the eight countries.

Column 1 reports the panel estimates when all the subperiods are assumed to have the same coefficient β. This estimation allows for time effects. For most countries, the restriction of β being constant over the subperiods cannot be rejected (See Barro and Sala-i-Martin [1994]).

Column 2 reports the value of β estimated from a single cross section using the longest available data. For example, for the United States, the coefficient β estimated by regressing the average growth rate between 1880 and 1990 is $\beta = 0.022$ (s.e.= 0.0002).

Figure 2:

Dispersion of Personal Income across U.S. States, 1880-199



0.33 in 1920, but then rose to 0.40 in 1930. This rise reflects the adverse shock to agriculture during the 1920s: The agricultural states were relatively poor in 1920 and suffered a further reduction in income with the fall in agricultural prices. After 1930, dispersion fell to 0.35 in 1940, 0.24 in 1950, 0.21 in 1960, 0.17 in 1970, and a low point of 0.14 in 1976. The long run decline stopped in the mid-1970s, after the oil shock, and σ_t rose to 0.15 in 1980 and 0.19 in 1988. The rise in the dispersion was reversed in the last two years of the 1980s and dispersion kept falling through 1992. An interesting aspect of Figure 3 is that the behavior of the cross-sectional dispersion of personal income net of transfers is very similar to the gross of transfers. In particular, the dispersion of both concepts of income fell after 1930, rose between 1977 and 1988 and fell between 1988 and 1992. This is true, even though the level of the dispersion is lower for income gross of transfers. Hence, it seems as if transfers help reduce cross-state dispersion of per capita income. However, interstate transfers are not responsible for the long run decline in income dispersion.

The second row of Table 1 report similar estimates for 47 Japanese prefectures for the period 1955-1987. The first column corresponds to a single regression for the period 1955-1987. The estimated β coefficient is 0.019 (s.e.=0.004) with an adjusted R^2 of 0.59. The standar error of the regression is 0.0027. Table 1 uses data starting in 1955 because income data by sector are not available before 1955. Income data, however, are available for 1930. If we use the 1930 data, the estimated speed of convergence would be 0.027 (s.e.=0.003). The good fit can also be appreciated in Figure 3. The evidently strong negative correlation between the growth rate 1930-1987 and the log of income per capita in 1930 confirms the existence of β-convergence across the Japanese prefectures.

To assess the extent to which there has been σ-convergence in Japan, we calculate the unweighted cross-sectional standard deviation for the log of per capita income, σ_t, for the 47 prefectures from 1930 to 1990. Figure 4 shows that the dispersion of personal income increased from 0.47 in 1930 to 0.63 in 1940. One explanation of this phenomenon is the explosion of military spending during the period. The average growth rate for Districts 1 (Hokkaido-Tohoku) and 7 (Kyushu), which are mainly agricultural, was -2.4% and -1.7% per year respectively. On the other hand, the industrial regions of Tokyo, Osaka and Aichi grew at 3.7%, 3.1% and 1.7% per year respectively.

The cross prefectural dispersion decreased dramatically since 1940. It fell to 0.29 by 1950, to 0.25 in 1960, to 0.23 in 1970 and hit a minimum of 0.125 in 1978. It has increased slightly since then: σ_t rose to 0.13 in 1980, 0.14 in 1985 and 0.15 in 1987. Dispersion has been relatively constant since then.

Figure 3:
Convergence of Personal Income Across Japanese Prefectures
1930 Income and Income Growth 1930-1990

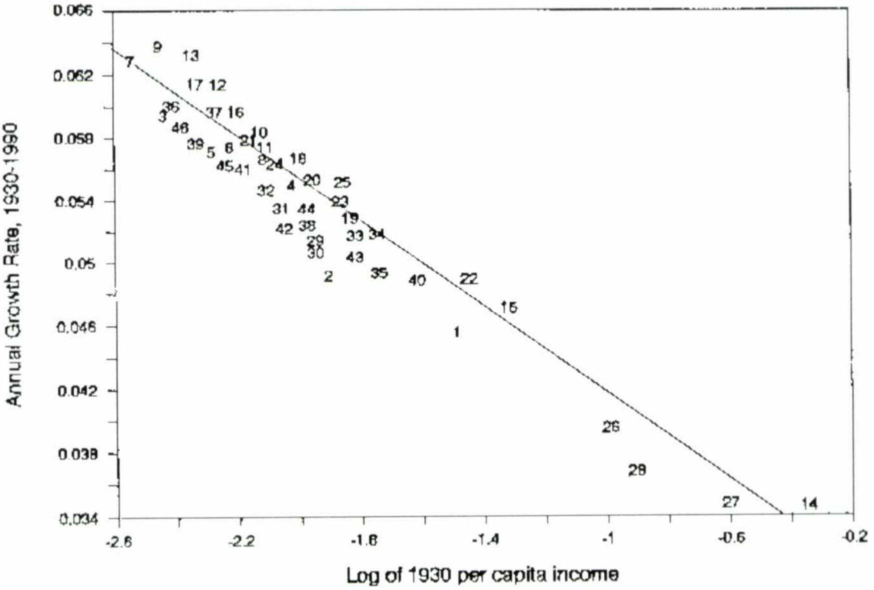
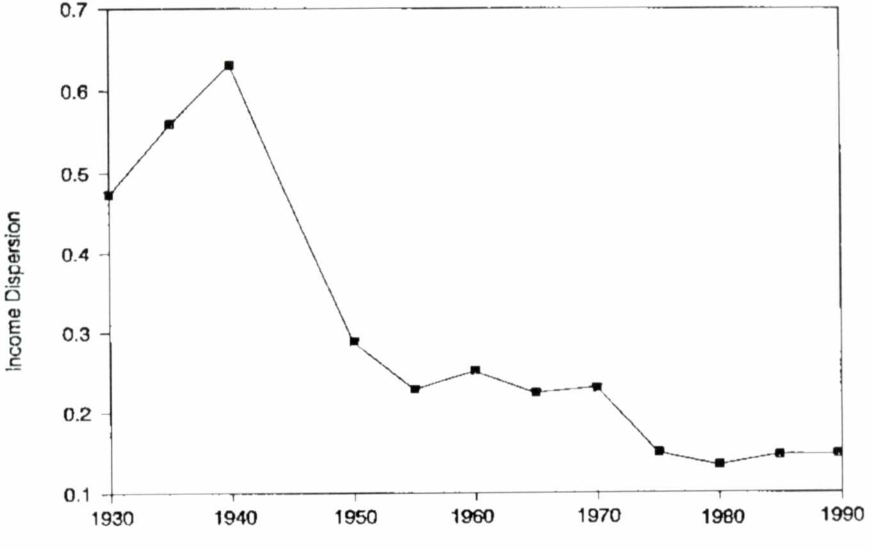


Figure 4:
Dispersion of Personal Income Across Japanese Prefectures
1930-1990



One popular explanation of the increase in dispersion for the 1980s is the take-off of the Tokyo region from the rest of Japan. Since Tokyo was relatively richer at the end of the 1970s (average per capita income in real terms for the Tokyo region was 2,000 billion Yen and the average for the rest of Japan was 1,751 billion Yen) and grew faster during the 1980s (2.95% a year versus 2.16% a year) which could explain this apparent divergence. To check this point Barro and Sala-i-Martin (1992b) calculated the cross sectional standard deviation of the log of per capita income for the seven Japanese Districts, and for the six Districts exclusive of Kanto-Koshin (which includes Tokyo). The exclusion of the Tokyo region shifts the cross sectional variance down for all periods, but it does not change the general behavior of σ_t over time. The increase in dispersion during the 1980s is larger if the Tokyo region is included, but it is still increasing if excluded. Thus, even though Tokyo contributed to the general increase in cross sectional dispersion during the 1980s, its take off does not fully explain it.

Rows 3 to 8 in table 1 refer to β-convergence across European regions within eight countries (Germany, France, United Kingdom, Italy, Netherlands, Belgium, Denmark and Spain). The first row relates to the estimate of β for a sample of 40 years, 1950-1990, when we restrict the speed of convergence to coincide across the 90 regions and over time. The estimate, however, allows for country fixed effects. The estimated speed of convergence is 0.015 (s.e.=0.002). The estimate of β when we allow each of the four decades to have a fixed time effect is 0.031 (s.e.=0.004).

Figure 5 shows for the 90 regions the relation of the growth rate of per capita GDP (income per capita for Spain) from 1950 to 1990 (1955 to 1987 for Spain). The values shown are all measured relative to the means of the respective countries. The figure shows the type of negative relation that is familiar from the U.S. states and Japanese prefectures. The correlation between the growth rate and the log of initial per capita GDP in Figure 5 is -0.72. Because the underlying numbers are expressed relative to own-country means, the relation in Figure 5 pertains to β-convergence within countries rather than between countries.

The estimates of the long sample for each of the five major countries (Germany, United Kingdom, France, Italy and Spain) are reported in the next five rows. The estimates range from 0.010 (s.e.=0.003) for Italy to 0.030 (s.e.-0.007) for the United Kingdom. The restricted panel estimates for the individual countries are reported in column 3. Note that the individual point estimates are all close to 0.020 or 2% a year. They range from 0.0148 for France to 0.0292 for the United Kingdom. The estimates for Spain are 0.023 (s.e.=0.007) for the long sample and 0.019 (s.e.=0.004) for the restricted panel estimates with fixed time effects.

The final row reports the results for Canada as given by Coulombe and Lee (1993) for the period 1961 to 1991. The estimate of β for the 30 year sample is 0.024 (s.e.=0.008).

Figure 6 shows the behavior of σ_t for the regions within the largest five countries in the sample: Germany, United Kingdom, Italy, France and Spain. The countries are always ranked highest to lowest-Italy, Spain, Germany, France and United Kingdom. The overall pattern shows declines in σ_t over time for each country, although little net change occurs after 1970 for Germany and the United Kingdom. In particular, the rise in σ_t from 1974 to 1980 for the United Kingdom -the only oil producer in the European sample-reflects most likely the effect of oil shocks. In 1990, the values of σ_t are 0.27 for Italy, 0.22 for Spain (this value corresponds to 1987), 0.186 for Germany, 0.139 for France, and 0.122 for the United Kingdom.

The main lesson from this subsection is that there is convergence both in the β and σ sense across regions of the U.S., Japan, Europe, Spain and Canada. The speed of β convergence is amazingly similar across countries: about 2% a year.

Conclusions

This paper has reviewed the empirical evidence on regional convergence. It has been argued that both σ and β-convergence seem to occur in a variety of data sets. The speeds at which the rrgions of different countries converge over different time periods is surprisingly similar: About 2% a year.

A variety of explanations which could account for these findings can be found in the literature. Some of them were rejected and others not. Measurement error, price dispersion, and national public policies that tried to induce convergence are not likely to be the underlying forces behind the observed patterns of convergence. The one-sector models of endogenous growth are not going to explain these findings, even if we amend them to include capital mobility or labor mobility. Endogenizing the saving rate, the fertility rate and the depreciation rate are potential ways to explain these facts, but are not found to be satisfactorty.

Figure 5: Growth Rate from 1950 to 1990 versus 1950 per capita GDP for 90 Regions in Europe

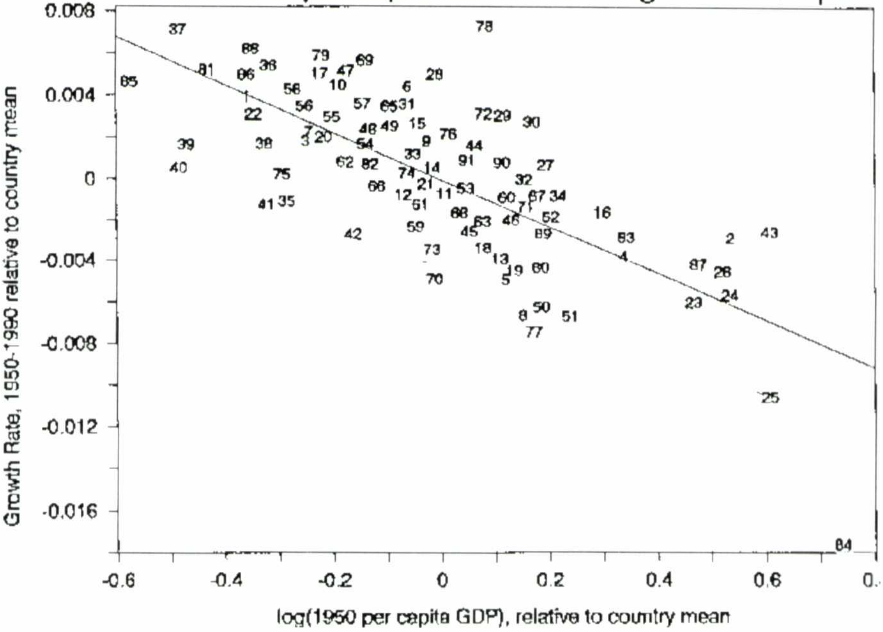
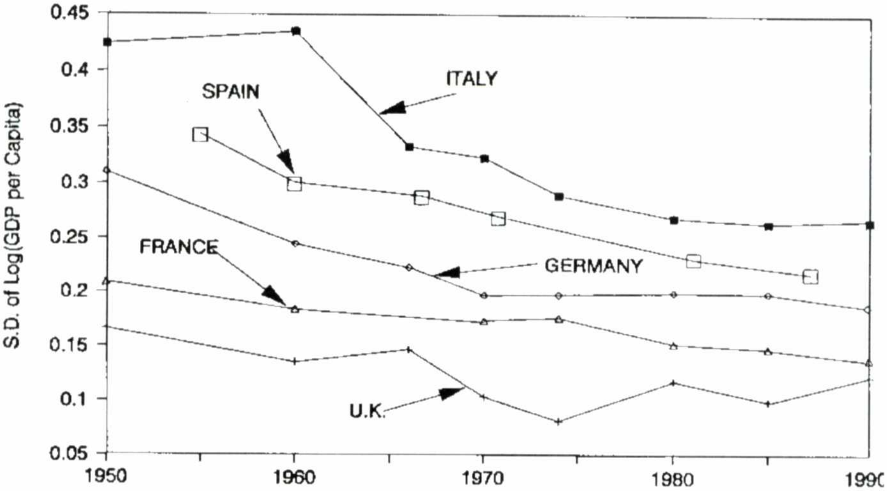


FIGURE 6: DISPERSION, σ_t , OF GDP PER CAPITA WITHIN FIVE EUROPEAN COUNTRIES



Among the still plausible explanations, we find the neoclassical model without or with capital mobility. The model can be extended to include migration. Migration is likely to accelerate the process of convergence at the theoretical level, but is found to be empirically unimportant.

Although the neoclassical model with diminishing returns to capital is the most popular explanation for the convergence findings, two additional hypotheses are found to be hard to reject with the existing evidence. The first one is the convergence of technology through the process of technological diffusion. The second is the two-sector model of endogenous growth, whose transitions arise in response to initial sectoral imbalances (the imbalance effect). Hence, more research still needs to be done to pinpoint the exact nature of the dynamic process that explains the wealth of regions.

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