

ON THE ROLE OF ECONOMIC HISTORY IN THE CONVERGENCE DEBATE

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ABSTRACT

For over a decade and a half macroeconomists who study economic growth have been embroiled in a debate over the issue of economic convergence. That is, for similar economies do poorer economies tend to catch-up to richer economies? The answer to the question goes to the very core of how economists explain economic growth. Macro theorists have developed scores of economic growth models to address this question. In addition, numerous econometric tests have been conducted attempting to answer this convergence question. Yet one group of economists that have not had much impact on this issue are economic historians. However when economic history is used to augment the theoretical and empirical investigations of the convergence question, the results can be striking. This paper seeks to stimulate economic historians interest in the convergence debate by illustrating the impact economic historical research can have on this important topic.

I. Introduction

One of the oldest and most perplexing issues facing economists is the daunting task of attempting to explain and predict the rate of economic growth. While this task maybe daunting it is also certainly exhilarating. Nobel Laureate Robert Lucas explained that when he examines the wide variation of cross-country economic rates of growth "...it is hard to think about anything else." (Lucas, 1988, p. 5)

The goal of this paper is to convince economic historians to join Lucas and those of us interested in economic growth in a fascinating examination of growth issues and the growth process. Specifically, this paper seeks to expand the role economic historians play in the convergence debate in economic growth. Section II of this paper will offer an overview of the convergence debate in economic growth, and the various empirical methods to test for convergence. Section III will lay out the role economic historians can play in the convergence debate, along with specific examples of where a knowledge of economic history has played an important role in the convergence debate. Section IV concludes.

II. The Convergence Debate

Moses Abramovitz and Paul Davis (1996) noted that productivity experiences of nations can be compared to foot race, with one important exception. In a foot race, if one runner gets off to a fast start, there is no reason a priori to believe that his rival should run faster than he simply because the leader got off to a faster start. A productivity race, as Abramovitz and Davis noted, is different. Under certain conditions, being behind gives a productivity laggard the ability to grow faster than the early leader. This is the main idea behind the "convergence hypothesis." The most often cited example of the convergence hypothesis has been the experience since World War II, when America's large lead in productivity levels converged to those of other advanced countries.

The theoretical justification for the convergence hypothesis comes from the neo-classical growth model developed by Robert Solow (1956). In this class of growth models economic growth comes from capital accumulation, population growth and technological advances. In a basic neo-classical growth model the model assumes all markets are in equilibrium, production exhibits constant returns to scale and diminishing returns. Thus, adding more and more of one input to a fixed amount of all other inputs results in successively smaller increases in output. Mathematically the key relationships in such a model are:

A Production function: $Y = f(K,L)$, where Y is aggregate output, K is the capital stock in the economy and L represents the labor force. The capital per capita ratio = $K/L = k$, where k represents the amount of capital per capita or the amount of capital per worker. The savings function: $sY = S$, where s is the proportion of total income that is saved each period. Investment is determined by: $\Delta K = sY$. This says that the savings in each period results in an increase in the capital stock. Thus, savings equals investment in the neo-classical growth model. These additions to the capital stock are what in turn increase the level of output per worker and thus generate economic growth.

From these above relationships we get the following:

Percentage change in capital per capita:

$$\Delta k/k = \Delta K/K - \Delta L/L$$

And from this we get:

Change in capital per capita:

$$\Delta k = sY/K - k(\Delta L/L)$$

This says that the change in capital per capita is determined by the amount of savings less the addition to capital stock (i.e. savings) needed to keep pace with population growth. Therefore, if $sY/K > k(\Delta L/L)$ this implies that Δk is positive or capital per capita is going up thus output per capita is going up. In other words this means economic growth.

On the other hand, if $sY/K < k(\Delta L/L)$ implies that Δk is negative or the economy is not saving enough to keep pace with population growth. Thus, capital per capita is falling or output is falling.

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Finally, if $sY/K = k(\Delta L/L)$ this implies that Δk is equal to zero. This is called the steady-state. Economies will always move to their steady state. If the economy has a per capita capital stock that is below its steady-state level, then its level of capital per capita will be increasing since $sY/K > k(\Delta L/L)$. The capital per capita will continue to increase until it reaches its steady-state. If on the other hand, the economy has a per capita capital stock that is above its Steady-state level, then it's level of capital per capita will be decreasing since $sY/K < k(\Delta L/L)$. This is shown in Figure 1 where k^* is the steady-state level of capital per capita.

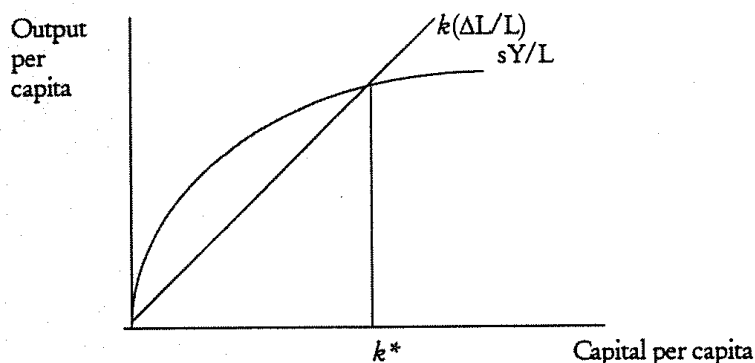


Figure 1: Basic neo-classical growth model with a steady-state.

Comparing two countries with the same Steady-state suggests that poorer countries, those with an initial lower level of capital per capita and thus lower level of output per capita, will grow faster than richer countries due to the diminishing returns assumption. The empirical evidence of the existence of this convergence, or catch-up, is mixed.

Abramovitz (1986), using the Maddison (1982) time series data base of productivity levels for 16 Western nations, finds support for the catch-up hypothesis. According to Abramovitz, a country's ability to catch-up to richer countries is determined by the country's "social capacity" to absorb new technology. Baumol (1986), also using the Maddison data, finds evidence of convergence amongst the developed countries. DeLong (1988) points out that Baumol's definition of developed countries suffers an ex post problem, and when an ex ante definition of "developed" is used the convergence disappears.

Using the Summers and Heston (1988) time series data set of real income, government and private consumption, investment and population, Mankiw, Romer and Weil (1992) attempt to test for "conditional convergence." The neoclassical growth model assumes convergence conditional on all countries having the same steady-state, i.e. the same technology, same savings rate, and same population growth rate. When these are controlled for, Mankiw et al. find what they call conditional convergence.

Bernard and Durlauf (1995) make use of a newer Maddison (1989) data base of annual Purchasing Power Parity-adjusted GDP per capita levels for 15 OECD countries from 1900 to 1987. They find little evidence of convergence in long-term output levels. However, their tests do suggest that there is a set of common long-run factors that jointly determine output growth among several OECD countries.

Thus, up to this point, most of the evidence of convergence has been among the developed countries. When one turns to developing nations, the issue of openness of markets becomes a central issue. Romer (1993) emphasizes that the implications of openness (e.g. openness to international trade, foreign direct investment, and the flow of knowledge and ideas) can differ significantly across different growth models. Empirically however, Ben-David and Loewy (1998) and Edwards (1998) among others have demonstrated that openness may be a driving force in convergence. Another difficult issue is the level of economic "freedom" in an economy. Economic freedom is an important variable in long run economic growth and may play an important role in the level of economic convergence. However, cross-country time series data on measurement of economic freedoms is relatively scarce. More generally, Ben-David (1995b) finds convergence among the world's wealthiest countries and also finds convergence among the world's very poorest countries.

At a sub-national level Loewy and Papell (1996) find evidence of regional convergence in the United States. Similarly, Di Liberto (1994) has found evidence of convergence across the regions of Italy. At a state level, Ben-David (1990) and Barro and Sala-i-Martin (1991) have found convergence among the states of the United States.

How one correctly tests for the existence of convergence or catch-up is a much discussed issue in the growth literature. One of the methods used in the original work of Abramovitz (1986) was to measure the relative variance around the mean levels of relative productivity. If the relative variances, as measured by the coefficient of variation, falls over a specific time period, this is taken as evidence of convergence. This method, hereafter referred to as the CV method, has been used more recently by Williamson (1995), de la Fuente (1997), and others. However the effectiveness of the CV method maybe called into question if the data is not mean reverting, that is the data is non-stationary.

A second test for convergence, popularized originally by Baumol (1986) and used by DeLong (1988), Barro (1991) and others, is to regress the growth rate over a given period, on an intercept term and the initial level. A significant negative coefficient on the initial level would be taken as evidence of convergence. This second test for convergence can be used by running the following regression:

$$Growth\ Rate(t_0-t_n) = \alpha_1 + \alpha_2 \ln(Real\ Income\ Per\ Capita, t_0) \quad (2.1)$$

where t_0 is the initial time period and t_n is the end time period. The variable, or r , is calculated by solving:

$$y_t = e^{rt} y_0 \quad (2.2)$$

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for r to obtain:

$$r = (\ln y_t - \ln y_0) / t \quad (2.3)$$

where y_t = real income per capita in time t .

Recently however, Friedman (1992) and Quah (1993a, 1993b) have raised questions about the usefulness of such tests to indicate the existence of convergence in per capita output levels. The primary criticism of these tests is the regression to the mean argument that would bias these tests. Friedman points to Hotelling's (1933) view that convergence is best measured using the cross-country output differences over time.

A third test for convergence is based on Ben-David's (1995a, 1995b) time series test for convergence in per capita output levels. As discussed above, the cross sectional convergence test is estimated by regressing each country's average growth rate of per capita income on the country's initial level of per capita income, where the Ben-David time series test for convergence has the gap between country's income and the group's average income for a given year on the left side, with the previous year's gap on the right side of the equation. In terms of the log of real income levels would be represented by:

$$(y_{i,t} - \bar{y}_t) = \phi(y_{i,t-1} - \bar{y}_{t-1}) \quad (2.4)$$

Where $y_{i,t}$ represents the log of real income in economy i at time t and \bar{y}_t represents the group average in time t . One of the advantages of this test over the cross sectional test is that this time series test makes use of each year's data rather than relying on the initial year and subsequent growth rate as with the cross sectional test. In this time series test, a convergence coefficient of less than one ($\phi < 1$) indicated convergence within the group, while a $\phi > 1$ indicates divergence.

This test is consistent with the time series test for convergence discussed by Bernard and Durlauf (1995, 1996). Bernard and Durlauf develop a structured definition of convergence in per capita output levels for a multi-country setting. In terms of relative real county income the Bernard-Durlauf definition of convergence would be:

Definition 2.1 *Countries $p=1, \dots, n$ converge if the long run forecasts of incomes for all counties are equal at a fixed time t :*

$$\lim_{k \rightarrow \infty} E (y_{1,t+k} - y_{p,t+k} | I_t) = 0 \quad \forall p \neq 1 \quad (2.5)$$

This definition of convergence asks whether the long run forecasts of income differences tend toward zero as time tends toward infinity. Under this definition, if ϕ in equation 2.4 is less than unity, convergence exists.

In making the distinction between cross sectional convergence tests and time series convergence tests in per capita output levels, Bernard and Durlauf (1996) state that convergence in a time series approach implies that differences between two countries cannot contain a unit root or a time trend. Thus no time trend is included in this time series test.

Bernard and Durlauf (1995, 1996) also discuss one potential difficulty in using the time series approach to test for convergence. If the countries in the data are in

transition towards a limiting distribution, the time series test may erroneously accept a non convergence null hypothesis. Time series tests assume that the data is generated by economies near their limiting distributions, i.e. the sample moments of the data are interpretable as the population moments. If the countries in the sample start at different initial conditions and are converging to, but are not yet at, a steady-state distribution, then the data maybe generated by a transitional law of motion rather than an invariant stochastic process. Thus, if the data is taken from economies which are far from their steady-states, then the sample moments might inaccurately approximate the limiting population moments.

As pointed out by Levin and Lin (1992), Hsiao (1986) and others, taking advantage of the panel characteristics of multi-country time series data can greatly increase the power of conventional time series regressions. In order to take advantage of the panel characteristics of data set, the economies or countries may be pooled together and a single convergence coefficient is calculated. In the presence of pooling, the intercept becomes zero since the variables have a zero mean over all the countries and years. The convergence coefficient is estimated by:

$$(y_{i,t} - \bar{y}_t) = \phi(y_{i,t-1} - \bar{y}_{t-1}) + \sum_{j=1}^k c_j \Delta(y_{i,t-j} - \bar{y}_{t-j}) + \varepsilon_t \quad (2.6)$$

A statistically significant convergence coefficient less than one ($\phi < 1$) is taken as evidence of convergence, and a statistically significant coefficient greater than one as evidence of divergence.

III. The Role of Economic History in the Convergence Debate.

As described in section two, the concept of convergence stems from the idea that countries or economies that are "similar" should experience the phenomena that the poor countries grow faster than the richer countries. Central to this idea is how to define countries or economies as "similar." Baumol (1986), Ben-David (1995) and Quah (1993a, 1993b) have all been strong proponents of the idea of the grouping of "similar" countries or economies into convergence clubs. That is, that while overall convergence may not exist, countries within a convergence club may show signs of a statistically significant level of convergence. The issue then turns to which countries should be included in a convergence club.

The issue of which countries to include in which convergence club was a central issue that Baumol faced in his seminal work in 1986. It was pointed out by DeLong two years later that Baumol had his club selection wrong. Baumol ignored economic history and included in his "rich" country club only those countries that were "rich" at the end period of 1979. When DeLong expanded the rich club to include all of those countries that were "rich" in 1870, the evidence of convergence disappears. Thus, close attention to economic history must be paid when constructing convergence clubs.

Ben-David (1995b) paid much closer attention to economic history in his construction of convergence clubs and finds evidence of convergence among both rich and

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poor countries. Ben-David and Brandl (1996) apply the lessons of economic history to the investigation of convergence among the nations of Sub-Saharan Africa. Based on the colonial history of Africa, Ben-David and Brandl find convergence among clubs of former African colonies that have been able to distance themselves the greatest from their former colonial ruler. It is argued that by trading with a wider variety of countries these former colonies gain the spillovers from trade that allow convergence to take place.

Thus, the evidence is clear that the construction of the convergence club hinges critically on the economic history of the club members. In fact, the "similarities" that unite the members of a convergence club may be seen only with the benefit of knowledge of the economic history of the member countries. This is clearly the case in the investigation of the African convergence clubs.

The economic historian can point to economies (both on the national and sub-national level) that may share "similarities" based on their economic histories. Specifically, the economic historian can point to economies that share similar technologies, similar governmental institutions, similar educational institutions and levels, similar trading patterns and similar financial institutions all of which may drive economic convergence. These similar economies can be grouped together into a club and the various econometric tests can be preformed to investigate the existence of a statistically significant level of economic convergence.

It needs to be stressed that the role of the economic historian plays can also be critically important in the formulation of sub-national convergence clubs. Are there regions, states, countries, etc. that could form convergence clubs? Often the "similarities" between the members of the convergence clubs are not readily measurable but can be described through historical analysis.

As Temple (1999) has pointed out, economic historians can offer a much deeper understanding of the social, political, institutional and technological sources of economic growth than empirical economists are able to alone. It is worth noting what economic historian Alexander Gerschenkron (1952) suggested over four decades ago:

"The historians' contribution consists in pointing at potentially relevant factors and at potentially significant contributions among them which could not be easily perceived within a more limited sphere of experience."

As Gerschenkron and Temple suggest historians can be useful in pointing to particular factors that make economies similar that others might miss.

This historical description versus readily measurable vehicles becomes a major issue when one considers the technology variable. Economists have a very difficult time in measuring "similar levels of technology," yet technological shocks are a major explanation of economic growth, and thus convergence, within the Solow Neo-classical growth model. Perhaps it is only possible to describe technological shocks and levels of technology in various economies through historical analysis, at least for today.

IV. Conclusion

This paper seeks to expand the role of economic historians in the convergence debate that ranges in the study of economic growth. The issue of which economies, both national and sub-national, to be included in a convergence club is best addressed by an economic historian. The implications of this line of research are far reaching. If it can be determined which economies exhibit evidence of convergence and over what time periods, conclusions may be drawn as to which economic policies or set of economic conditions are most favorable for economic growth. To paraphrase Lucas, once you start to think about such things it does become difficult to think of anything else.

Notes

1. For a more complete explanation see Jones (1998).
2. The countries were Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States. The time period covers 1870 to 1979.
3. The data covers most non-centrally planned countries and covers the period 1960 -1985.
4. For a more complete discussion see Barro and Sala-i-Martin's (1995) textbook on economic growth
5. The countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, the United Kingdom and the United States.
6. An exception is Mauro (1995).
7. The coefficient of variation is the standard deviation divided by the mean.
8. See Table 1 in Abramovitz (1986).
9. See Brandl (1996) for a discussion.
10. As pointed out by Bernard and Durlauf (1996), cross-sectional test have generally rejected a no convergence null hypothesis and cross-sectional tests are based on a weaker notion of convergence than are time series tests.
11. In Bernard and Durlauf (1995) it is shown that the idea of convergence as catching-up is implied by equation 2.5.
12. Panel characteristics refer to idea that a data set of many variables, in this case countries, over numerous time periods, in this case years, offer more explanatory power than does one variable over many periods, or many variables over one period.
13. See Ben-David (1995a) for proof.
14. In order to test if the convergence coefficient is different from unity the t-statistic on the ϕ from the following regression is used:

$$\Delta(y_{i,t} - \bar{y}_t) = \phi(y_{i,t-1} - \bar{y}_{t-1}) + \sum_{j=1}^k c_j \Delta(y_{i,t-j} - \bar{y}_{t-j}) + \epsilon_{i,t}$$
15. Galor (1996) describes a club convergence hypothesis as being: per capita income of countries that are identical in their structural characteristics converge to one another in the long-run provided that their initial conditions are similar as well. That is, countries converge to one another if their initial conditions are in the basin of attraction of the same Steady-state equilibrium.
16. Rodrik (1998) has also suggests that the tie between economic history and resulting trade policies in Africa may help to explain the overall economic growth performance of the sub-Saharan region of the continent.

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