NORTH-HOLLAND Journal of Economics and Business 53 (2001) 593–607

Journal of Economics & Business

Interpreting cross-section and time-series tests of convergence: the case of labor productivity in manufacturing

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Received 08 August 2000; revised 19 October 2000; accepted 31 October 2000

Abstract

This paper investigates whether a disaggregated measure, labor productivity in manufacturing, is converging across eight OECD countries during the period 1950–1998 using both cross-section and time series tests of convergence. The evidence indicates convergence using either test for the full sample, but tests over subperiods suggest that the dynamics of the underlying series change from economies in transition in the early years to economies in balanced, but parallel, growth paths in the later period. The results confirm that the appropriate test for convergence depends on the underlying structure of the data.

JEL classification: F43; O47

Keywords: Convergence; Labor productivity

1. Introduction

The convergence hypothesis has generated a vast empirical literature investigating the proposition that diminishing returns and exogenous technological change ensure that economies with unequal initial states eventually converge to equal states (absolute convergence)

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0148-6195/01/$ – see front matter
PII: S0148-6195(01)00051-0

or to parallel growth paths (relative convergence). Productivity, expressed as income or output per capita or per worker, is the primary focus of empirical tests of the convergence hypothesis. Convergence tests help answer the question of whether poor economies are catching up with rich economies, as predicted in standard neoclassical growth models.

Unfortunately, if not unexpectedly given the complexity of the problem, there is as yet no consensus on the acceptance or rejection of the convergence hypothesis (see recent surveys by Durlauf and Quah, 1998; Temple, 1999). Some stylistic facts have emerged, though none is uncontroversial. First, broad samples including rich and poor economies do not converge unconditionally using aggregate measures of productivity like GDP per capita (Sala-i-Martin, 1996; Evans, 1998). Second, economies that are similar in structural characteristics —so called "convergence clubs" (Baumol and Wolff, 1988), such as the members of the OECD—tend to converge within groups.[1] Third, convergence appears to occur across states and regions within countries: Barro and Sala-i-Martin (1992) and Evans and Karras (1996) present evidence for U.S. States; Sala-i-Martin (1996) finds convergence across regions of Europe and Japanese prefectures. Fourth, what little evidence that exists indicates that convergence of aggregate productivity does not imply convergence of disaggregated economic activity, even within convergence clubs. Bernard and Jones (1996) find that convergence of aggregate productivity for 14 OECD countries does not translate into convergence within sectors across countries; in particular, total factor productivity within manufacturing diverged across the sample.

Much of the literature on convergence is divided among cross-section tests of average productivity growth rates on initial productivity levels across a sample of countries (so-called *β-convergence*), measures of the dispersion of productivity levels across countries over time (so-called *σ-convergence),* and time-series tests of the stationarity of differences in productivity levels over time.[2] Examples of cross-section tests include Baumol (1986), Barro and Sala-i-Martin (1991, Barro and Sala-i-Martin, 1992), Mankiw, Romer and Weil (1992) and Sala-i-Martin (1996). Examples of time series tests, usually based on standard unit root and cointegration tests, include Bernard and Durlauf (1995), Carlino and Mills (1993), and Evans (1997b, Evans, (1998).

While cross-section and time-series based tests are often presented as alternatives, Bernard and Durlauf (1996) point out that there are quite different assumptions made about the characteristics of the data in each case. With cross section tests, economies are assumed to be in transition toward a steady state, and initial differences should tend to lessen over time. Under the β-convergence hypothesis, the coefficient (β) of the initial productivity level in growth regressions will be negative, reflecting the faster (slower) growth expected of economies with lower (higher) initial levels. With time series tests, economies are assumed to be near steady-state equilibria, and neither initial conditions nor shocks have statistically significant effects on differences in productivity; hence in this case the null hypothesis of a unit root in productivity differences should be rejected. As Bernard and Durlauf argue, "[A] given approach is appropriate depending upon whether one regards the data as better characterized by transition or steady state dynamics." (1996, p.171)

This paper examines the issue of transition dynamics explicitly by conducting both cross-section and time-series based tests of convergence of labor productivity in manufacturing for eight OECD countries. The countries in the sample share similar government