Chapter 1

Introduction and Growth Facts

1.1 Introduction

- In 2000, GDP per capita in the United States was $32500 (valued at 1995 $ prices). This high income level reflects a high standard of living.

- In contrast, standard of living is much lower in many other countries: $9000 in Mexico, $4000 in China, $2500 in India, and only $1000 in Nigeria (all figures adjusted for purchasing power parity).

- *How can countries with low level of GDP per person catch up with the high levels enjoyed by the United States or the G7?*

- Only by high growth rates sustained for long periods of time.

- *Small differences in growth rates over long periods of time can make huge differences in final outcomes.*

- US per-capita GDP grew by a factor ≈ 10 from 1870 to 2000: In 1995 prices, it was \$3300 in 1870 and \$32500 in 2000.[1] Average growth rate was $\approx 1.75\%$. If US had grown with .75% (like India, Pakistan, or the Philippines), its GDP would be only \$8700 in 1990 (i.e., $\approx 1/4$ of the actual one, similar to Mexico, less than Portugal or Greece). If US had grown with 2.75% (like Japan or Taiwan), its GDP would be \$112000 in 1990 (i.e., 3.5 times the actual one).

- At a growth rate of 1%, our children will have ≈ 1.4 our income. At a growth rate of 3%, our children will have ≈ 2.5 our income. Some East Asian countries grew by 6% over 1960-1990; this is a factor of ≈ 6 within just one generation!!!

- Once we appreciate the importance of sustained growth, the question is natural: *What can do to make growth faster?*

- Equivalently: What are the factors that explain differences in economic growth, and how can we control these factors?

- In order to prescribe policies that will promote growth, we need to understand what are the determinants of economic growth, as well as what are the effects of economic growth on social welfare. That's exactly where Growth Theory comes into picture...

[1] Let y_0 be the GDP per capital at year 0, y_T the GDP per capita at year T, and x the average annual growth rate over that period. Then, $y_T = (1+x)^T y_0$. Taking logs, we compute $\ln y_T - \ln y_0 = T \ln(1+x) \approx Tx$, or equivalenty $x \approx (\ln y_T - \ln y_0)/T$.

1.2 The World Distribution of Income Levels and Growth Rates

- As we mentioned before, in 2000 there were many countries that had much lower standards of living than the United States. This fact reflects the high cross-country dispersion in the level of income.

- **Figure 1**[2] shows the distribution of GDP per capita in 2000 across the 147 countries in the Summers and Heston dataset. The richest country was Luxembourg, with $44000 GDP per person. The United States came second, with $32500. The G7 and most of the OECD countries ranked in the top 25 positions, together with Singapore, Hong Kong, Taiwan, and Cyprus. Most African countries, on the other hand, fell in the bottom 25 of the distribution. Tanzania was the poorest country, with only $570 per person – that is, less than 2% of the income in the United States or Luxemburg!

- **Figure 2** shows the distribution of GDP per capita in 1960 across the 113 countries for which data are available. The richest country then was Switzerland, with $15000; the United States was again second, with $13000, and the poorest country was again Tanzania, with $450.

- The cross-country dispersion of income was thus as wide in 1960 as in 2000. Nevertheless, there were some important movements during this 40-year period. Argentina, Venezuela, Uruguay, Israel, and South Africa were in the top 25 in 1960, but none made it to the top 25 in 2000. On the other hand, China, Indonesia, Nepal, Pakistan, India, and Bangladesh grew fast enough to escape the bottom 25 between 1960 and 1970.

[2] Figures 1, 2 and 3 are reproduced from Barro (2003).

These large movements in the distribution of income reflects sustained differences in the rate of economic growth.

- **Figure 3** shows the distribution of the growth rates the countries experienced between 1960 and 2000. Just as there is a great dispersion in income levels, there is a great dispersion in growth rates. The mean growth rate was 1.8% per annum; that is, the world on average was twice as rich in 2000 as in 1960. The United States did slightly better than the mean. The fastest growing country was Taiwan, with a annual rate as high as 6%, which accumulates to a factor of 10 over the 40-year period. The slowest growing country was Zambia, with an negative rate at -1.8%; Zambia's residents show their income shrinking to half between 1960 and 2000.

- Most East Asian countries (Taiwan, Singapore, South Korea, Hong Kong, Thailand, China, and Japan), together with Bostwana (an outlier as compared to other sub-Saharan African countries), Cyprus, Romania, and Mauritus, had the most stellar growth performances; they were the "growth miracles" of our times. Some OECD countries (Ireland, Portugal, Spain, Greece, Luxemburg and Norway) also made it to the top 20 of the growth-rates chart. On the other hand, 18 out of the bottom 20 were sub-Saharan African countries. Other notable "growth disasters" were Venezuela, Chad and Iraq.

1.3 Unconditional versus Conditional Convergence

- There are important movements in the world income distribution, reflecting substantial differences in growth rates. Nonetheless, on average income and productivity differences are very persistent.

- **Figure 4**[3] graphs a country's GDP per worker in 1988 (normalized by the US level) against the same country's GDP per worker in 1960 (again normalized by the US level). Most observations close to the 45°-line, meaning that most countries did not experienced a dramatic change in their relative position in the world income distribution. In other words, *income differences across countries are very persistent.*

- This also means that *poor countries on average do not grow faster than rich countries.* And another way to state the same fact is that unconditional convergence is zero. That is, if we ran the regression

$$\Delta \ln y_{2000-1960} = \alpha + \beta \cdot \ln y_{1960},$$

  the estimated coefficient β is zero.

- On the other hand, consider the regression

$$\Delta \ln y_{1960-90} = \alpha + \beta \cdot \ln y_{1960} + \gamma \cdot X_{1960}$$

  where X_{1960} is a set of country-specific controls, such as levels of education, fiscal and monetary policies, market competition, etc. Then, the estimated coefficient β turns to be positive (in particular, around 2% per annum). Therefore, if we look in a group of countries that share similar characteristics (as measured by X), the countries with lower intial income tend to grow faster than their rich counterparts, and therefore the poor countries tend to catch up with the rich countries in the same group. This is what we call *conditional convergence.*

- Conditional convergence is illustrated in **Figures 5 and 6**, for the group of OECD countries and the group of US states, respectively.

[3] Figure 4 is reproduced from Jones (1997).

1.4 Stylized Facts

The following are stylized facts that should guide us in the modeling of economic growth (Kaldor, Kuznets, Romer, Lucas, Barro, Mankiw-Romer-Weil, and others):

1. *In the short run, important fluctuations:* Output, employment, investment, and consumptio vary a lot across booms and recessions.

2. *In the long run, balanced growth:* Output per worker and capital per worker (Y/L and K/L) grow at roughly constant, and certainly not vanishing, rates. The capital-to-output ratio (K/Y) is nearly constant. The return to capital (r) is roughly constant, whereas the wage rate (w) grows at the same rates as output. And, the income shares of labor and capital (wL/Y and rK/Y) stay roughly constant.

3. Substantial *cross-country differences* in both income levels and growth rates.

4. Persistent differences versus conditional convergence.

5. *Formal education:* Highly correlated with high levels of income (obviously two-direction causality); together with differences in saving rates can "explain" a large fraction of the cross-country differences in output; an important predictor of high growth performance.

6. *R&D and IT:* Most powerful engines of growth (but require high skills at the first place).

7. *Government policies:* Taxation, infrastructure, inflation, law enforcement, property rights and corruption are important determinants of growth performance.

8. *Democracy:* An inverted U-shaped relation; that is, autarchies are bad for growht, and democracies are good, but too much democracy can slow down growth.

9. *Openness:* International trade and financial integration promote growth (but not necessarily if it is between the North and the South).

10. *Inequality:* The Kunzets curve, namely an inverted U-shaped relation between income inequality and GDP per capita (growth rates as well).

11. *Ferility:* High fertility rates correlated with levels of income and low rates of economic growth; and the process of development follows a Malthus curve, meaning that fertility rates initially increase and then fall as the economy develops.

12. *Financial markets and risk-sharing:* Banks, credit, stock markets, social insurance.

13. *Structural transformation:* agriculture→manifacture→services.

14. *Urbanization:* family production→organized production; small vilages→big cities; extended domestic trade.

15. Other institutional and social factors: colonial history, ethnic heterogeneity, social norms.

The theories of economic growth that we will review in this course seek to explain how all the above factors interrelate with the process of economic growth. Once we understand better the "mechanics" of economic growth, we will be able, not only to predict economic performance for given a set of fundamentals (*positive analysis*), but also to identify what government policies or socio-economic reforms can promote social welfare in the long run (*normative analysis*).

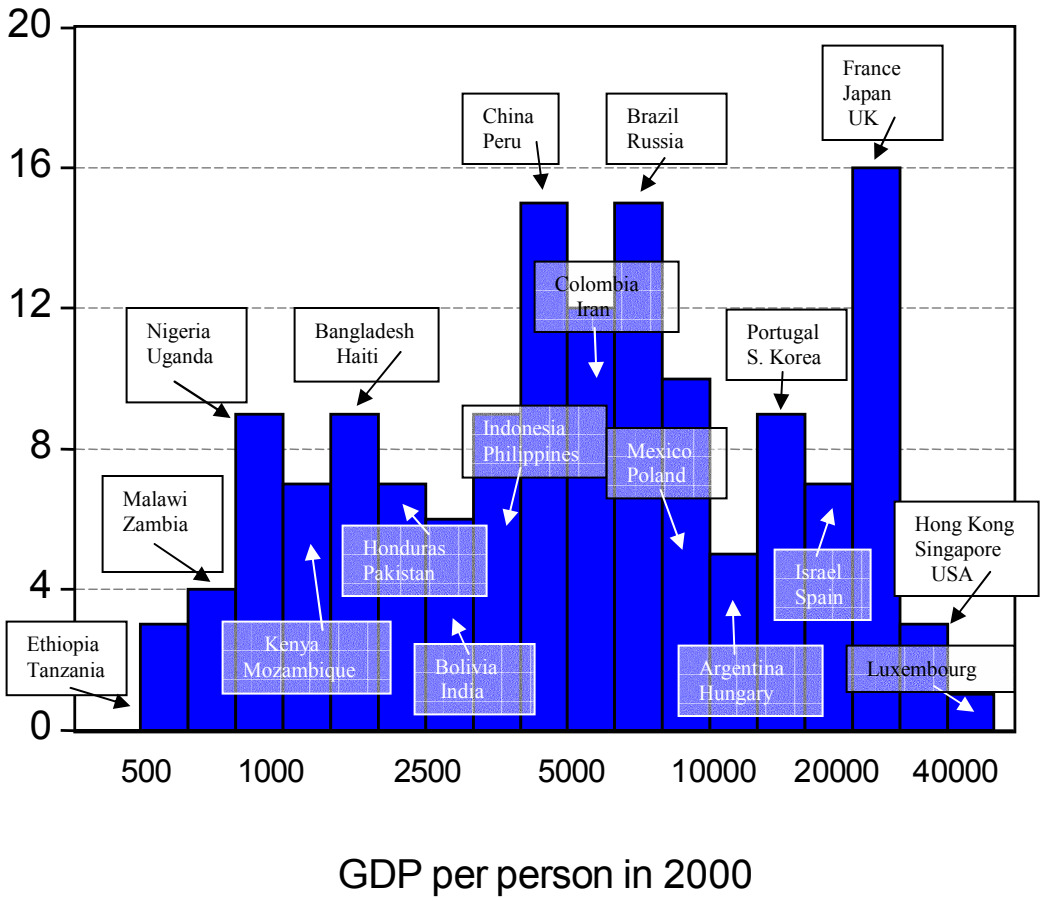


Figure 1

The World's Distribution of GDP per Person in 2000
(reproduced from Barro, 2003)

The graph shows the distribution of gross domestic product (GDP) per person for 147 countries in 2000. The horizontal axis is in 1995 U.S. dollars and uses a logarithmic scale. Representative countries are indicated for the various ranges of GDP per person.

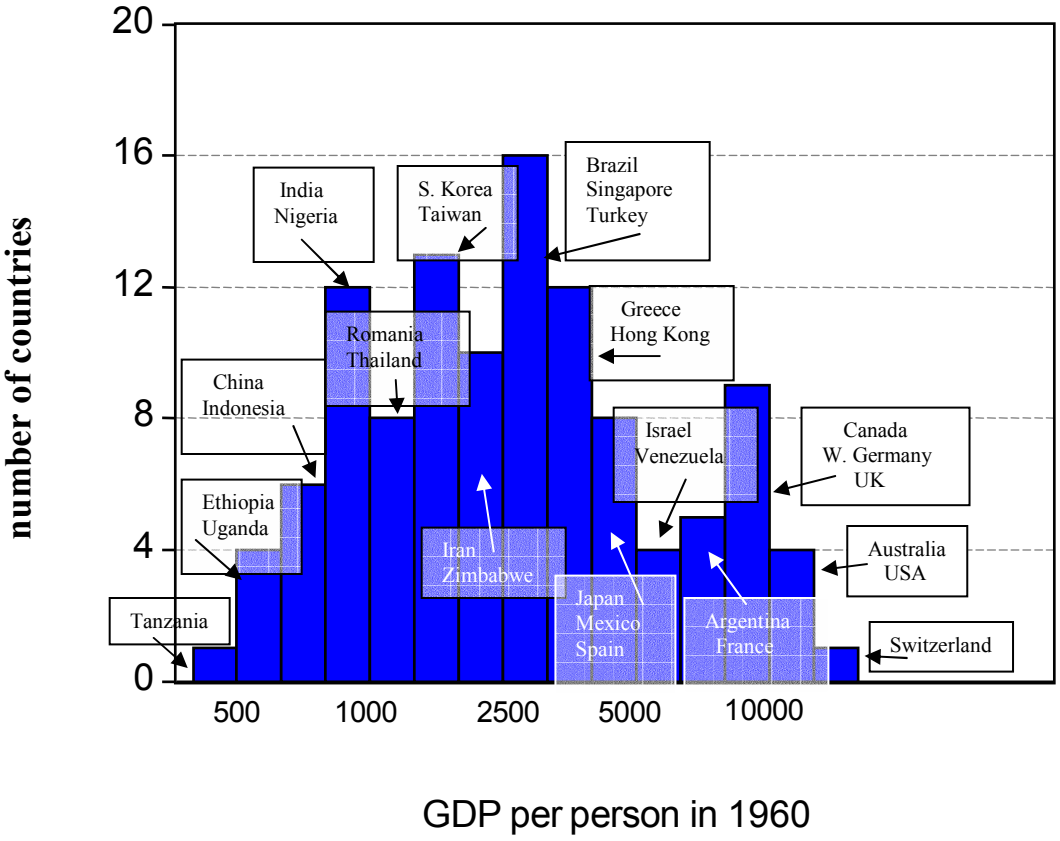


Figure 2

The World's Distribution of GDP per Person in 1960
(reproduced from Barro, 2003)

The graph shows the distribution of GDP per person for 113 countries in 1960. The horizontal axis is in 1995 U.S. dollars and uses a logarithmic scale. Representative countries are indicated for the various ranges of GDP per person.

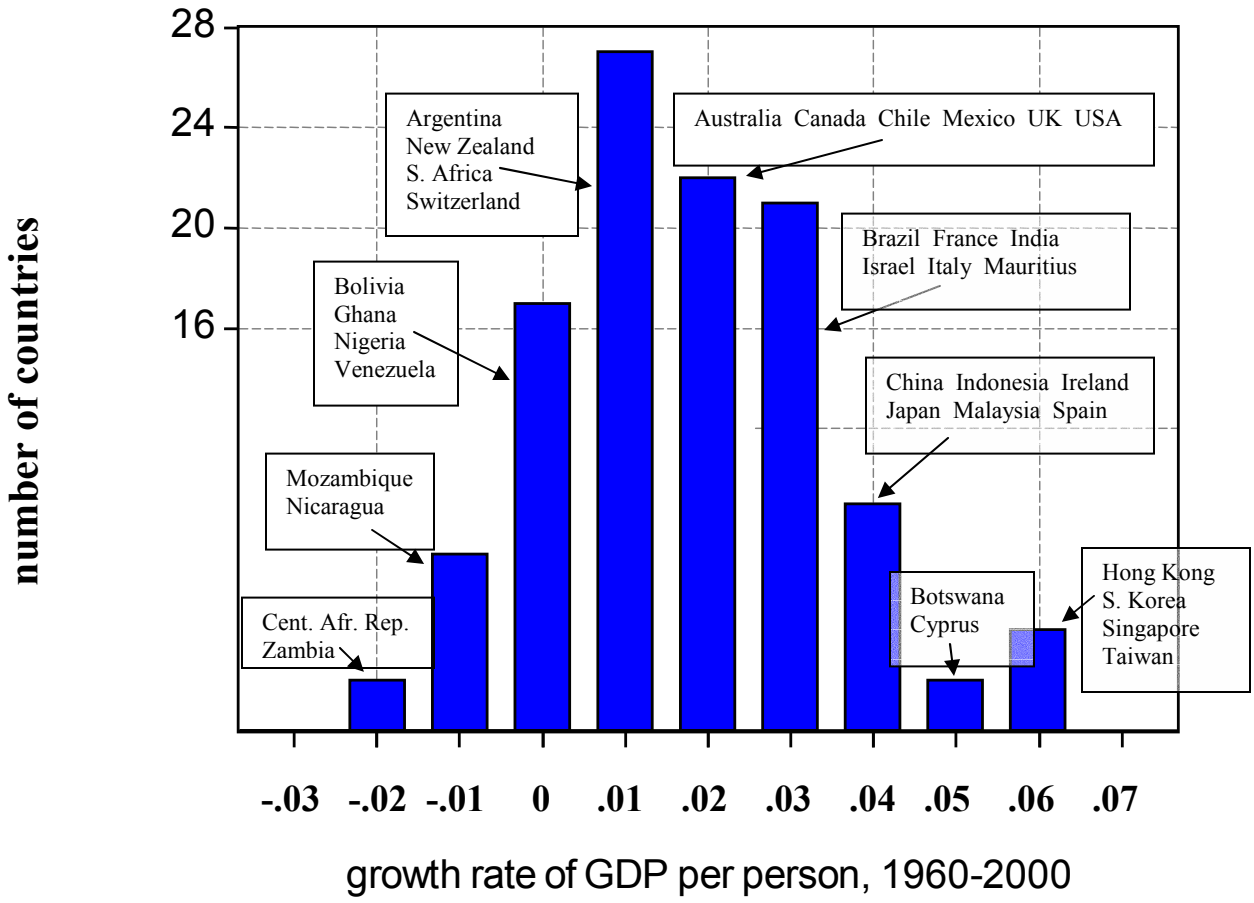


Figure 3

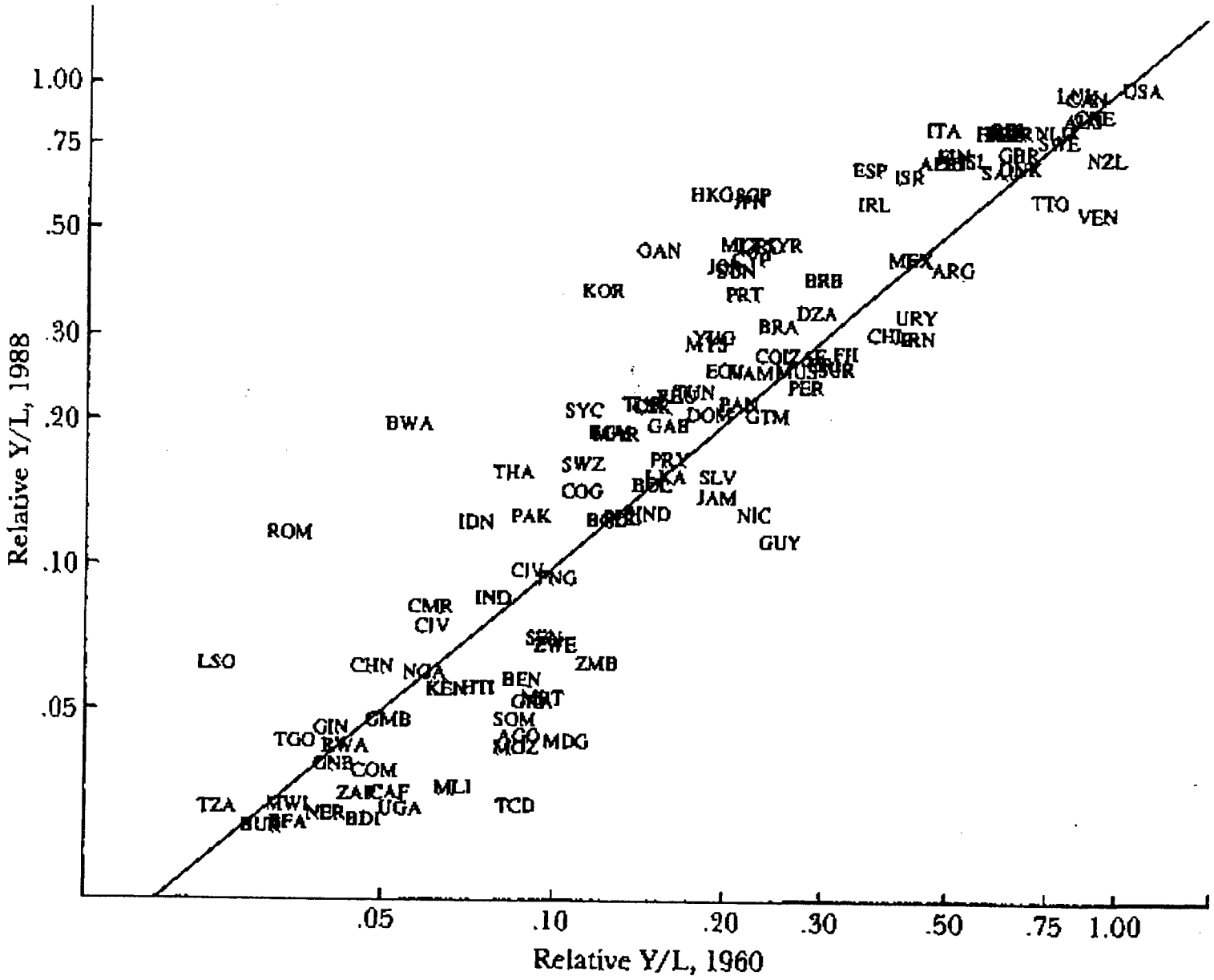
The World's Distribution of Growth Rates of GDP per Person, 1960-2000
(reproduced from Barro, 2003)

The graph shows the distribution of the annual growth rate of GDP per person for 111 countries from 1960 to 2000. Representative countries are indicated for the various ranges of growth rates.

Figure 4

Relative Y/L, 1960 vs. 1988

(log scale)



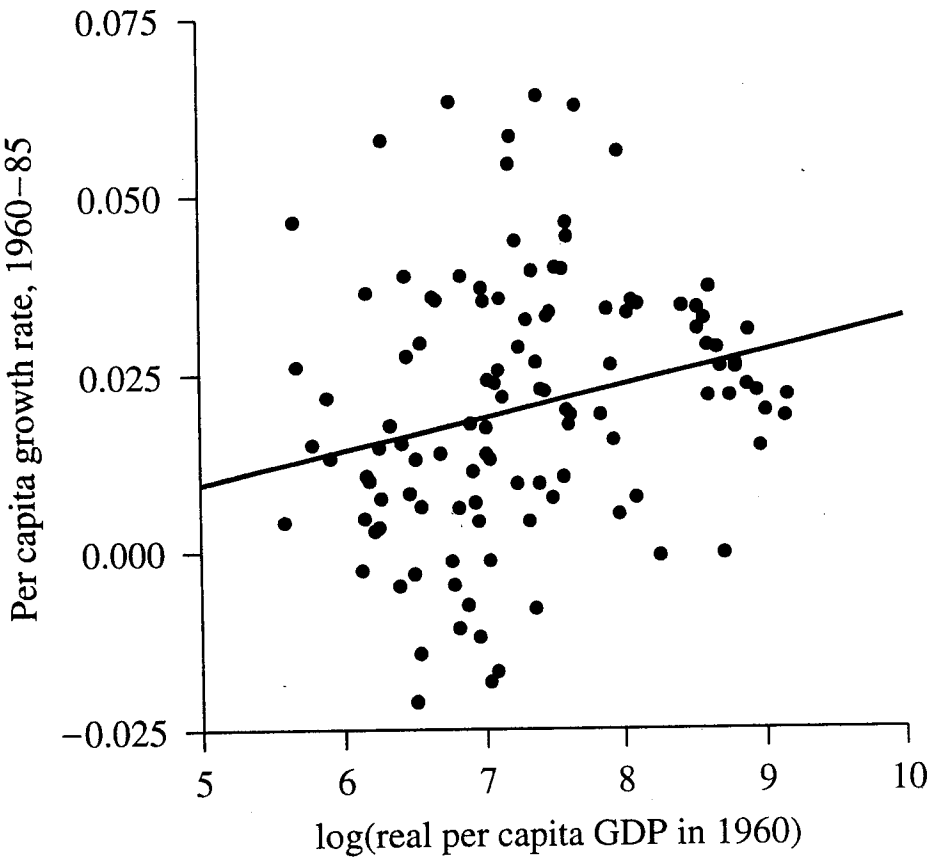


Figure 5

Convergence of GDP across countries: Growth rate versus initial level of real per capita GDP for 118 countries. For a sample of 118 countries, the average growth rate of GDP per capita from 1960 to 1985 (shown on the vertical axis) has little relation with the 1960 level of real per capita GDP (shown on the horizontal axis). The relation is actually slightly positive. Hence, absolute β convergence does not apply for a broad cross section of countries.

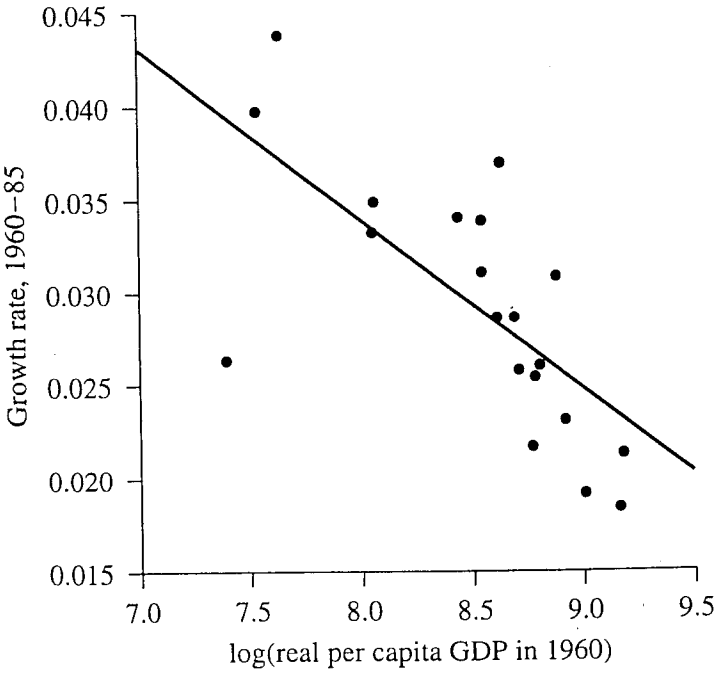


Figure 6

Convergence of GDP across OECD countries: Growth rate versus initial level of real per capita GDP for 20 OECD countries. If the sample is limited to the 20 original OECD countries, then the average growth rate of real per capita GDP from 1960 to 1985 is negatively related to the 1960 level of real per capita GDP. Hence, absolute β convergence applies for these OECD countries.

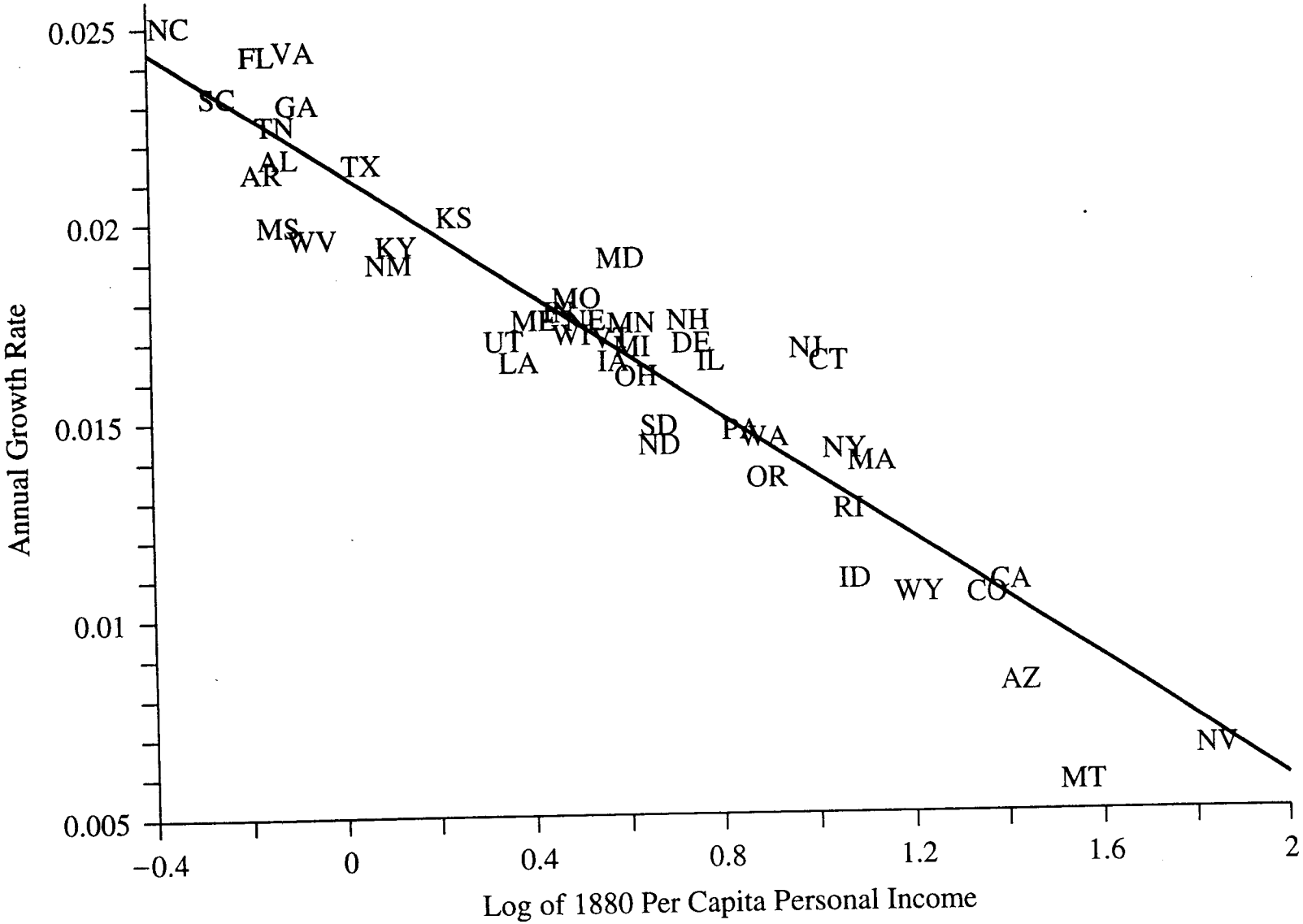


Figure 7

Convergence of personal income across U.S. states, 1880 personal income and 1880–1990 income growth. The average growth rate of state per capita income for 1880–1990, shown on the vertical axis, is negatively related to the log of per capita income in 1880, shown on the horizontal axis. Thus, absolute β convergence exists for the U.S. states. Each state is represented by its postal code (see Table 10.4).