

Topics for Today

- 1.) The Welfare Costs of Business Cycles
- "Macroeconomic Priorities", Lucas (AER, 2003)
- 2.) Some Basic Growth Facts
- 3.) Midterm Review

Macroeconomic Priorities

- Lucas asks: "What are the welfare benefits of improved stabilization policy?"
- He applies standard tools of cost/benefit analysis.
- Suppose $\exists$ 2 policies, which lead to C_A and C_B
- Suppose C_B is preferred to C_A . $[U(C_B) > U(C_A)]$.
- Define λ as
$$U(C_B) = U(C_A(1+\lambda))$$

λ = welfare gain from policy B (in units of goods)
"Equivalent Variation"
(policy change doesn't take place).

Could also have

$$U(C_B(1-\eta)) = U(C_A)$$

$\Rightarrow \eta$ = "compensating variation" } Policy Change occurs & you "compensate"

3 steps

$$1.) C_t = A e^{\mu t} e^{-\frac{1}{2}\sigma^2 t} \varepsilon_t$$

$$\log(\varepsilon_t) \sim N(0, \sigma^2) \\ \Rightarrow E(e^{-\frac{1}{2}\sigma^2 \varepsilon_t}) = 1$$

$$2.) U = E\left\{ \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma} \right\}$$

3.) Compensate for Bus. Cycle Risk

$$E\left\{ \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\gamma} [A(1+\lambda) e^{\mu t} e^{-\frac{1}{2}\sigma^2 t} \varepsilon_t]^{1-\gamma} \right\} = \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\gamma} [A e^{\mu t}]^{1-\gamma}$$

$$\Rightarrow (1+\lambda)^{1-\gamma} e^{-\frac{1}{2}\sigma^2 t(1-\gamma)} = 1$$

$$\Rightarrow \ln(1+\lambda) = \frac{1}{2} \gamma \sigma^2$$

$$\Rightarrow \boxed{\lambda \approx \frac{1}{2} \gamma \sigma^2}$$

dislike
of risk

quantity
of risk

Calibration

U.S. Annual Data (1947-2001) : $\mu = .02$ $\sigma = .032$ [$.032^2 \approx .001$]

$$r = \rho + \gamma \mu \Rightarrow \gamma \approx 1.0 - 2.0$$

$$\beta = \frac{1}{1+\rho}$$

$$\Rightarrow \lambda = \frac{1}{2}(2)(.001) = .001 = \frac{1}{10} \text{ of } 1\% \text{ of consumption}$$

$$C \approx \$10 \text{ trillion}$$

$$Pop \approx 330 \text{ million}$$

$$\frac{C}{Pop} \approx \$30,000 \text{ per year}$$

$$\Rightarrow \lambda \approx \$30 \text{ per year !}$$

Caveats

1.) Incomplete MKts. / Distribution

- Some may benefit a lot
- Krusell & Smith (RED, 2009)
 - 4% gain to poor households (homogeneous unemployment)
 - 30% gain to poor households! (with long-term unemployment).

2.) Preferences. CRRA is restrictive.

- Epstein-Zin $\Rightarrow$ Can separate Inter-temporal Subst. from risk aversion

$\Rightarrow$ Calibrate risk aversion to stock returns
 $\Rightarrow$ much larger costs.

3.) Indirect Growth Effects.

- If volatility depresses growth then costs are much greater
- On the other hand, some consumption variability is natural + even desirable. Should not think of stabilization policy as eliminating all risk

Small Differences in Growth Rates Make a Big Difference

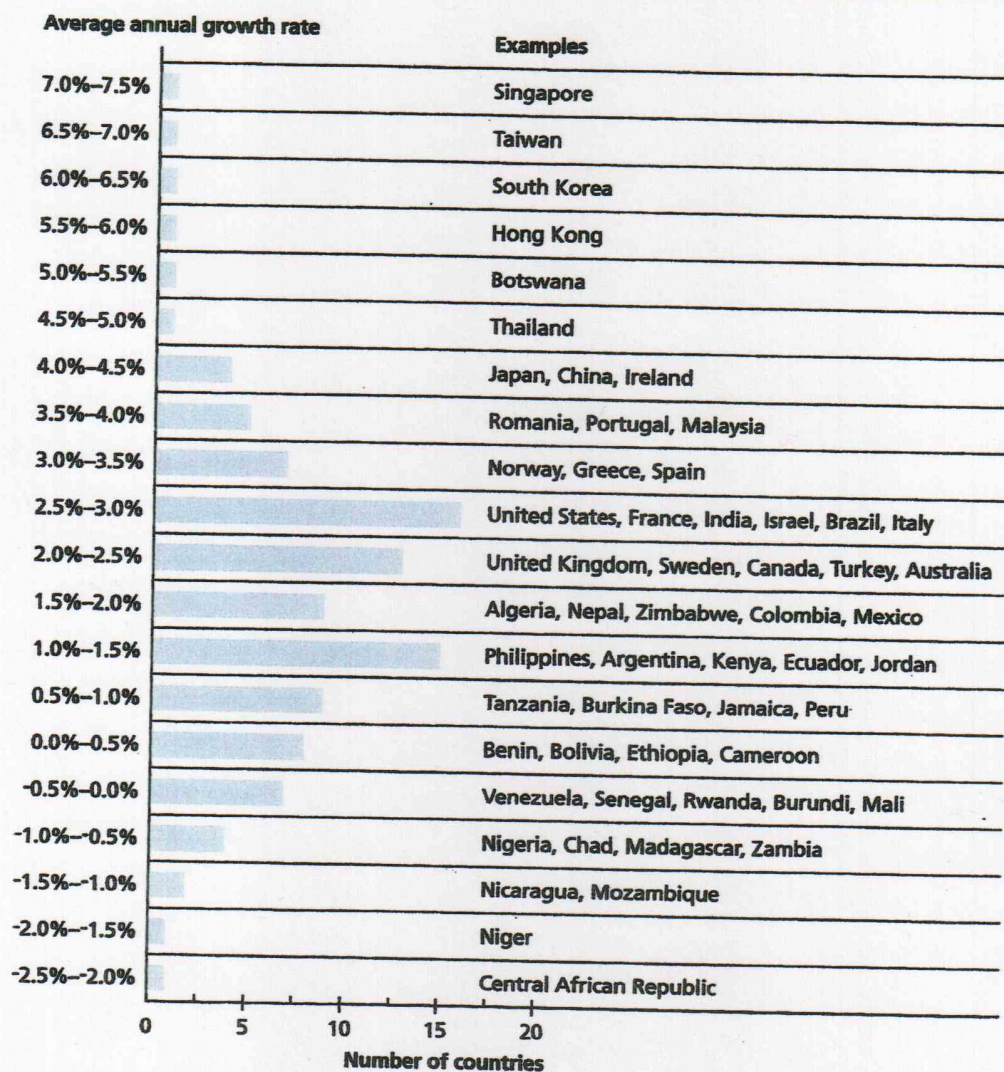
	<u>1870</u>	<u>1998</u>	<u>Annual Growth Rate</u>
Australia	\$ 3,645	20,390	1.4%
Japan	737	20,084	2.6%

(per capita GDPs in 1990 U.S. \$)

Understanding why growth differs across countries and over time is the fundamental question in all of economics!

Intl. Differences in Per Capita Income in 2004

<u>Country</u>	<u>Per Capita Income (2000 intl. \$)</u>
USA	\$ 39,535
Canada	31,600
Japan	26,658
Mexico	8,883
Brazil	7,800
China	5,772
India	3,212
Sudan	1,254
Zambia	1,065
Niger	863
Congo (Dem. Rep.)	417

FIGURE 1.6**The Distribution of Growth Rates, 1960–2000**

Source: Heston, Summers, and Aten (2002).

	Growth in output per person (percent per year)		
	1948-72	1972-95	1995-2000
Canada	2.9	1.8	2.7
France	4.3	1.6	2.2
Germany	5.7	2.0	1.7
Italy	4.9	2.3	4.7
Japan	8.2	2.6	1.1
U.K.	2.4	1.8	2.5
U.S.	2.2	1.5	2.9

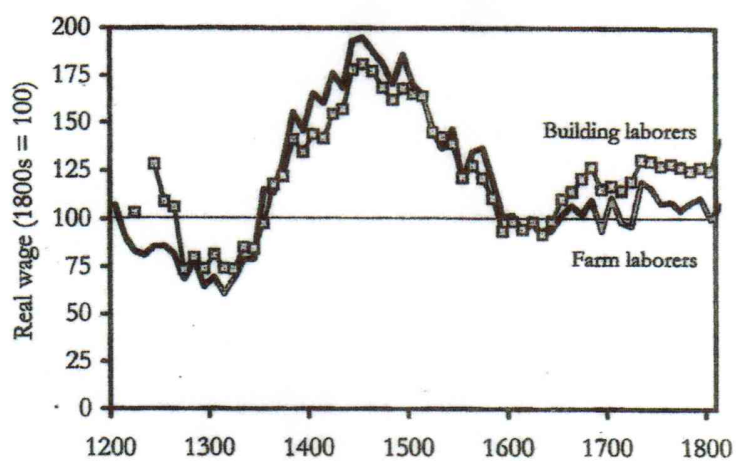


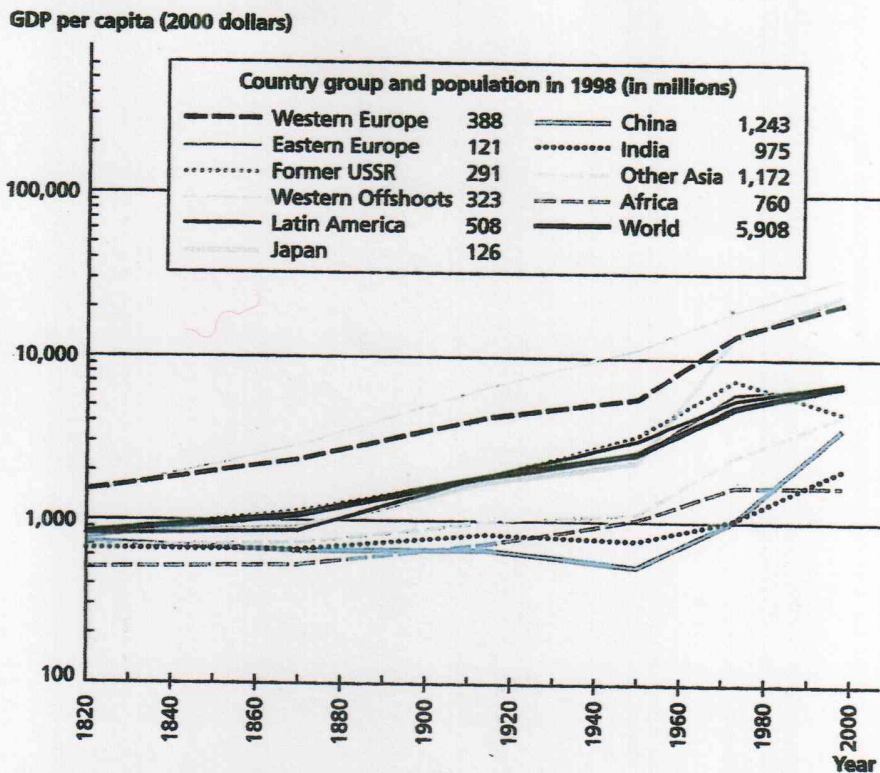
Figure 3.1 English laborers' real wages, 1209-1809.

Table 3.1 Expenditure Shares of Laborers before 1800

Category of expenditure	Share (%)
Food and drink	75
Grains and starches	44
Dairy	10
Meat	9
Drink	8
Sugar and honey	3
Salt and pepper	1
Clothing and bedding	10
Housing	6
Heating	5
Light and soap	4

FIGURE 1.7

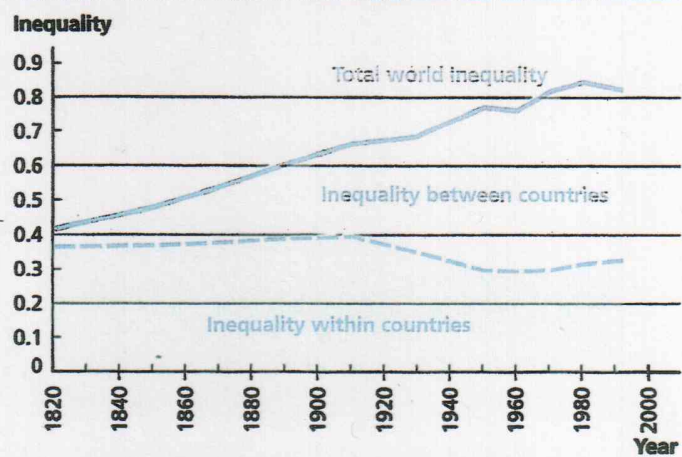
GDP per Capita by Country Group, 1820–1998



Source: Maddison (2001).

FIGURE 1.8

World Inequality and Its Components, 1820–1992



*Bourguignon and Morrison (2002).

†Mathematical Note: The mean logarithmic deviation is defined as

$$\frac{1}{n} \sum_{i=1}^n \ln \left(\frac{\bar{x}}{x_i} \right),$$

where $\bar{x}$ is the mean value of x and n is the number of observations.

Source: Bourguignon and Morrison (2002).

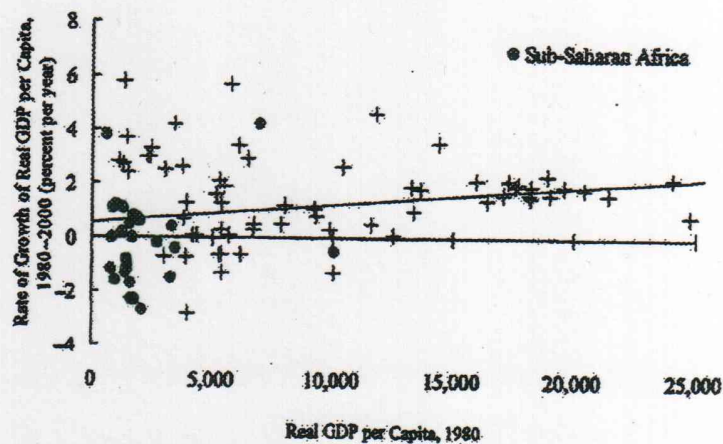


FIGURE 4. AVERAGE ANNUAL GROWTH (1980-2000) ON INITIAL LEVEL OF REAL GDP PER CAPITA

Note: The data are values for real GDP in U.S. dollars per equivalent adult.

Source: Penn World Tables, version 6.1 (available online: (<http://pwt.econ.upenn.edu/>)).

AEA PAPERS AND PROCEEDINGS

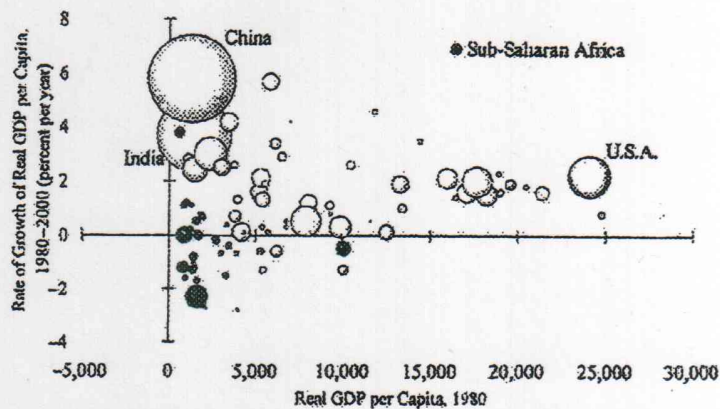
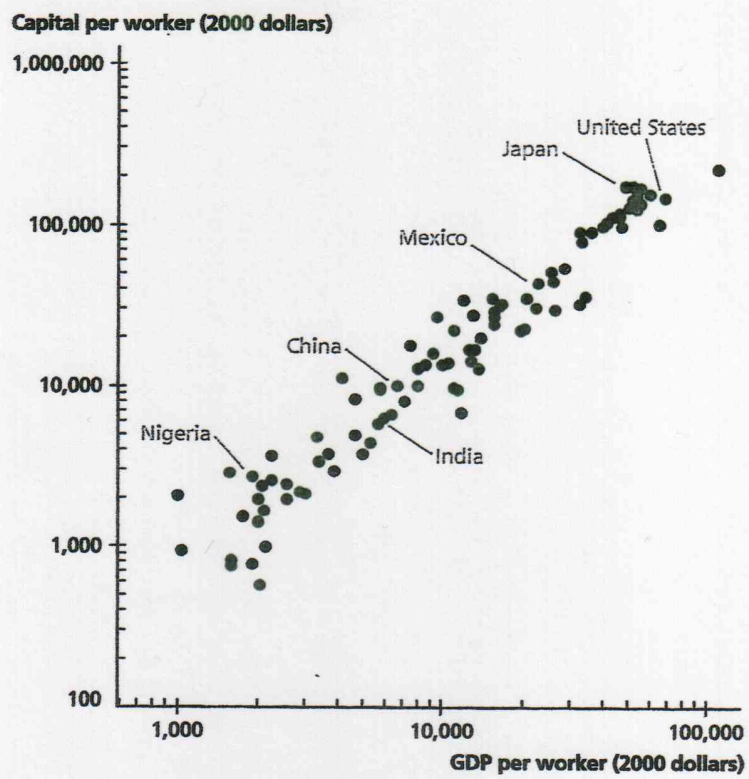


FIGURE 5. AVERAGE ANNUAL GROWTH (1980-2000) ON INITIAL LEVEL OF REAL GDP PER CAPITA (AS IN FIG. 4, BUT WITH AREA PROPORTIONAL TO POPULATION IN 1980)

Note: The data are values for real GDP in U.S. dollars per equivalent adult.

Source: Penn World Tables, version 6.1 (available online: (<http://pwt.econ.upenn.edu/>)).

FIGURE 3.1
GDP and Capital per Worker, 2000



Source: Calculations based on Heston et al. (2002).

Empirically, countries with higher investment rates have higher capital to output ratios:

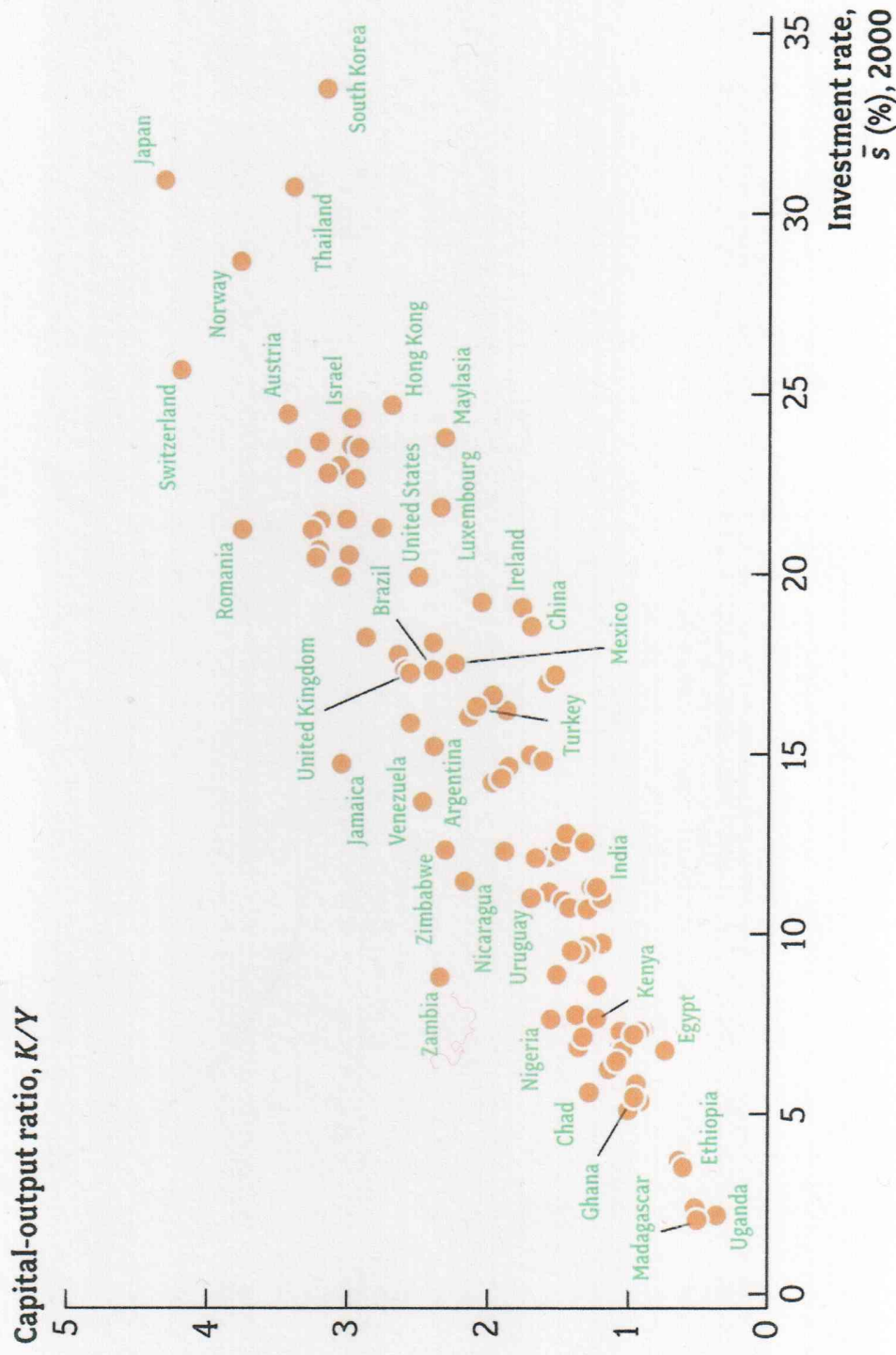


FIGURE 5.3 Explaining Capital in the Solow Model

International Evidence on Investment Rates and Income per Person

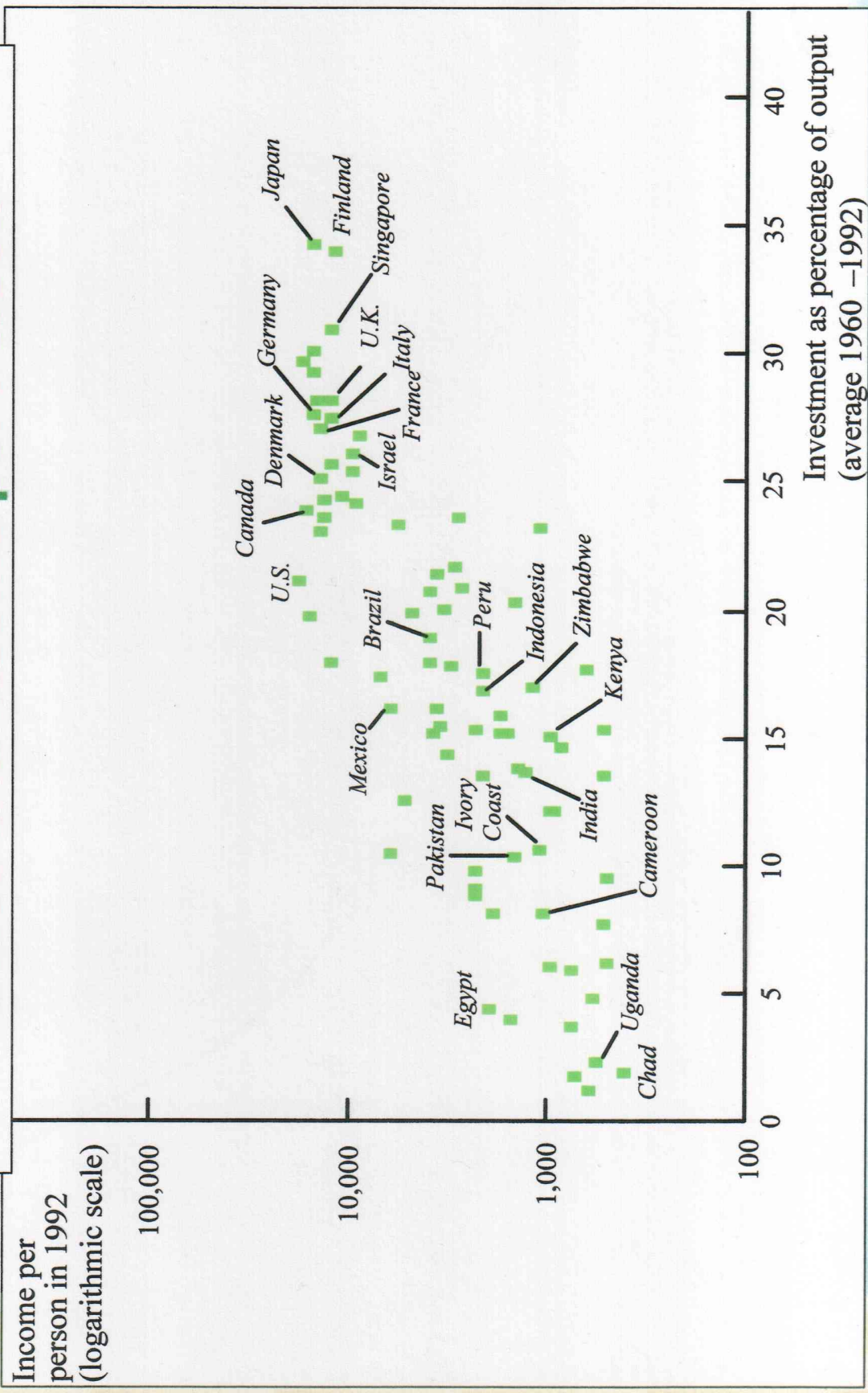


FIGURE 2.3

Relationship Between Latitude and Income per Capita

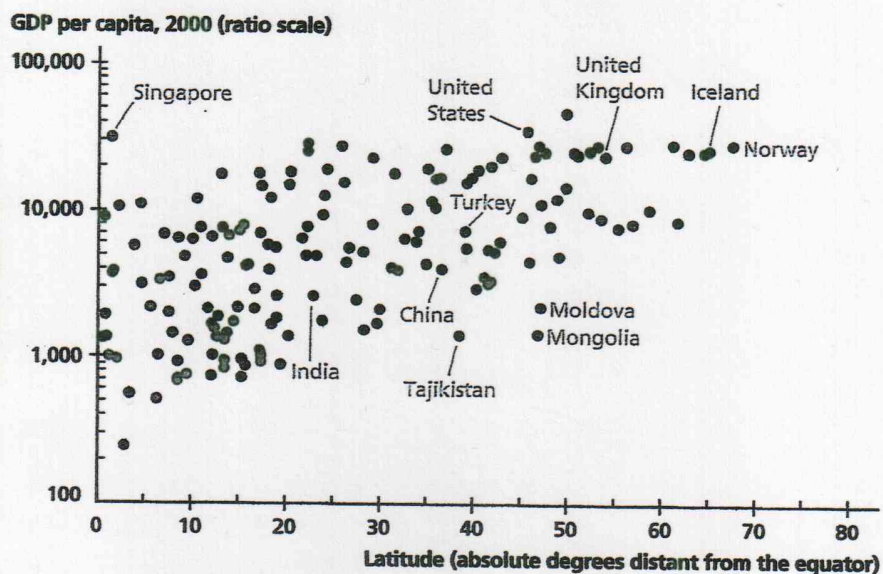


FIGURE 2.4

Relationship Between Income per Capita and Population Growth

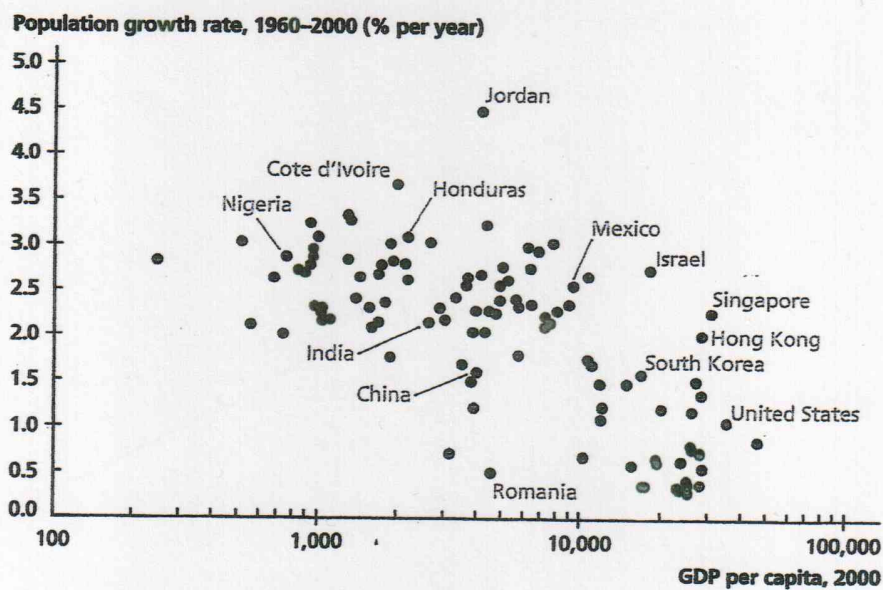
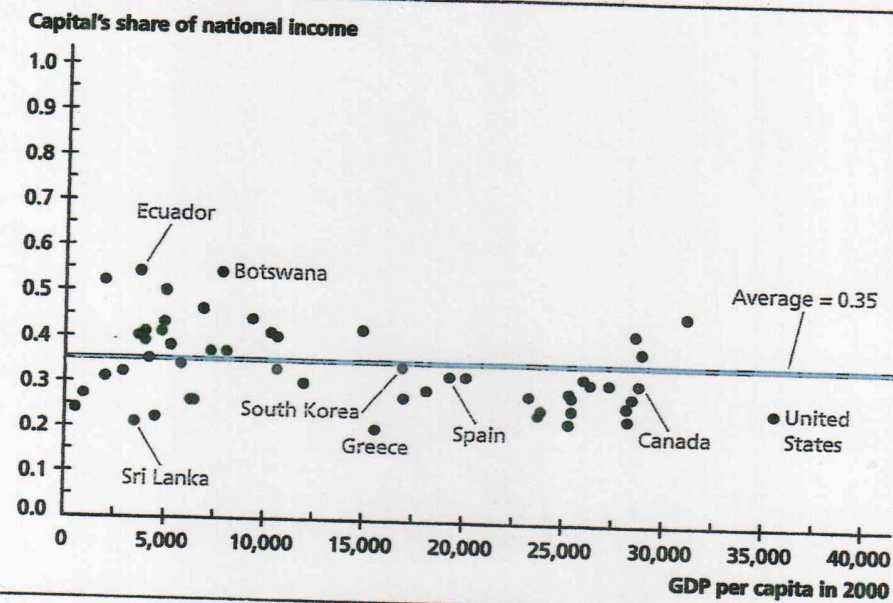


FIGURE 3.3

Capital's Share of Income in a Cross-Section of Countries



Source: Bernanke and Gürkaynak (2002), table 10 and note 18.

Summary of Basic Growth Facts

- 1.) Historically, sustained growth in per capita income is a recent phenomenon. Before 1800, increases in productivity + income were offset by population growth (i.e., the so-called "Malthusian Trap").
- 2.) Since the Industrial Revolution, per capita output has grown over time, and its growth rate does not tend to diminish. If anything, growth has accelerated during the past 100 years.
- 3.) Growth rates and living standards differ substantially across countries.
- 4.) If anything, inequality across countries in per capita incomes has increased over time. However, if countries are weighted by population, there is some recent evidence of convergence.

- 5.) Per capita incomes are positively correlated with latitude, and negatively correlated with population growth.
- 6.) The shares of Labor + Capital in National Income are nearly constant over time, and nearly equal across countries.
- 7.) The Capital/Labor ratio grows over time.
- 8.) Per capita income is positively correlated with capital/labor ratios, both over time and across countries.
- 9.) The rate of return on capital is nearly constant