

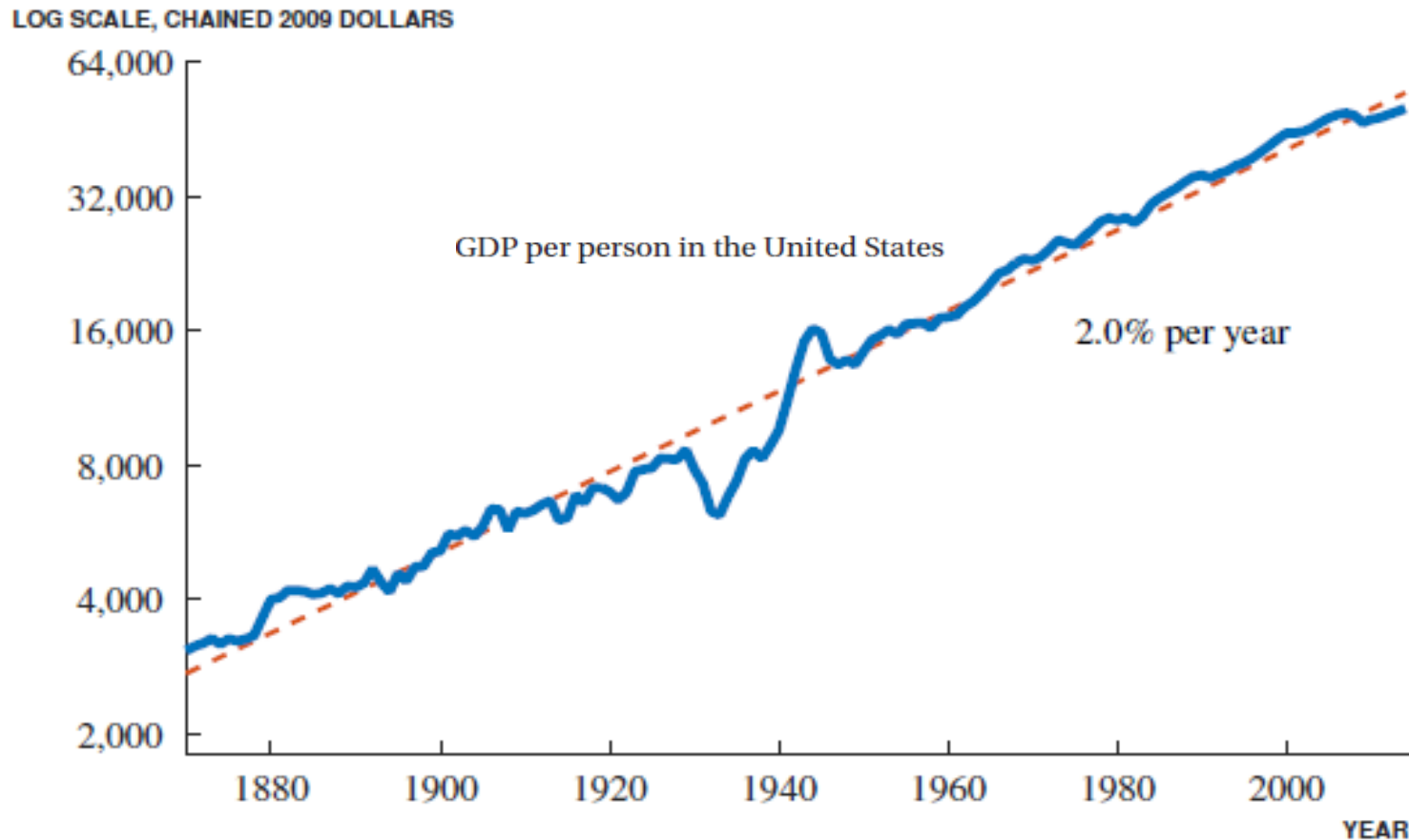
Macro Week 2

A. Economic Growth

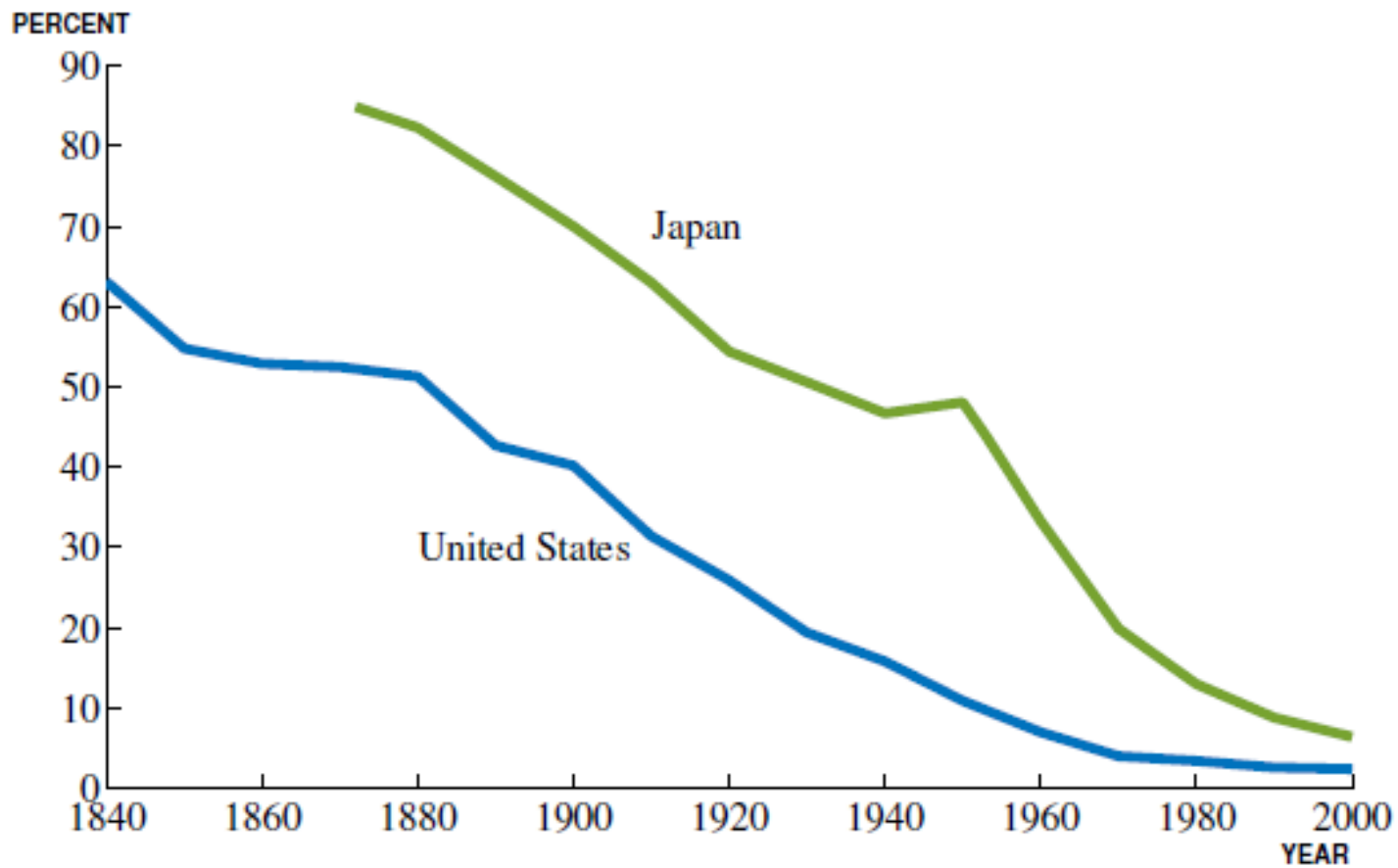
B. Monetary Policy in the Long Run

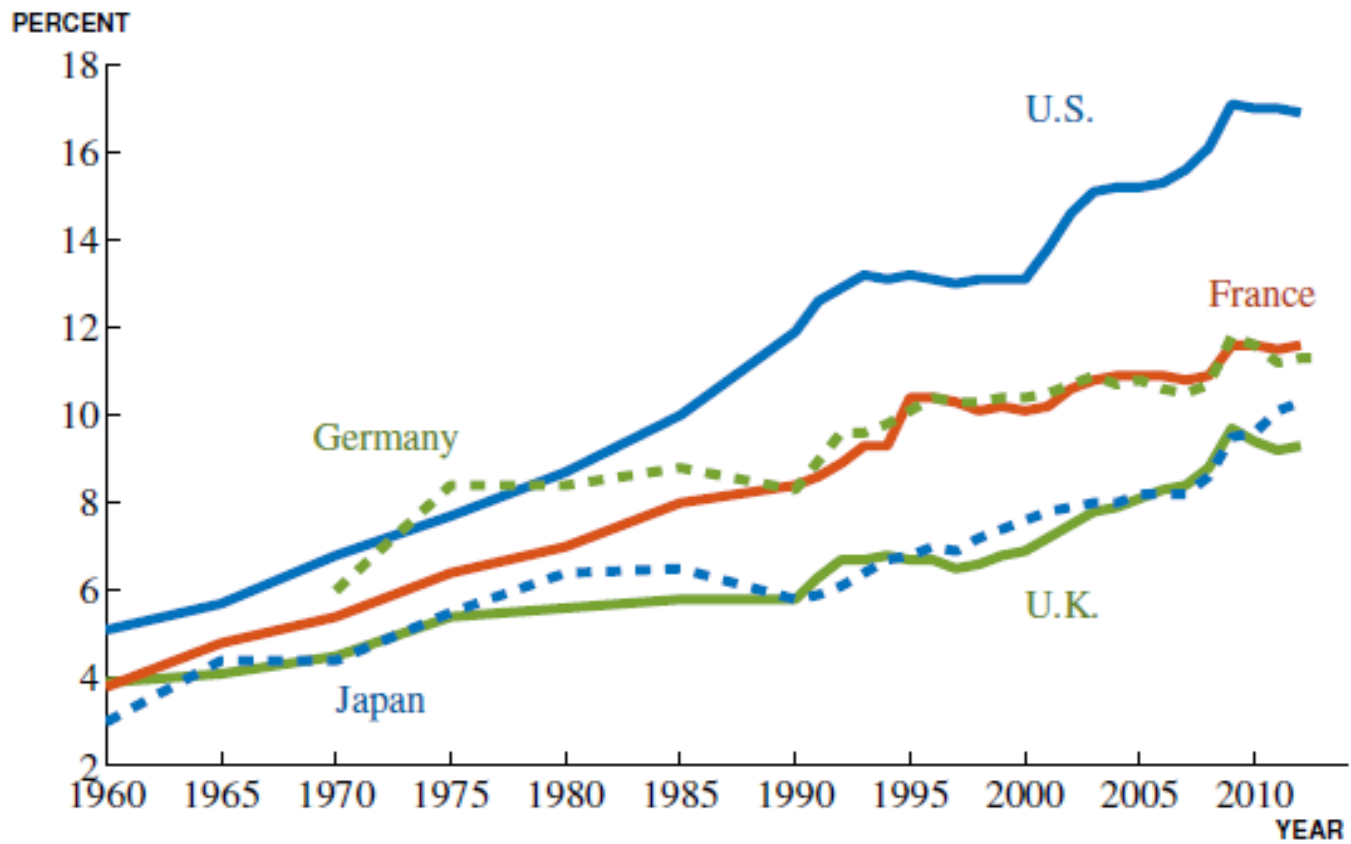
A. ECONOMIC GROWTH

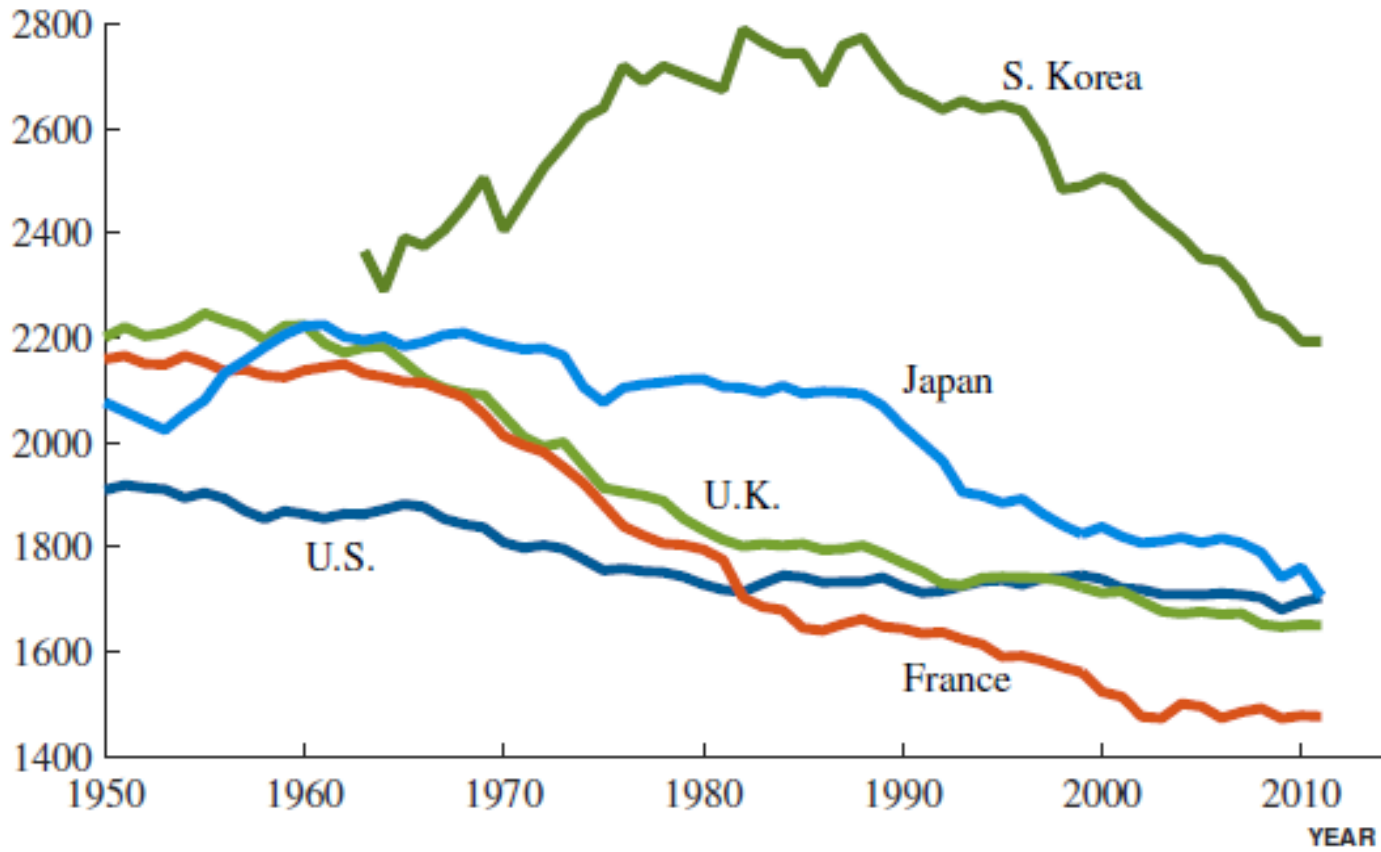
U.S. real income per person (a.k.a. US real GDP per capita)



Note: Data for 1929–2014 are from the U.S. Bureau of Economic Analysis, NIPA Table 7.1. Data before 1929 are spliced from Maddison (2008).







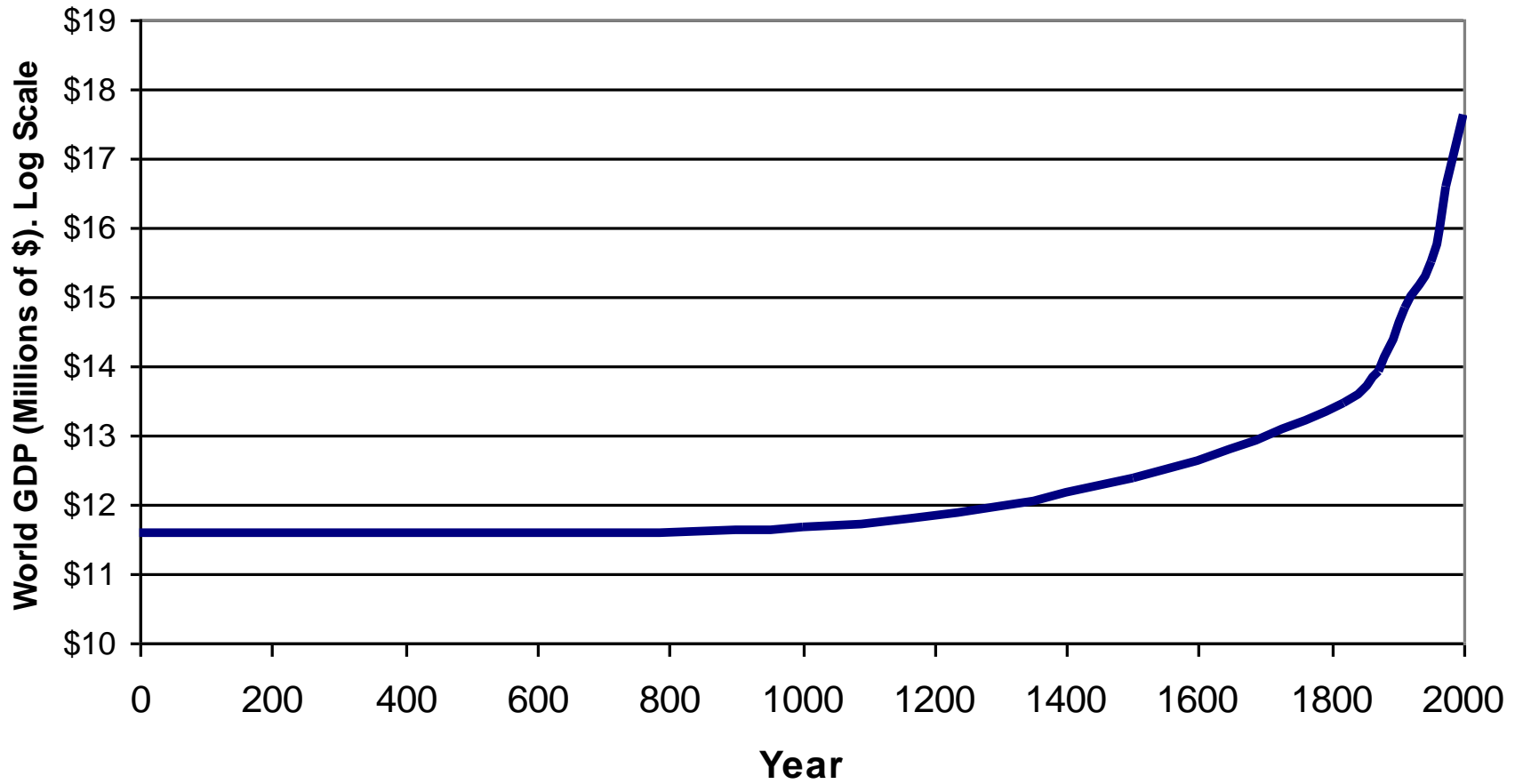
Basic Facts about Income

- It generally goes up – this is called the *trend*
 - Why?
 - But the pace of at which income goes up varies over time, across countries, and across people. Why?
- There are fluctuations around the trend – this is called the *business cycle*
 - When real GDP is above its long-run trend, the economy is said to be in the boom phase of the cycle or in an expansion; when real GDP is below its long-run trend, the economy is experiencing a slowdown or a slump.
 - **Output gap: the difference between real GDP and its long-run trend**

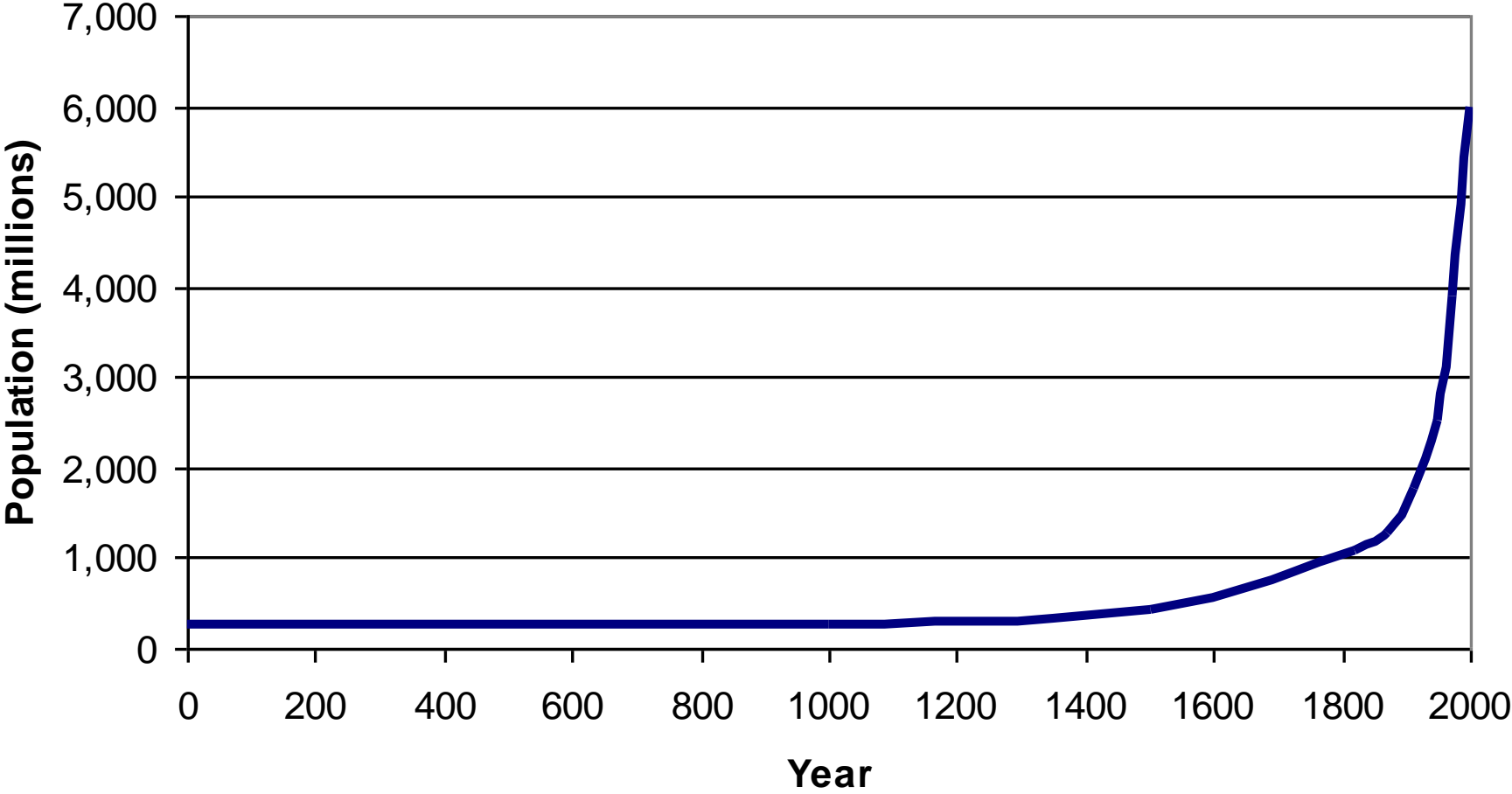
Very Important Warning about Jargon

- To drive you crazy, I will almost surely end up using four words that all mean roughly the same thing: “income” “output,” “production” and “real GDP”.
- Then I will totally drive you up the wall by talking about “growth”: you can assume I’m talking about “growth in incomes (or output or production or real GDP)” rather than spiritual growth.
- “Real GDP per capita” is the nerd’s way of saying “average income”
 - Example: “U.S. real GDP per capita is \$40,000” is like saying “Average income in the U.S. is \$40,000 a year”.

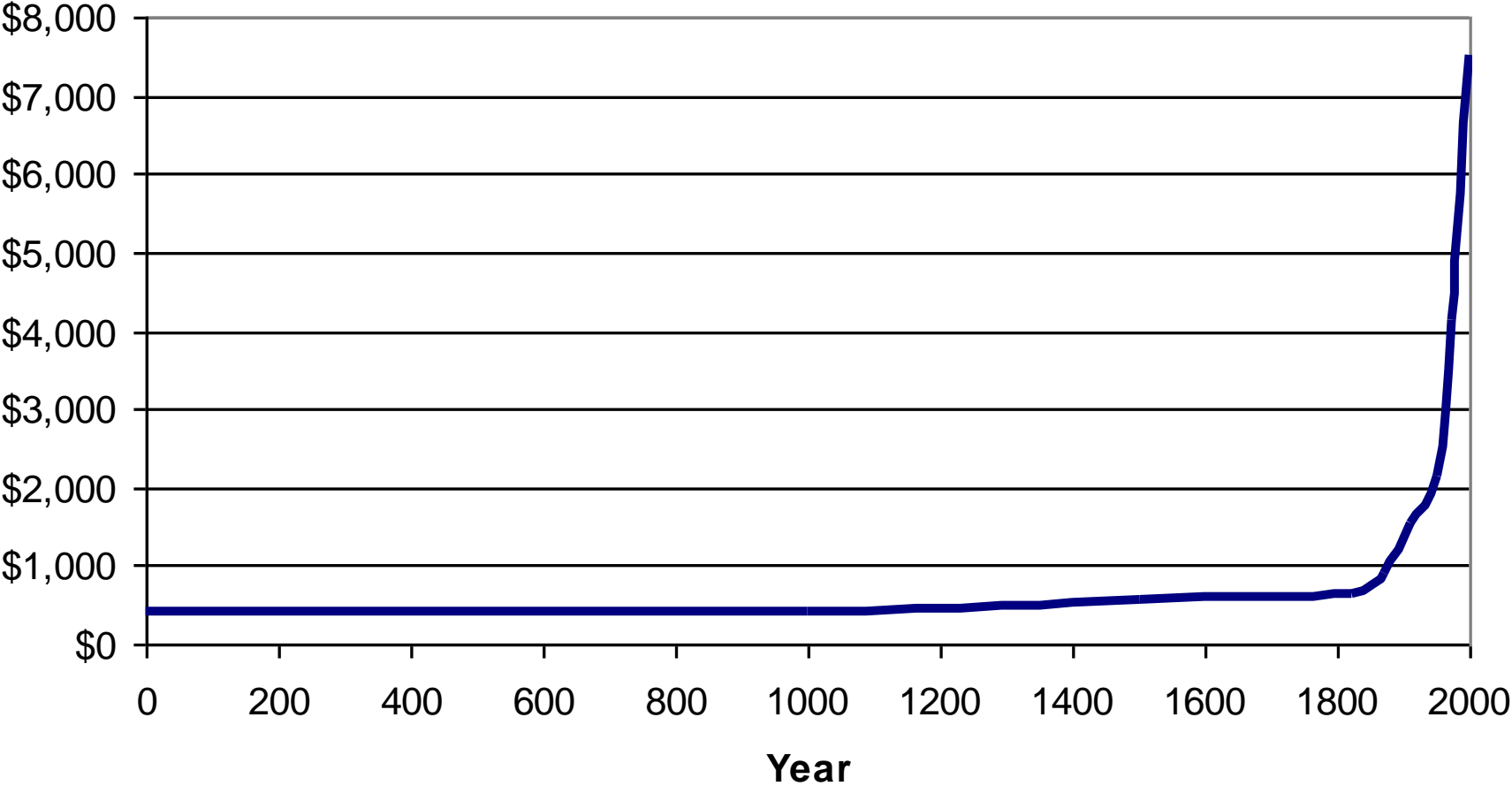
World Aggregate GDP over Time



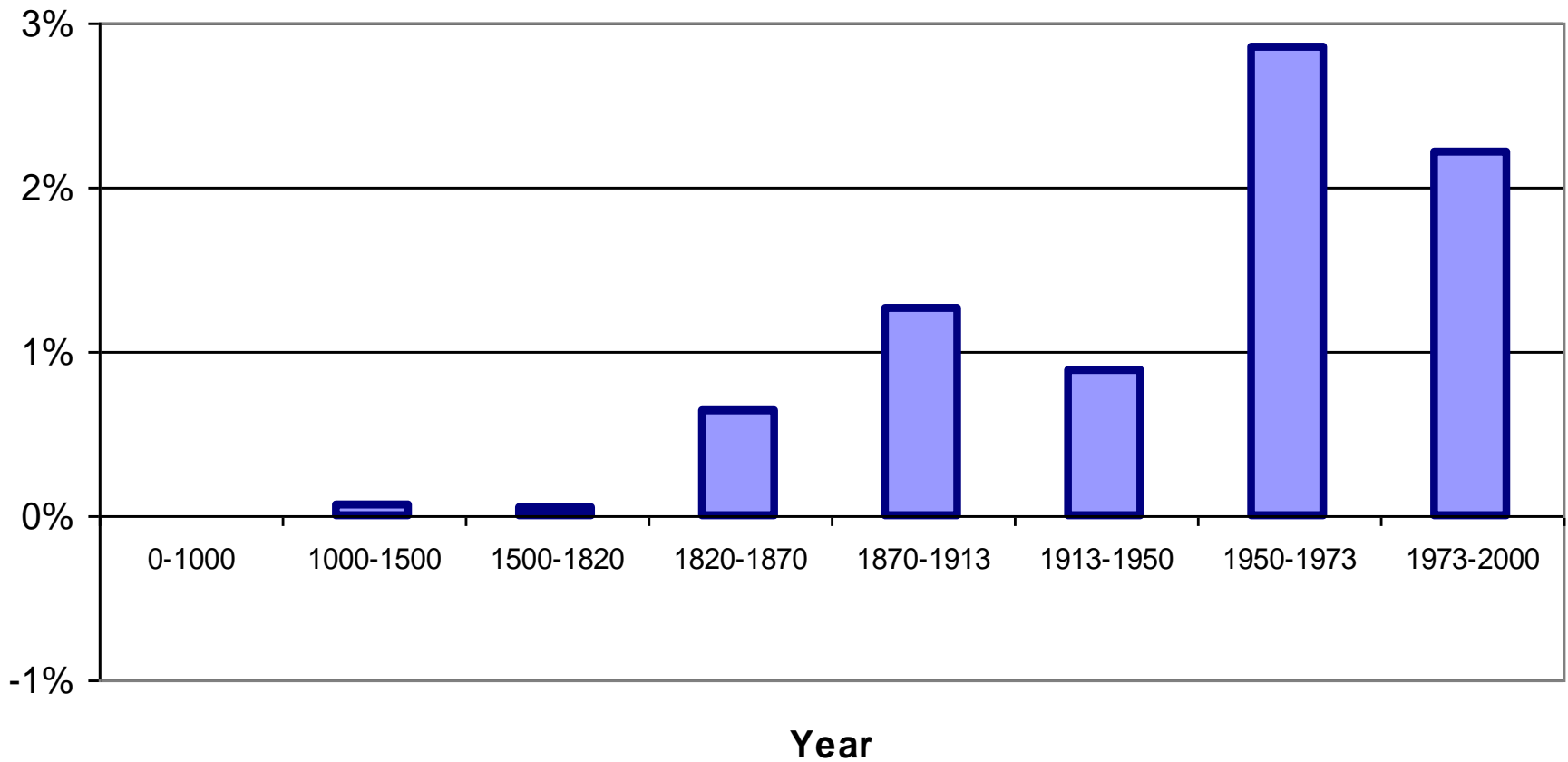
World Population over Time

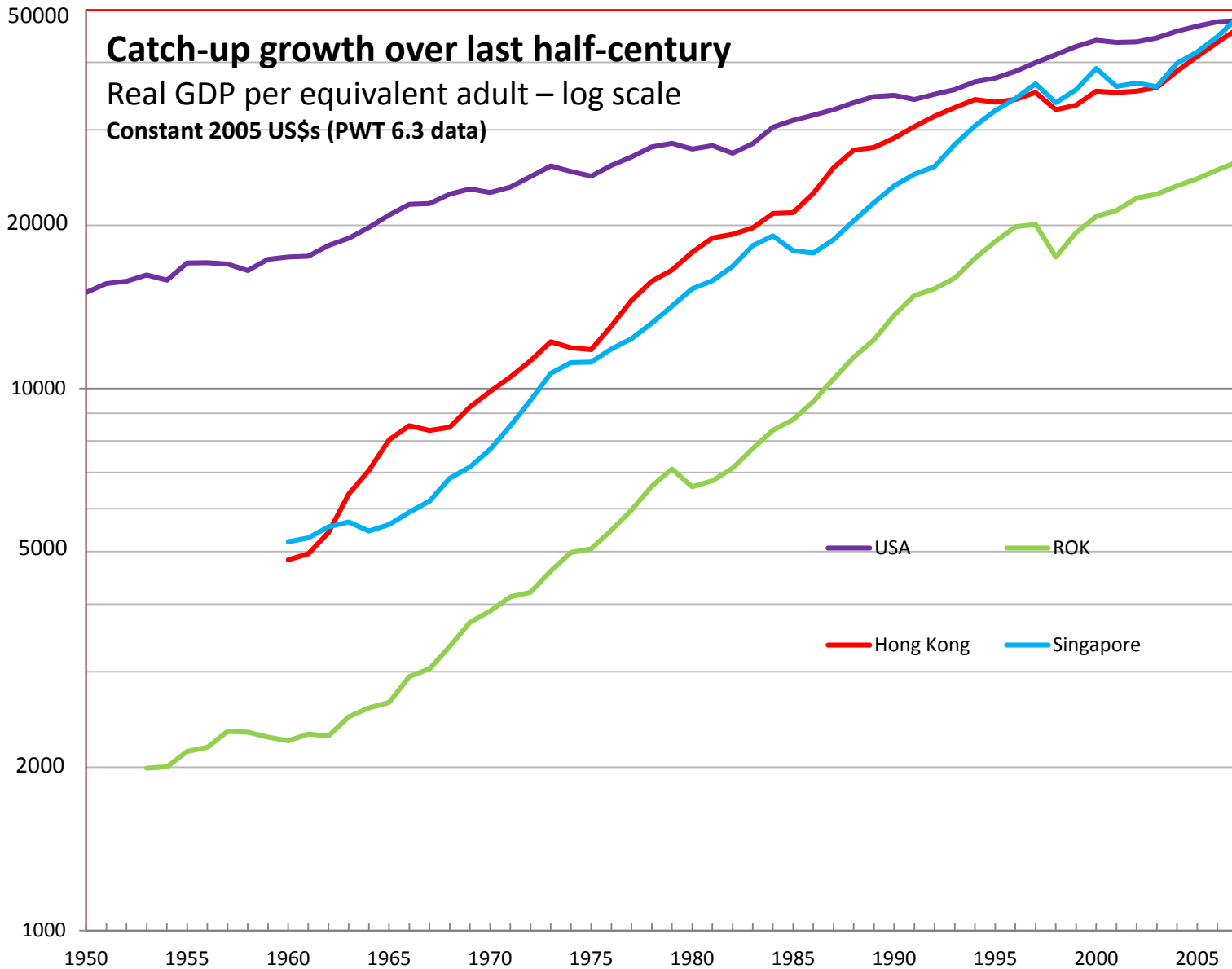


World Per Capita GDP over Time



World Per Capita GDP over Time: Growth Rates





Growth over last half-century in selected countries

Real GDP per equivalent adult – log scale

Constant 2005 US\$ (PWT 6.3 data)

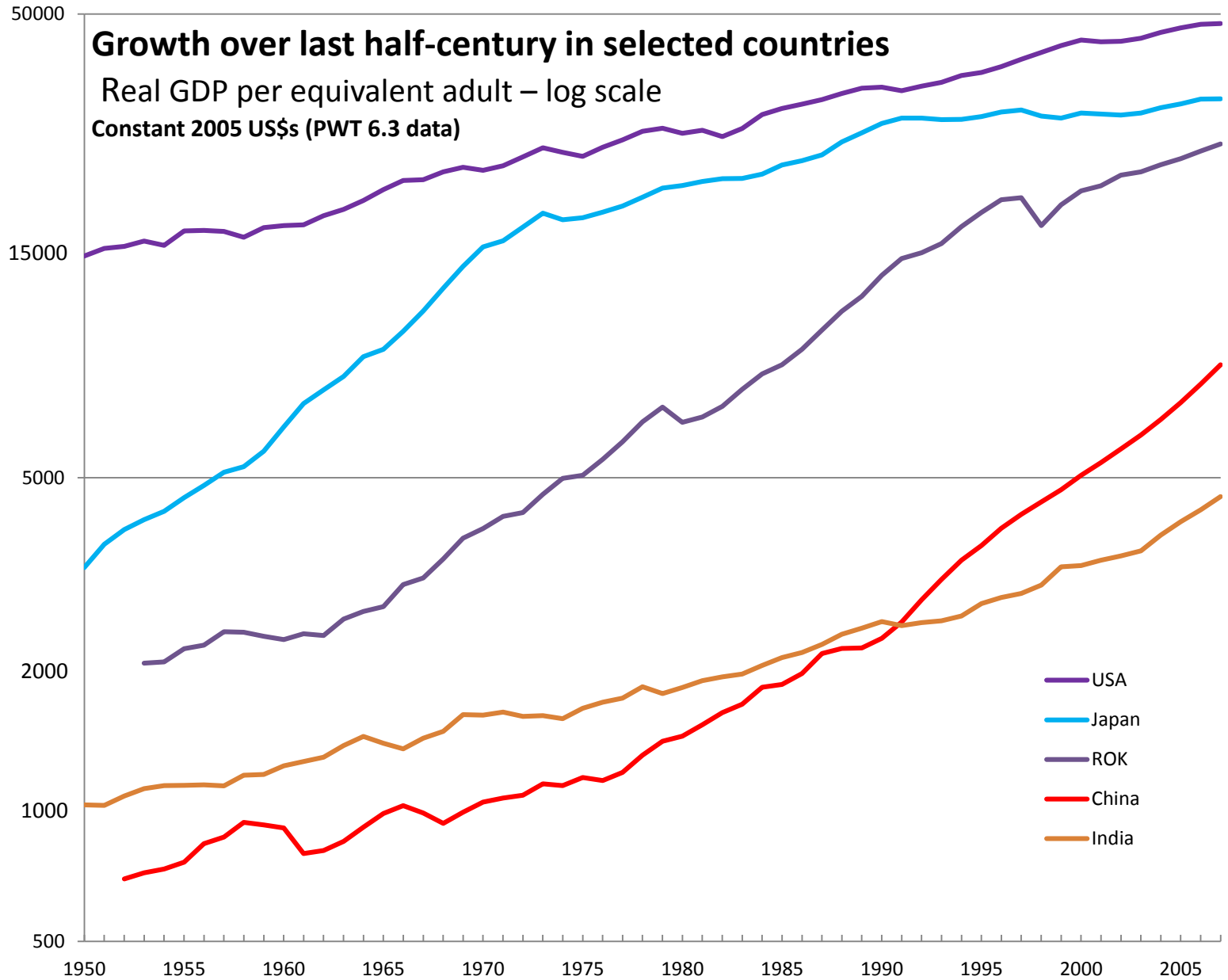


Table 1: Growth Experiences Compared: Ghana, India, and Korea

	1956 Per Capita GDP (in 2000 PPP \$US)	2003 Per Capita GDP (in 2000 PPP \$US)	Average Per Capita Growth 1962-2003
Ghana	1,874	2,114	0.10%
India	900	2,732	2.54%
Korea	1,347	16,977	6.07%

Source: World Development Indicators and Groningen Growth and Development Center

GROWTH ACCOUNTING

Production Function

- Production Function: $Y = A F(K, L)$
In English: Output “depends on” (= “is a function of”) capital input (K) and labor input (L). The extent to which inputs deliver output depends on the level of “technology” (A).
- Growth in Output =
Growth in total factor productivity
+ (share of capital * growth of capital)
+ (share of labor * growth of labor)
- Growth in total factor productivity (TFP) is sometimes referred to as the “Solow residual”

Average Income

- Taking the production function: $Y = A F(K, L)$ and dividing through by L gives Labor productivity as:

$$Y/L = (A/L) f(K/L)$$

- Growth in labor productivity =
growth in TFP per worker
+ growth in capital per worker (also called “capital deepening”)
- Note that labor productivity can also be called ‘income per capita’ or ‘average income’

An illustration: The Cobb-Douglas production function

$$Y_t = A_t \times (K_t)^\alpha (L_t)^{1-\alpha}$$

$$\frac{\Delta Y}{Y_t} = \alpha \frac{\Delta K}{K_t} + (1 - \alpha) \frac{\Delta L}{L_t} + \frac{\Delta A}{A_t}$$

$$\frac{\Delta Y}{Y_t} - \frac{\Delta L}{L_t} = \alpha \left(\frac{\Delta K}{K_t} - \frac{\Delta L}{L_t} \right) + \frac{\Delta A}{A_t}$$

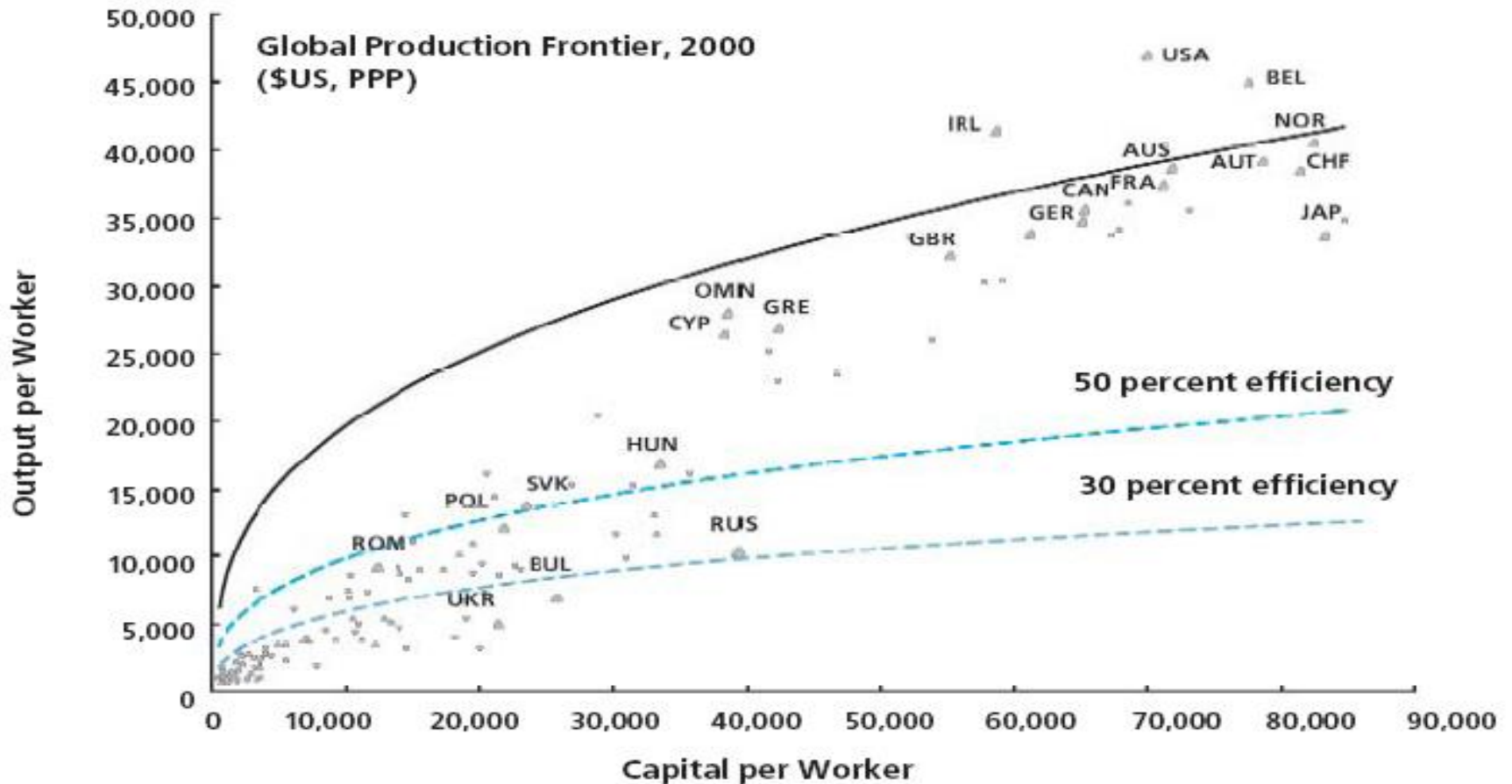
- The first line shows the Cobb-Douglas production function
- The second line is the growth accounting -- for growth in incomes
- The third line is growth accounting – for growth in average incomes

Growth accounting for the U.S., 1948-2000

	Annual Growth Rate of Y	Annual Growth Rate of Y/L	Contribution of K/L	Annual Growth Rate of A
1948-1973	4.0%	3.0%	1.2%	1.8%
1973-1995	2.7%	0.9%	0.8%	0.1%
1995-2000	4.2%	3.0%	1.1%	1.9%

$(\alpha = 0.4)$

Production Function & Role of TFP



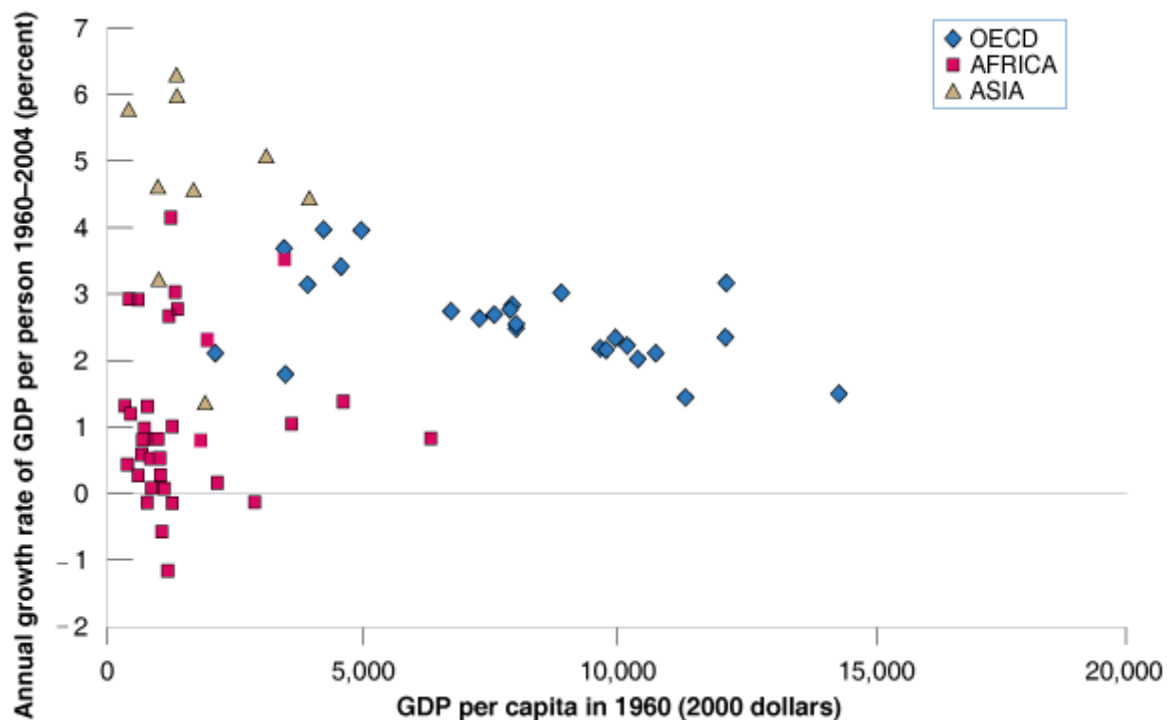
Convergence

(Catch-up)



Growth Rate of GDP per Person since 1960 versus GDP per Person in 1960 (2000 dollars) for 70 Countries

There is no clear relation between per person the growth rate of output since 1960 and the level of output per person in 1960.



A General View of Growth

- $Y = F$ (Policies, Institutions, Geography, Shocks or Something Else)
- Policies
 - Macroeconomic Policies
 - Openness to trade
- Institutions
 - Extent of Rule of Law; Protection of Property Rights; Quality of Bureaucracy
- Geography;
 - Sachs: the “bad latitude” problem; Jared Diamond’s “guns, germs and steel”
- Shocks
 - Terms of trade shocks
 - Political conflict
 - Financial crises
- Something Else
 - Foreign Aid?
 - Resource Curse?
 - Expectations/Motivation?

Sustained high growth in developing economies is a post-World War II phenomenon.

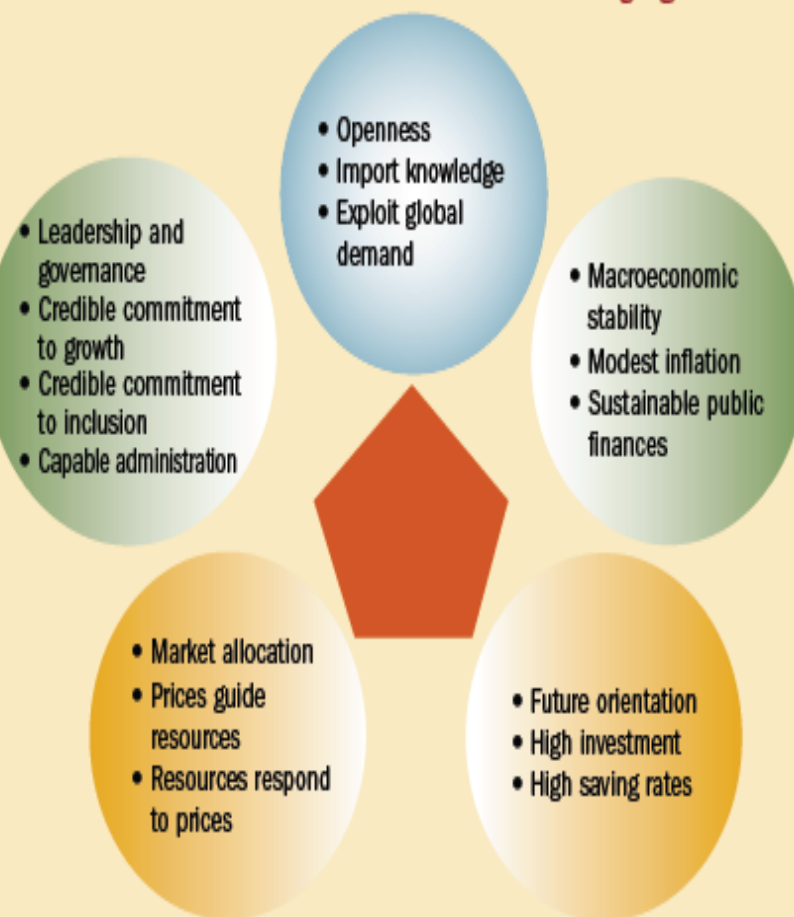
Economy	Period of high growth	Per capita income	
		At start of growth period	2005 ¹
Botswana	1960-2005	210	3,800
Brazil	1950-1980	960	4,000
China	1961-2005	105	1,400
Hong Kong SAR	1960-1997	3,100	29,900
Indonesia	1966-1997	200	900
Japan	1950-1983	3,500	39,600
Korea	1960-2001	1,100	13,200
Malaysia	1967-1997	790	4,400
Malta	1963-1994	1,100	9,600
Oman	1960-1999	950	9,000
Singapore	1967-2002	2,200	25,400
Taiwan Province of China	1965-2002	1,500	16,400
Thailand	1960-1997	330	2,400

Source: World Bank, *World Development Indicators 2007*.

Note: A 7 percent cutoff was chosen because growth at these rates produces very substantial changes in incomes and wealth: income doubles every decade at 7 percent.

¹In constant 2000 U.S. dollars.

The five common characteristics of sustained high growth

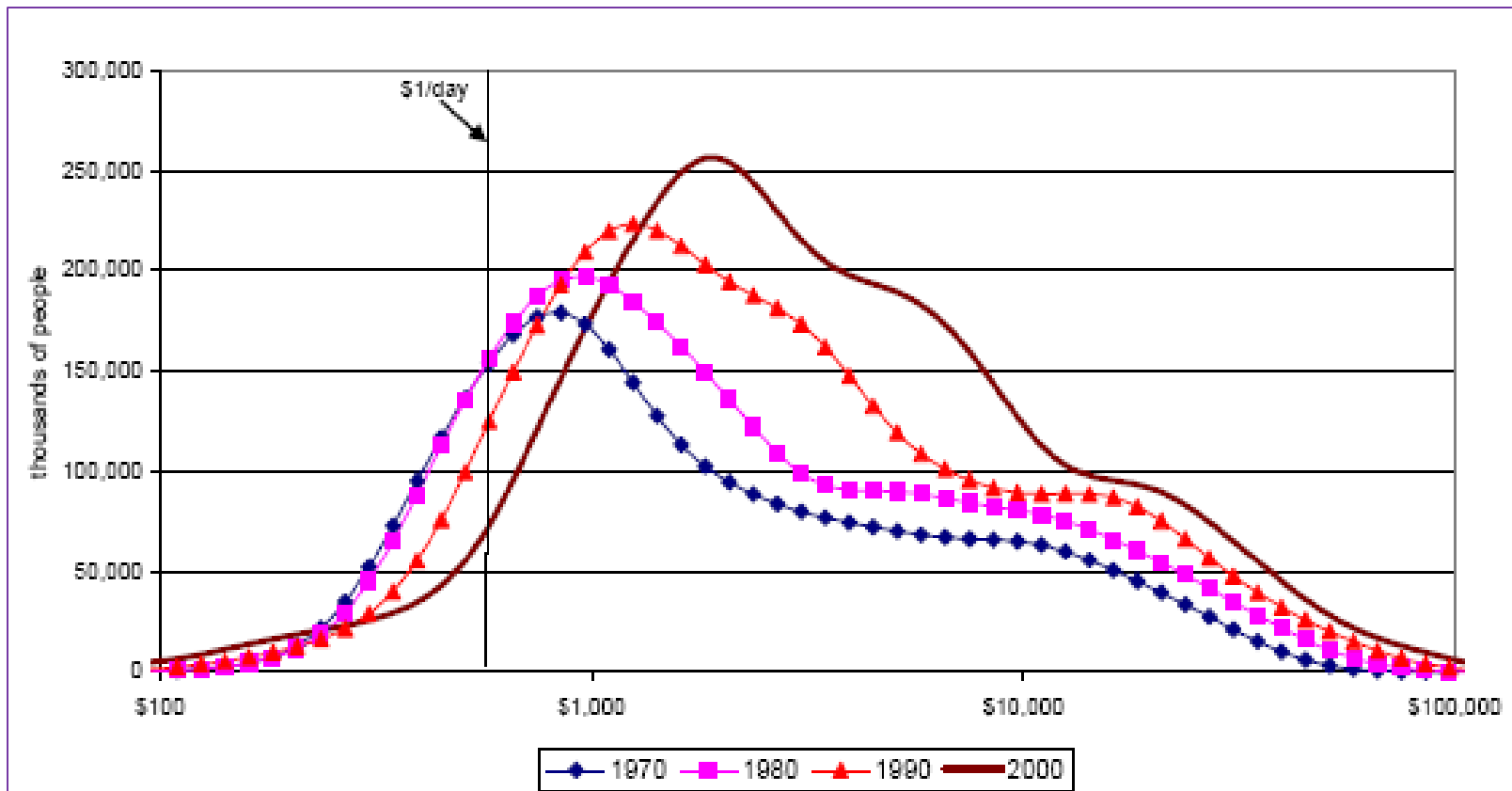


DISTRIBUTION OF INCOME (INEQUALITY)

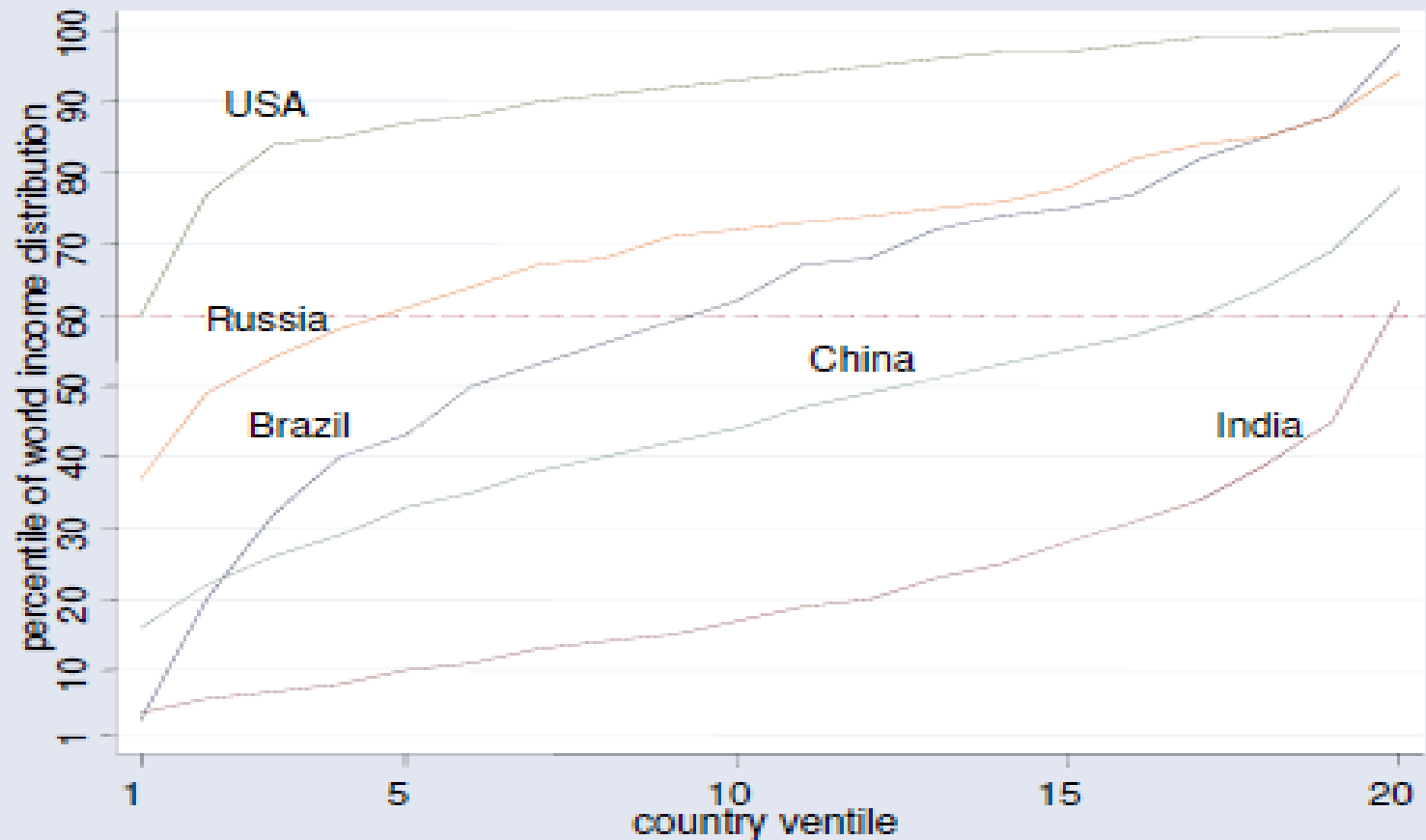
Basic Facts About Income Inequality

Concept of income inequality	Cross-country inequality	Within-country inequality	Global inequality
What it measures	Inequality of <i>average</i> incomes across countries	Differences between incomes of the rich and the poor within a country	Differences between incomes of the rich and the poor, ignoring the country to which they belong
What the evidence shows	Divergence	Increasing inequality in many countries (for example, Brazil, China, United States), but low and stable levels in many others (for example, Canada, France, Japan)	Convergence

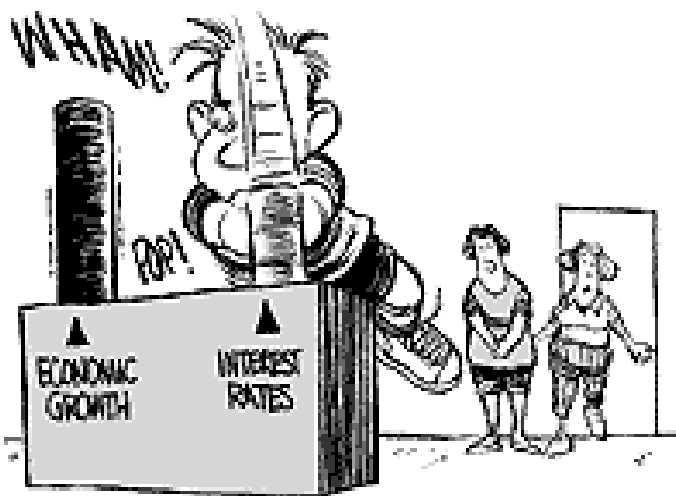
Evolution of the World Distribution of Income



Inequality and Poverty



B. MONETARY POLICY IN THE LONG RUN



When the Fed Wants to “Loosen”



Fed buys
T-bills
from
banks

Fed pays
for the T-
bills by
writing a
cheque:
**injecting
liquidity**

**Banks now
have more
cash** than
they want to
hold

Banks that
want to
borrow from
other banks
can do so at
a **lower fed
funds rate**

***money is
cheap***

Fed injects
liquidity
until **fed
funds rate**
has fallen to
the Fed's
set "**target**"

Three ways for the government to finance spending

Three ways to finance G

- Taxation
- Borrowing
- Inflation

Hyperinflation

What is it?

- $\pi \geq 50\%$ per month

What causes it?

- Excessive money supply growth.

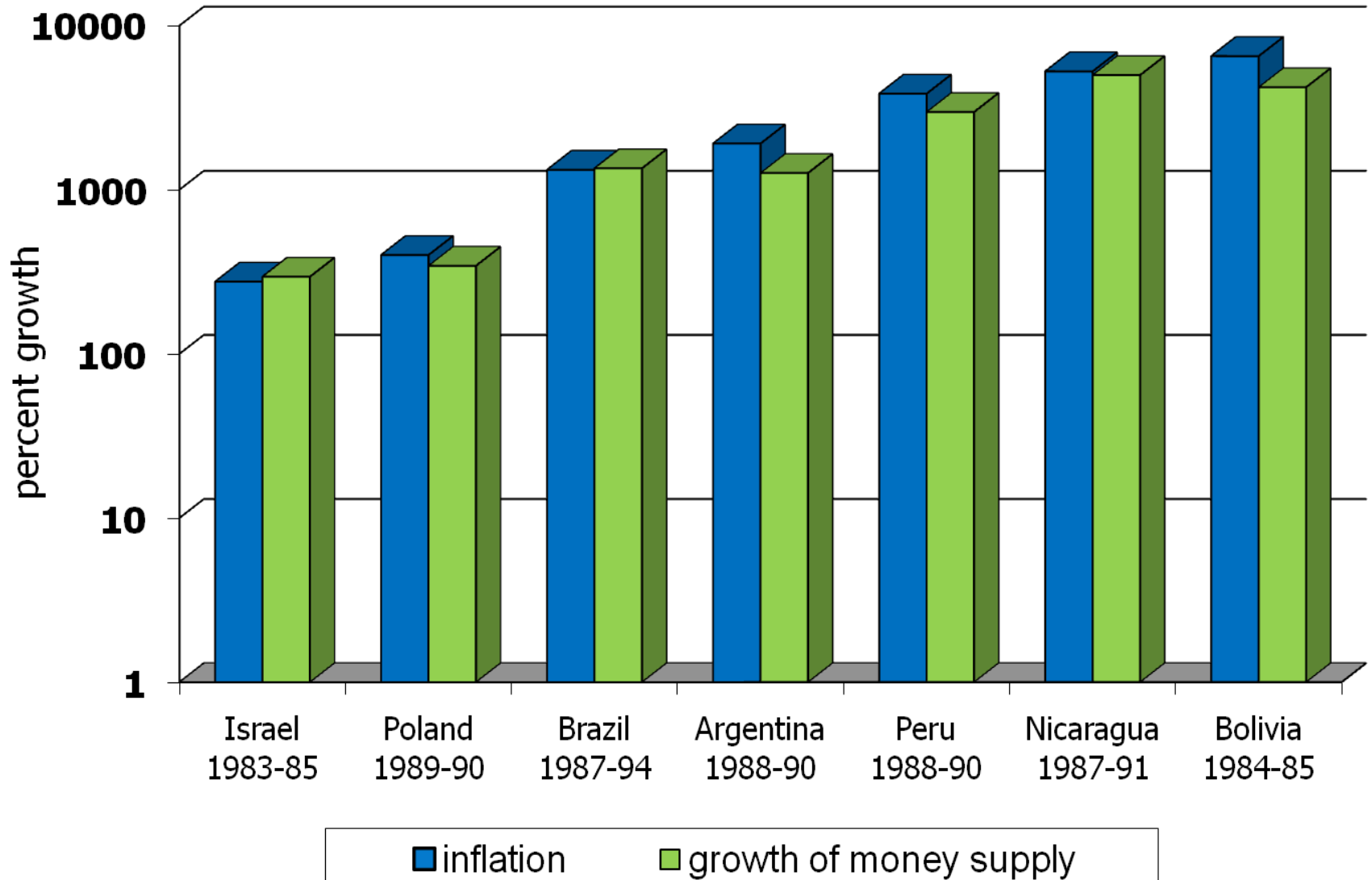
Does that work?

- Only for a short time.
- Because money ceases to function as a store of value, and may not serve its other functions (unit of account, medium of exchange), people start conducting transactions with barter or a stable foreign currency.
- Because people are no longer willing to subject themselves to the “inflation tax,” it ceases to be a source of revenue for the government.

How is it stopped?

- Proximate step: **stop printing money.**
- At a more fundamental level: it requires a credible announcement of government fiscal reform (i.e. cuts in government spending, increases in tax revenue, new sources of borrowing or some combination of all three) and follow-through.

Episodes of Hyperinflation



High Inflation

Seven Hyperinflations of the 1920s and 1940s

Country	Beginning	End	P_T/P_0	Average Monthly Inflation Rate (%)	Average Monthly Money Growth (%)
Austria	Oct. 1921	Aug. 1922	70	47	31
Germany	Aug. 1922	Nov. 1923	1.0×10^{10}	322	314
Greece	Nov. 1943	Nov. 1944	4.7×10^6	365	220
Hungary 1	Mar. 1923	Feb. 1924	44	46	33
Hungary 2	Aug. 1945	Jul. 1946	3.8×10^{27}	19,800	12,200
Poland	Jan. 1923	Jan. 1924	699	82	72
Russia	Dec. 1921	Jan. 1924	1.2×10^5	57	49

P_T/P_0 is the price level in the last month of hyperinflation divided by the price level in the first month.

The Quantity Theory of Money

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

Key	
π	inflation rate
$\Delta M/M$	growth rate of money supply
$\Delta Y/Y$	growth rate of output (real GDP)

Normal economic growth requires a certain amount of money supply growth to facilitate growth in transactions. Money growth in excess of this amount leads to **inflation**.

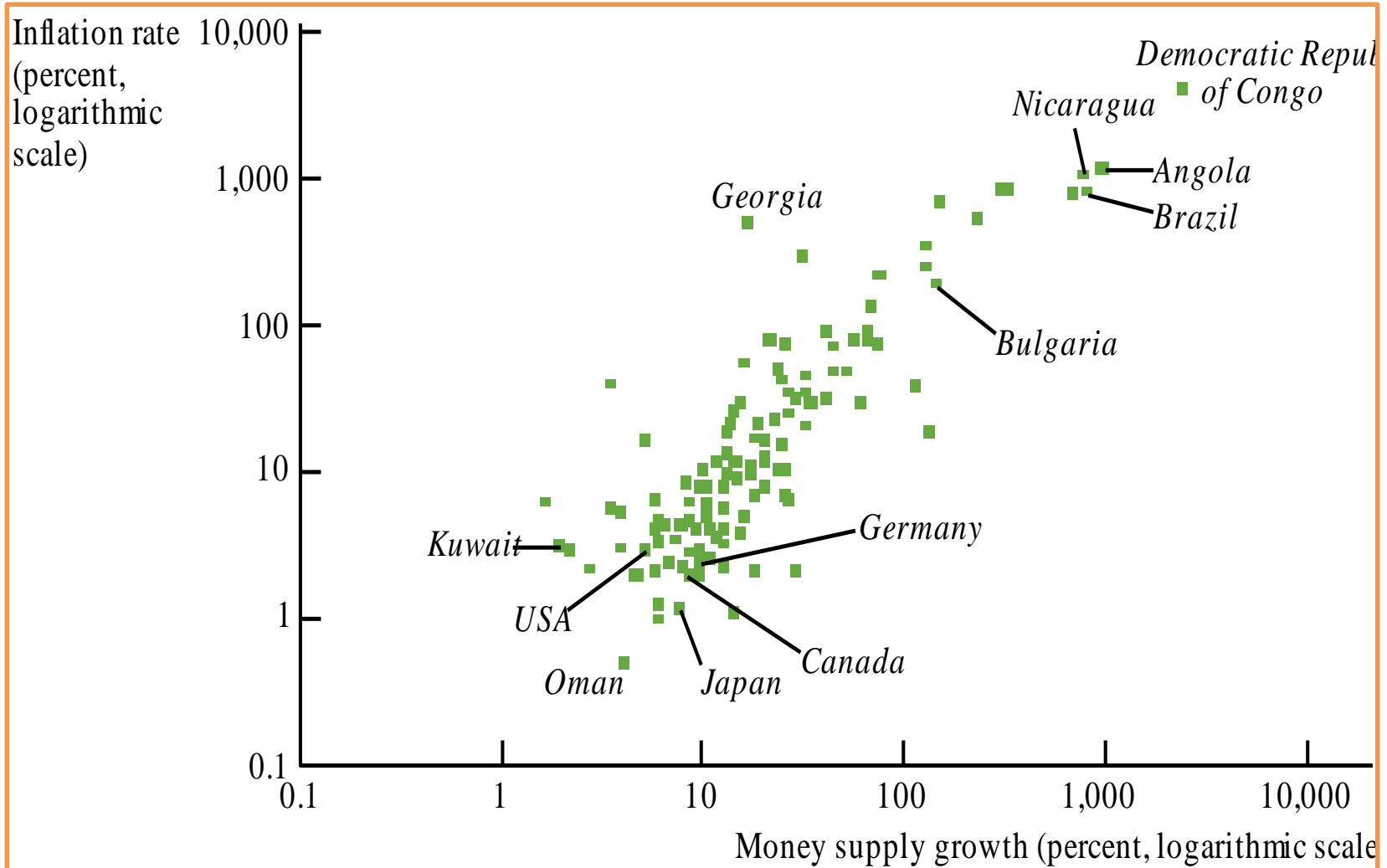
Inflation is “too much money chasing too few goods”

[Note: we’re simplifying by assuming that the ‘velocity of money’ is constant.]

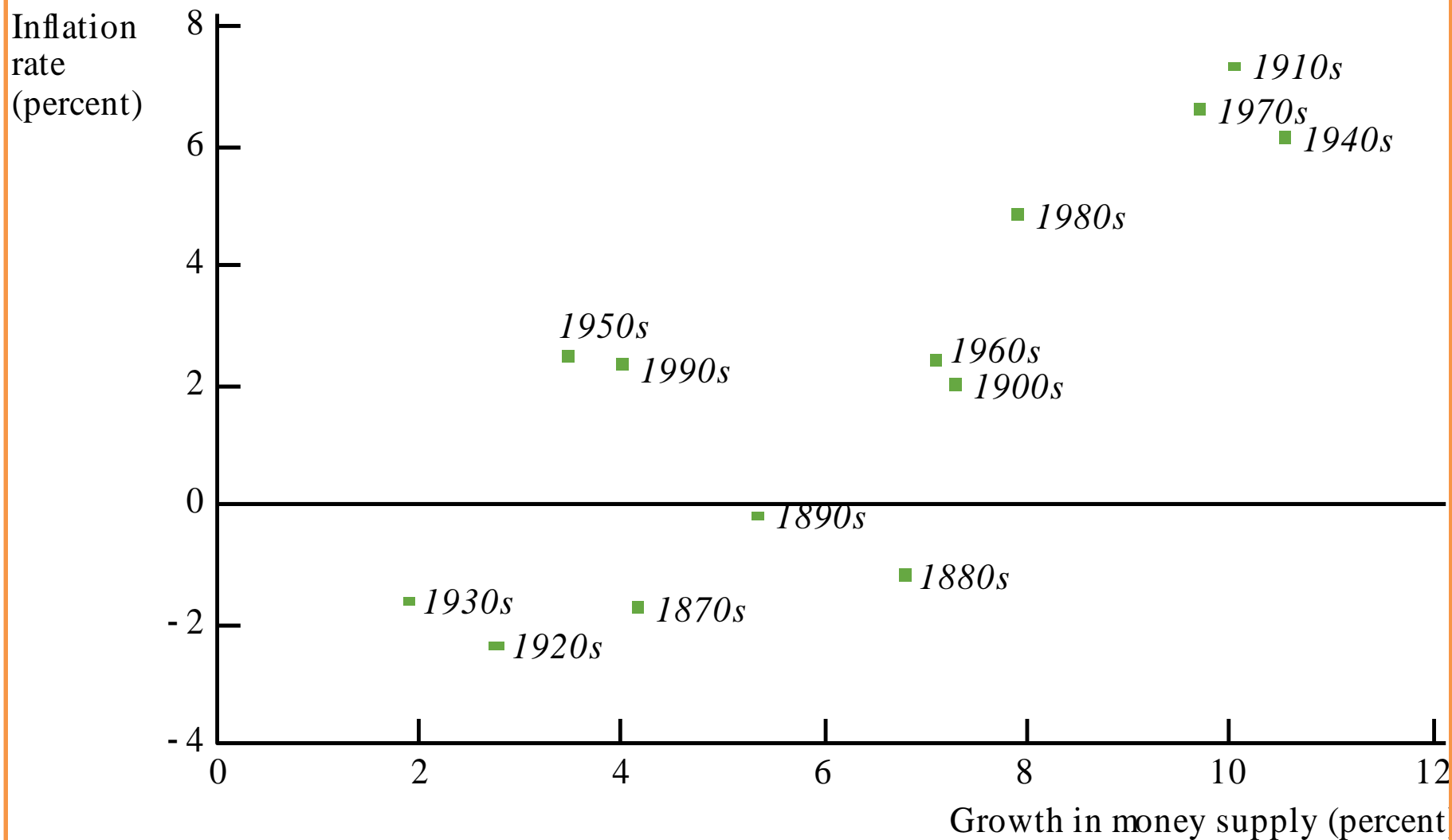
In the **long-run**, $\Delta Y/Y$ (growth rate of real GDP) depends on growth in the factors of production and on technological progress.

Hence, the Quantity Theory of Money predicts a long-run **one-for-one relation** between **changes in the money growth rate** and **changes in the inflation rate**.

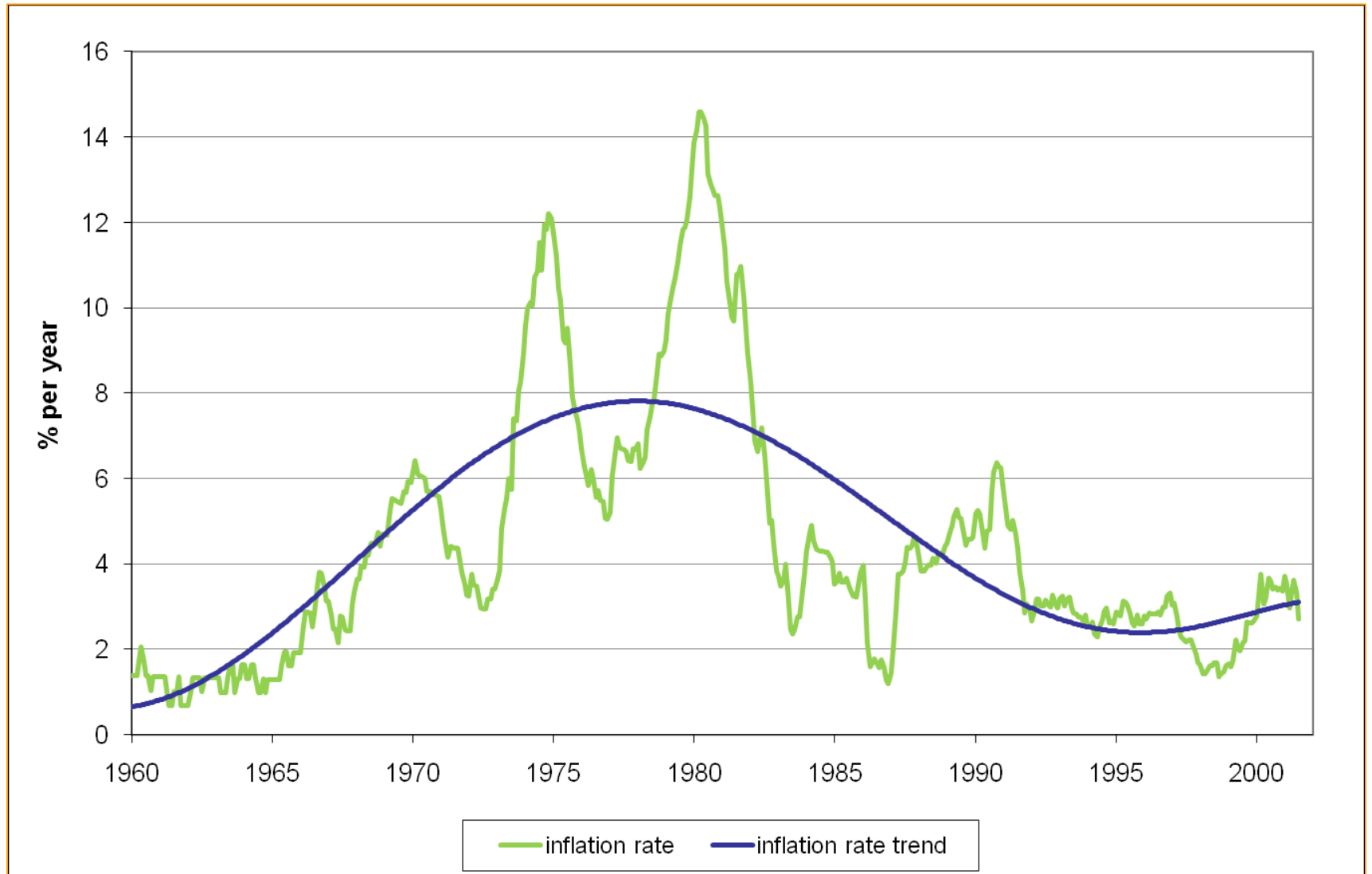
International Data on Inflation & Money Growth



U.S. data on inflation and money growth, decade averages



U.S. Inflation & its Trend



Transition from Short Run to Long Run (1)

- Interest rates and money supply
 - Raising policy interest rates is similar to curbing growth of money supply.
 - Lowering policy interest rates is similar to raising the growth rate of the money supply.
- In the short run, the central bank lowers policy interest rates (i.e. raises the growth rate of the money supply) to stimulate the economy (bring output back to trend; close the output gap)
- But we just learnt that raising the growth rate of the money supply raises inflation. So isn't it a bad idea for the central bank to lower the policy interest rate? Answer: it depends.

Transition from Short Run to Long Run (2)

- ‘Good’ scenario:
 - Central bank has lowered rates because the economy is in a slump (output gap is large). In this case, inflation may not go up much; plus, some stimulus can be justified even if inflation does go up a bit
 - The central bank has credibility, that is, people expect it to keep its (medium- to long-run) inflation target. This means that people expect that interest rates will be raised back to neutral once the output gap has closed. Hence, inflation expectations remain anchored.

Transition from Short Run to Long Run (3)

- 'Bad' scenario(s):
 - Wrong reasons: Central bank has lowered rates even though the economy is not in a slump (output gap is zero). Or, the central bank may have made a mistake about the size of the output gap. In these cases, inflation may go up (and the stimulus cannot be justified on the grounds that it is helping the economy recover from a slump)
 - Right reasons, poor credibility: Central bank may have lowered rates for the right reasons (economy is indeed in a slump) but it has poor credibility. That is, people expect it will not keep to (or have difficulty keeping to) its medium- to long-run inflation target. This means that people expect that interest rates will not be raised back to neutral once the output gap has closed. Hence, inflation expectations can get unanchored.
 - Wrong reasons, poor credibility: Worse case scenario – inflation may kick up because central bank has intervened at the right time; and problem is compounded as inflation expectations get unanchored.