

Data and Questions of Macroeconomics

Key Macroeconomic Variables

- National Income
- Unemployment
- Inflation
- Stock market index
- Interest rates
- Exchange rates
- Government budget balance
- Trade balance

For each of these questions we want to address the following questions:

- What would we like these variables to measure?
- How, in fact, are they measured?
- How have they performed historically?
- Why do we care about these data?

For now, we will look at just the first three.

National Income

- **What would we like it to measure?**

Our standard of living

- **How, in fact, is it measured?**

Bureau of Economic Analysis is responsible for construction and maintenance of **national income and product accounts (NIPA)**.

Measurement began in the 1930s due to frustration of Roosevelt and Hoover trying to design policies to combat the Great Depression. Simon Kuznets (Nobel laureate) was commissioned to develop initial methodology and estimates. In 1947, the process became much more consistent.

Methodologies have frequently been changed (improved?) as a result of advances in economics, accounting, and data collection. Past data are then revised to reflect new definitions.

- There are two main measures of national income:

Gross domestic product (GDP) and Gross national product (GNP)

GDP is an attempt to measure production in the country

GNP is an attempt to measure income accruing to a country's residents.

Relation of GNP to GDP in the US, 1990

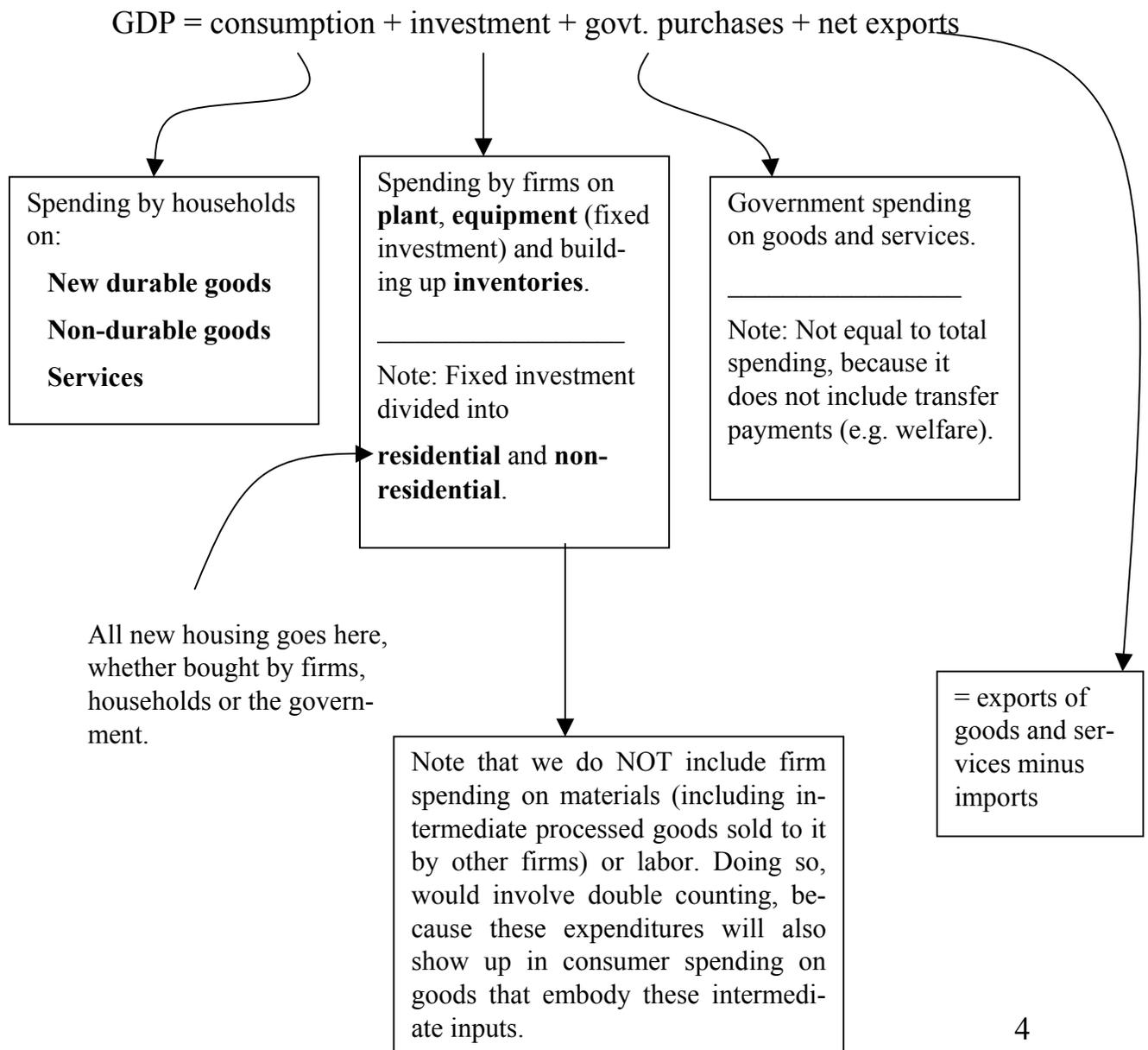
GNP	\$5,465 bn
Minus Income earned by citizens from work conducted or capital owned abroad	\$137.4 bn
Plus: Income earned by non-citizens from work conducted or capital owned in the U.S.	\$95.7 bn
= GDP	\$5,423 bn

Notes:

1. Data quality for GDP are better.
2. Difference between GDP and GNP is small, ~1% for the US. However, the difference can be bigger for other countries, especially small ones.

- The BEA collects data from numerous sources: IRS, surveys, customs, etc.
- Using these data, there are three ways to construct GDP data:
 1. The expenditure method.
 2. Income method.
 3. Value added method.

The expenditure method



The income method

The method attempts to add up the net income of all employees and business, before taxes.

Composition of National Income, 1995, \$ billions

Wages and salaries	4,209	} labor's share, 73%
Owner's income	478	} Profit's share, 27%
Rental income	122	
Corporate profits	589	
Net interest earned	401	
National Income	5,799	

↑

These shares are quite stable over time.

Value added method

- The value added by a firm is the difference between the revenue a firm earns by selling its products and the amount it pays for the products of other firms it uses as intermediate goods.
 - *Example:* A firm buys \$1,000 of wheat, mills and bakes it using \$1,000 of labor. The firm sells the bread for \$2,500, making \$500 profit. The value added is \$1,500.
-

- The details of how the government calculates these measures of national income are pretty tedious.
- In theory all three measures should give the same value for GDP. But in practice they can differ because of methodological complications (e.g. the treatment of taxes) and problems with data collection (e.g. some activity is not observed because of tax evasion). This can create difficulties for governments trying to work out the state of the economy, and therefore the sorts of policies they should implement.

(online reading: "Statistical Discrepancies in GDP")

- The important feature of the measures is that they avoid double counting.
 - Q.** If I buy a computer in Pittsburgh for \$3,000, and sell it to my cousin in Arkansas for \$10,000, what is the contribution to national income?
 - A.** \$10,000, consisting of \$3,000 of computer equipment, and \$7,000 transportation services.

Real versus Nominal GDP

- To add apples to oranges we need a common unit: their value works quite nicely.
- In practice, the BEA collects data on total revenues for each type of good, surveys the prices of those goods, and then infers the quantities produced from these data.

So GDP is estimated by

$$(1) \quad Y = p_A y_A + p_B y_B,$$

but both quantities are inferred from

$$(2) \quad y_A = \frac{R_A}{p_A}, \quad y_B = \frac{R_B}{p_B}.$$

price of good B

quantity of good B

revenues: total value of sales of good B

Note what equation (1) means for the growth rate of income. Differentiate (1) with respect to time:

$$\dot{Y} = \dot{p}_A y_A + p_A \dot{y}_A + \dot{p}_B y_B + p_B \dot{y}_B.$$

$$\dot{x} = \frac{dx}{dt}$$

We can write this as a growth rate:

$$\frac{\dot{Y}}{Y} = \frac{(\dot{p}_A y_A + p_A \dot{y}_A) + (\dot{p}_B y_B + p_B \dot{y}_B)}{p_A y_A + p_B y_B},$$

Denominator is total revenue, $R_A + R_B$.

which, in turn, can be written in the following form:

$$\frac{\dot{Y}}{Y} = \left\{ \frac{R_A}{R_A + R_B} \left(\frac{\dot{p}_A}{p_A} \right) + \frac{R_B}{R_A + R_B} \left(\frac{\dot{p}_B}{p_B} \right) \right\} + \left\{ \frac{R_A}{R_A + R_B} \left(\frac{\dot{y}_A}{y_A} \right) + \frac{R_B}{R_A + R_B} \left(\frac{\dot{y}_B}{y_B} \right) \right\}$$

weighted sum of individual **price** growth rates, with weights equal to the share of the good in total sales.

weighted sum of individual **output** growth rates, with weights equal to the share of the good in total sales.

= INFLATION RATE + REAL GDP GROWTH

NOMINAL
GDP
GROWTH
RATE

This is what the BEA observes

- So, as we are really interested in real GDP growth, we need to be able to measure accurately the rate of inflation. *Problems measuring inflation also imply problems in measuring real national income growth.*

What GDP Does Not Measure

- Assume for the moment that inflation is measured accurately, and that revenues are observed without problem.
- Then, by assumption, we have an accurate measure of GDP growth . . .
- . . . but this is still a poor measure of the standard of living.

GDP Omits:

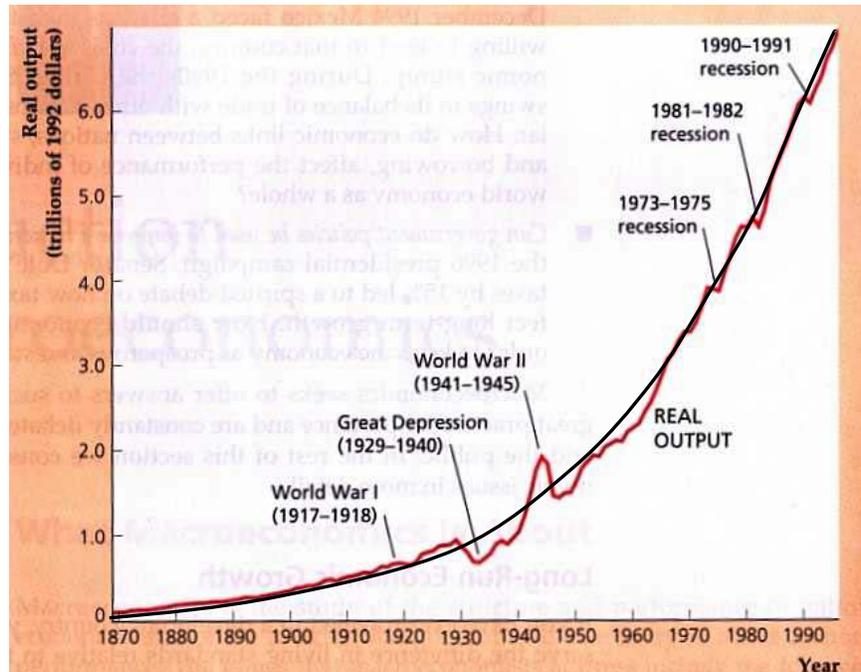
- The value of leisure time.
- Non-marketed household production.
- Environmental damage.
- Non-economic values: peace, security, happiness, schadenfreude, etc.

And on top of this, GDP figures do not measure GDP all that well because there are problems in

- measuring revenues accurately
- measuring inflation well.

So, unsurprisingly, GDP is the best measure of our national standard of living that we have.

*Real Gross Domestic Product
United States, 1870-1995*



Main features of real GDP performance:

- A more or less constant rate of growth, over a period of 120 years, shown by the exponential trend line.
- Fluctuations around this trend, notably
 - *Recessions*: the Great Depression (1930-39); the recessions of 1973-75 and 1981-82 associated with the oil-price increases; the 1990-91 recession for reasons we will explore later.
 - *Booms*: periods of rapidly growing or above-trend output, notable in the two world wars, the late 1960s, and the 1990s.

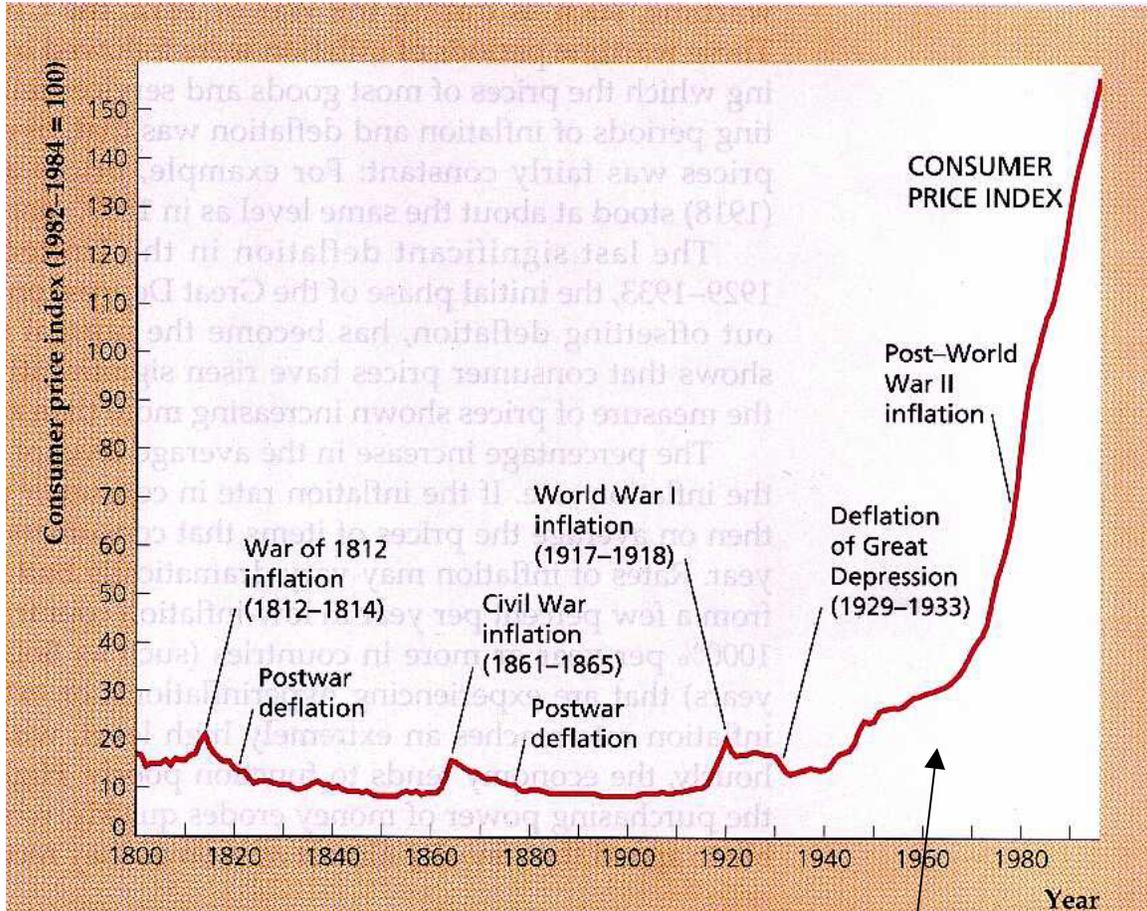
These features of GDP growth leads to two distinct questions:

- What determines the long-run average trend rate of growth?
- What determines the frequency and amplitude of booms and recessions?

Economists have almost invariably attacked these two questions separately.

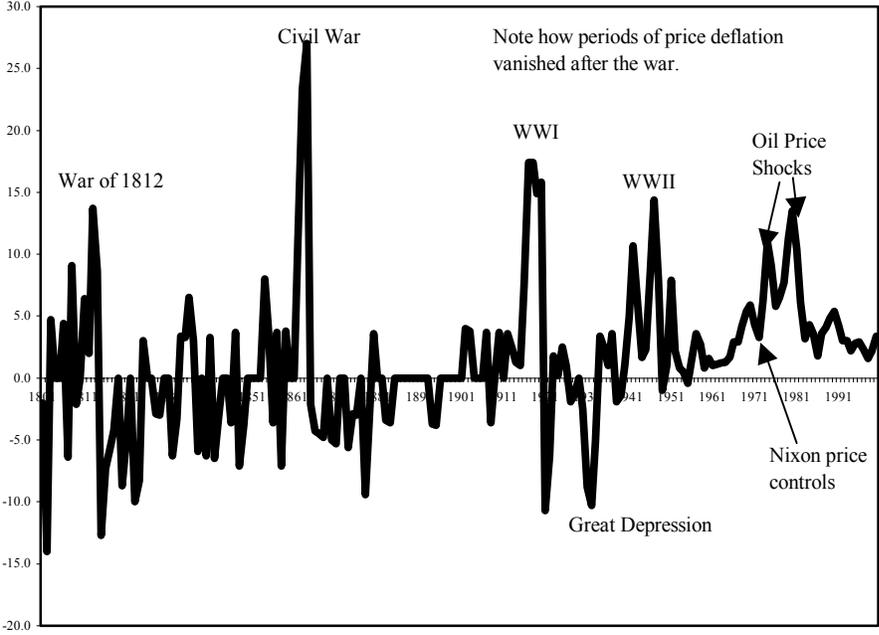
- Imagine a world with no cycles, so that the trend can be studied. This is the study of **economic growth**.
- Imagine a world with no trend, so that the cycle can be studied. This is **business cycle analysis**.

Inflation



Note absence of periods of deflation after WWII.

US Inflation Rate, 1801-2000



Source: Handbook of Labor Statistics, U.S. Department of Labor, Bureau of Labor Statistics.

- The consumer price index is a weighted sum of the prices of individual goods. The weights are equal to the relative importance of each good in consumption (the consumption share).

- The CPI has been under investigation in recent years (**Boskin Commission**). It has been concluded that, for many years, the CPI has **overstated** increase in the cost of living.

- Getting the inflation rate wrong has important consequences:
 1. We don't really know what is going on with real income growth: and without reliable data on GDP growth, it is hard to know what policies work and what policies do not.
 2. We get the adjustment to individual index welfare payments wrong.

- Because we have been overstating the rise in the cost of living, our measurement problems imply:
 1. Real GDP growth has been understated.
 2. The Federal government has been increasing expenditure on welfare and other transfer payments too rapidly, and making recipients better off than we intended at the cost of an increased budget deficit.

Why the CPI overstates inflation

There are a number of reasons, among them:

1. Substitution Bias

The CPI has traditionally studied the cost of buying a fixed basket of goods. But individuals can offset part of the effect of rising prices by changing the goods they buy.

- The CPI is the answer to the question: how much money do I need to buy exactly what I bought last year?
- A true cost of living index is the answer to the question: how much money do I need to be exactly as well off as I was last year?

These are distinct questions.

An extreme example of the substitution bias:

- I am indifferent between chips and Doritos, but I like a bit of variety. I always eat 3 units, and I buy two of the cheaper one and one of the more expensive one.

Year		Chips	Doritos
2001	Price per unit	50	100
	Quantity purchased	2	1
2002	Price per unit	100	50
	Quantity purchased	1	2

- In 2001, I spent 100 on chips and 100 on Doritos for a total of 200, and bought 3 units in total.
- In 2002, I spent 100 on chips and 100 on Doritos, for a total of 200, and bought 3 units in total.

- The CPI asks: how much do I need in 2002 to buy exactly what I bought in 2001? The answer is:

200 to buy the 2 units of chips I had bought in 2001 but which now cost 100 each, PLUS 50 to buy the 1 unit of Doritos I had bought, which now cost 50.

Total expenditure required: 250, which is 25% more than I spent in 2001. So the CPI says inflation was 25%.

- However, given my preferences, I can keep myself exactly as well off as before without raising my expenditure at all. The true cost of living says inflation was 0%.

2. Quality change

The CPI does not do a good job of tracking improvements in quality, and introduction of new goods.

- For example, the best desktop computer today is about \$3,000. The best desktop in 1988 was \$3,000. Are we really claiming that computers have not declined in price?
- In the computer case, we need to find something measurable that proxies for what we care about. For example, more clock speed allows us to do more things better, so we could use clock speed as a measure for quality. Doing this, we find that the cost of computer services (measured as cost per instruction per second) has declined at about 9% per year for 20 years.
- Computers are such egregious example of the quality problem that the BEA has actually gone and adjusted its data on computer prices.
- But it has done so for very few other things: measuring quality is in most cases very hard and time-consuming to do.
 - **Jerry Hausman** has studied the “quality improvement” caused by the proliferation of breakfast cereal brands. He concludes that we have overstated price inflation in the breakfast cereal sector by about 25 a year for over 15 years.

Why do we care about inflation?

(or deflation)

• Inflation imposes costs

- but the extent of these costs depend on whether inflation is anticipated or unanticipated.

Anticipated inflation

1. Shoe-leather costs. Resources expended by individuals to mitigate the consequences of holding money that is losing value.
2. Menu costs. Expenditures by firms on changing and communicating price increases.
3. Tax bracket creep. Most countries fix tax rates in nominal terms. Inflation puts people into higher tax brackets.
4. Seignorage. Money is a government liability. Inflation erodes the size of that liability at cost to holders of money. [Inflation tax].

In cases of hyperinflation it is easy to imagine that these costs are quite high.

Wholesale Price Index, Germany

July 1914	1.0
Jan 1919	2.6
July 1919	3.4
Jan 1920	12.6
Jan 1921	14.4
July 1921	14.3
Jan 1922	36.7
July 1922	100.6
Jan 1923	2,785.0
July 1923	194,000.0
Nov 1923	726,000,000,000.0

Shoe-leather costs:

"Workmen are given their pay twice a day now--in the morning and in the afternoon, with a recess of a half-hour each time so that they can rush out and buy things--for if they waited a few hours the value of their money would drop so far that their children would not get half enough food to feel satisfied."

Erich Remarque, *"The Black Obelisk"*, tr. by D. Lindley (1957, p. 262)

Menu costs:

"So they left the price marks as they were and posted (hourly) a new multiplication factor. The actual price marked on the goods had to be multiplied by this factor to determine the price which had to be paid for the goods. Every hour the merchant would call up the bank and receive the latest quotation upon the dollar. He would then alter his multiplication factor to suit and would perhaps add a bit in anticipation of the next quotation. Banks had whole batteries of telephone boys who answered each call as follows: '100 milliarden, bitte sehr, guten Tag.'

Karl R. Bopp, (1939): "Hjalmar Schacht: Central Banker,"
The University of Missouri Studies, 14 (1): p. 13

To cope with this, bank employment rose from 100,000 to 375,000 people between 1913 + 1923.

Germany's hyperinflation was dramatic (and in its consequences), but it is not the record holder.

Other Hyperinflations

Monthly inflation rates:

Germany, 1922-1923: 3.25 million percent

Greece, 1943-1944: 8.55 billion percent

Hungary, 1945-1946: 4.19 quintillion percent



The 100 million billion Pengo note, Hungary, 1946

Not even enough room to put the 100,000,000,000,000,000 Pengos numbers!

But what about more modest rates of inflation, say 10%?

- Costs are more subtle and more difficult to measure.
 - but people still change their spending plans to preempt price increases
 - there is still some tax bracket creep
 - the government still raises some revenue by printing money.

In 1981, Stan Fischer attempted to measure the costs of 10% inflation (against an alternative of 0%). He came up with a number of 0.5% of GDP — of the order of \$80 billion per year.

- This appears to be quite modest
- most recent publications still cite this number; relatively little work has been done in the last 20 years, because most economists expect any number they come up with to be small.

Unanticipated inflation

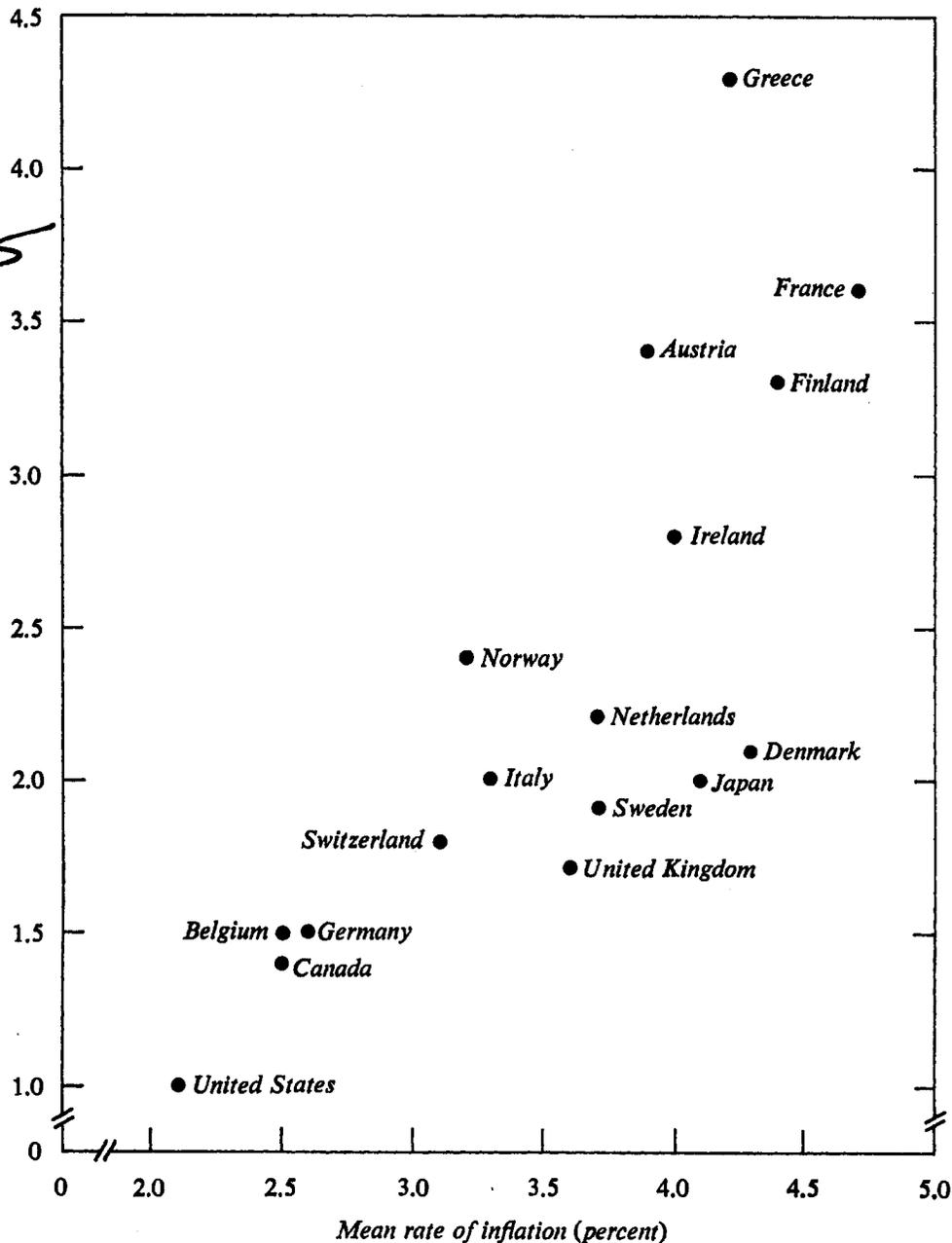
- The costs of unanticipated inflation are believed to be more significant.
- "It is a famous proposition in economics that fully anticipated inflation has no significant effect on the level or distribution of real income. As with other false generalizations, this proposition seems both true and essentially meaningless."

G. Ackley, Am. Ec. Rev. 68, p. 149 (1978)

- Because "there is clear evidence that the variability of inflation increases with its average extent". (p. 68)
- Because "the same reasoning that would argue for more toleration of inflation in 1971 than in 1965 would point toward acceptance of a still higher inflation rate the next time a similar unfavorable surprise is encountered."
↳ This quote by Arthur Okun (1971), who also produced the next graph ⇒

Figure 1. Average and Variability of Percentage Changes of GNP Deflators, Seventeen OECD Countries, 1951-68

Standard deviation of inflation rate (percent)



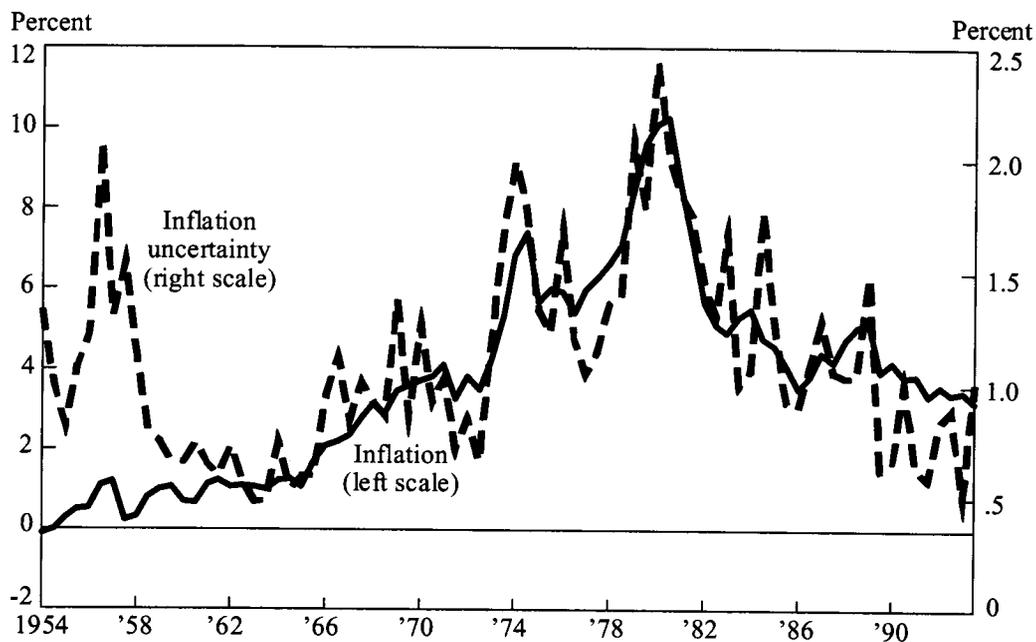
Source: Derived from data in Organisation for Economic Co-operation and Development, *National Accounts Statistics, 1950-1968* (Paris: OECD), pp. 366-415.

Source: Arthur Okun (1971): "The Mirage of Steady Inflation." *Brookings Papers on Economic Activity*, pp. 485-498.

Instead of just looking at the variance of inflation, one can also look at forecasters' uncertainty.

This graph plots the mean and standard deviation of 12-month inflation forecasts from a regular survey of 50 economists.

Inflation and Inflation Uncertainty



Note: Inflation is the average of the Livingston Survey 12-month inflation forecasts. Inflation uncertainty is the dispersion of the Livingston Survey 12-month inflation forecasts.

Source: Livingston Survey, Federal Reserve Bank of Philadelphia.

Source: Golob, J. (1994): "Does Inflation Uncertainty Increase with Inflation?" Kansas City Fed Economic Review.

Resource misallocation with unanticipated inflation.

- When owners/managers of firms guess inflation wrong, they often set the "wrong" prices. Relative price variability then goes up.

- Some goods too cheap, some goods too expensive, and we have the 'wrong' patterns of production & consumption.

try Google search for "inflation uncertainty and relative price variability" for evidence from around the world.

- why don't firms simply change the ~~costs~~ prices they charge once they find out they predicted the change in the relative price level incorrectly?

Ans: menu costs.

Menu costs are more than you think:

A study* compared frequency of price changes in 4 supermarkets who only had to label shelves, with a 5th that had to label every item on the shelf.

	Low Menu Cost	High Menu Cost
No. of price changes / week	3,916	1,578
% of products	15.7%	6.3%
Menu costs / profit (%)	35.2%	362%
Cost per price change (\$)	\$0.52	\$1.33

*Lay, D. et al. (1997) "The Magnitude of Menu Costs." Quarterly Journal of Economics.

we will look at this paper in more detail later.

So menu costs stop firms from changing their prices all the time. This is what allows for resource misallocation.

Redistribution between debtors & creditors

- when loans are negotiated, they specify a nominal amount that must be repaid (principal plus interest).
 - unanticipated inflation transfers wealth from creditors to debtors
 - unanticipated deflation transfers wealth from debtors to creditors

(why?)

The practical and political significance of this can be profound.

- The Crime of 1873:
- Japan in the late 1990s.

The Crime of 1873

- Prior to 1873, US was on a bimetallic money standard (gold + silver). In 1873 it switched to a gold standard.
- Price of gold was fixed in \$. When gold became scarce, its price could not go up in dollars. So the only way to reflect its scarcity was for prices of other goods to go down in \$ terms \Rightarrow deflation.
- In 1890s gold became scarce
 - no new mines
 - European countries buying it up.

So prices dropped:

3% per year for agricultural goods

- Real burden of debt rose
 - \Rightarrow farm + small business bankruptcies
 - \Rightarrow 18% unemployment in 1894.
- 1898 elections
 - William Jennings Bryan (for "free silver")
 - vs. William McKinley (for gold standard).

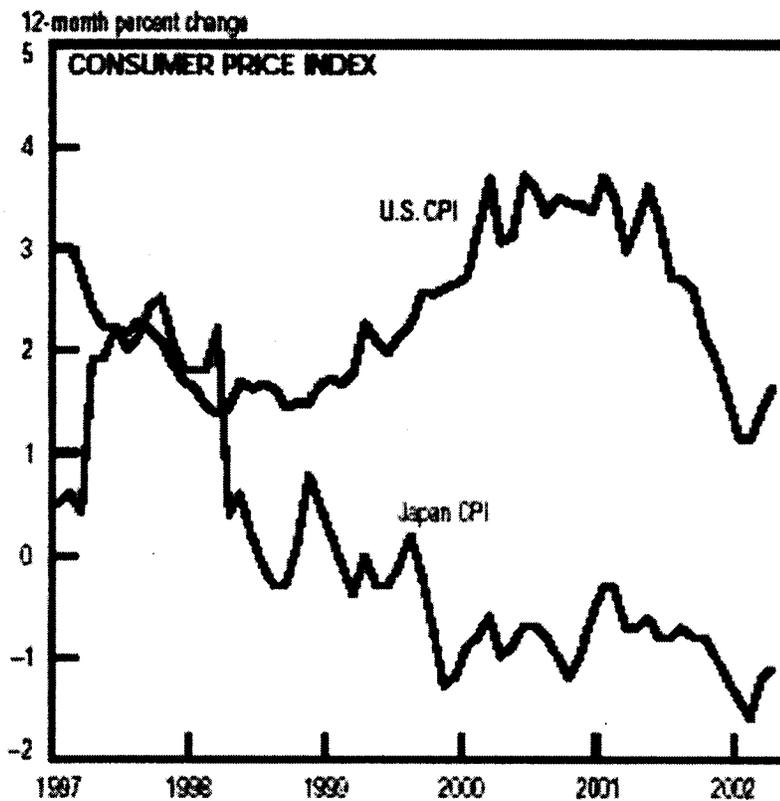
"Cross of Gold Speech."

We care not upon what lines the battle is fought. If they say bimetallism is good, but that we cannot have it until other nations help us, we reply that, instead of having a gold standard because England has, we will restore bimetallism, and then let England have bimetallism because the United States has it. If they dare to come out in the open field and defend the gold standard as a good thing, we will fight them to the uttermost. Having behind us the producing masses of this nation and the world, supported by the commercial interests, the laboring interests and the toilers everywhere, we will answer their demand for a gold standard by saying to them: You shall not press down upon the brow of labor this crown of thorns, you shall not crucify mankind upon a cross of gold.

1896 Democratic Convention
William Jennings Bryan.

- McKinley won the election
 - But Bryan got his inflation anyway.
 - new gold discoveries (Klondike)
 - new processing methods (cyanide)
- So gold increased in supply and had to become cheaper relative to other goods.

Deflation in Japan causes record bankruptcies in 2001.



“New figures out today are confirming Japan's image as a paradise for corporate bankruptcy lawyers, with more companies going bust in 2001 than in any year since 1984. The figures, released by leading private sector economic research firm Teikoku Databank, show that 19,441 companies went under in 2001. . . . [T]his is a 1.9% increase on 19,071 bankruptcies in 2000. . . . But the overall level of debt held by companies which collapsed into bankruptcy actually declined, down 32.4% from its 2000 peak to 16,210bn yen (\$122bn).”

BBC Business News, Monday, 21 January, 2002

And with such low inflation, deflation is becoming a concern for the US.

U.S.: Greenspan Says Deflation Possible But Not Likely

By Andrew F. Tully

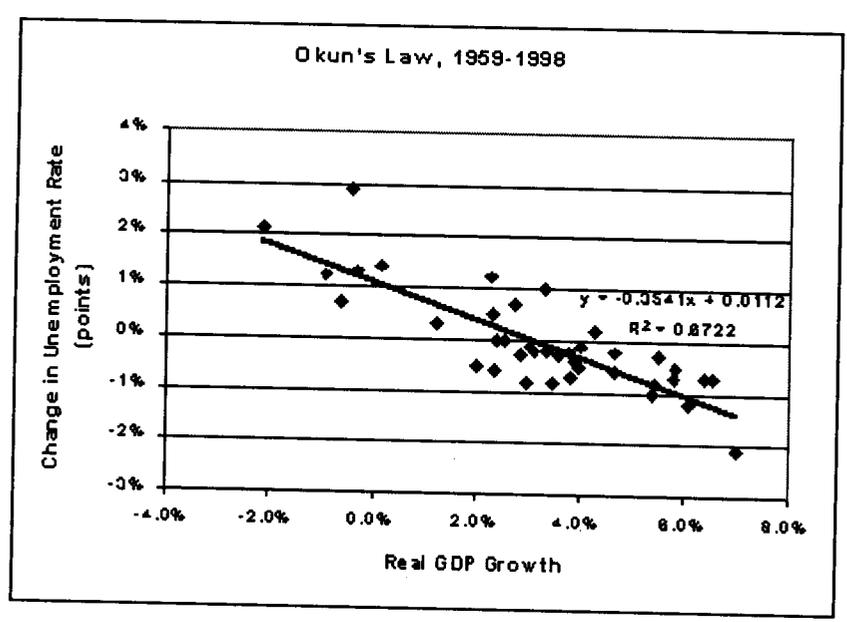
Washington, 22 May 2003 (RFE/RL) -- The head of America's central bank says debilitating deflation is possible over the next several months, but he says fiscal policymakers have the tools to ensure that the possibility is remote. . .

Radio Free Europe
22 May 2003.

Okun's Law for the U.S.

$u_t - u_{t-1} = -0.4 (g_y - 3\%)$

unemployment declines... .. by 0.4% .. for every 1% GDP growth falls below the 3% trend rate.



GDP must rise by 3% to keep unemployment stable because (i) the labor force is growing in size, (ii) labor is becoming more productive.

NOTE: We can write a model about GDP and infer what is happening to unemployment via Okun's Law.

Unemployment.

Official unemployment rate:

- Is produced from a telephone survey.
- Has a very specific definition:

$$\frac{\text{No. employed}}{\text{Labor force}}$$

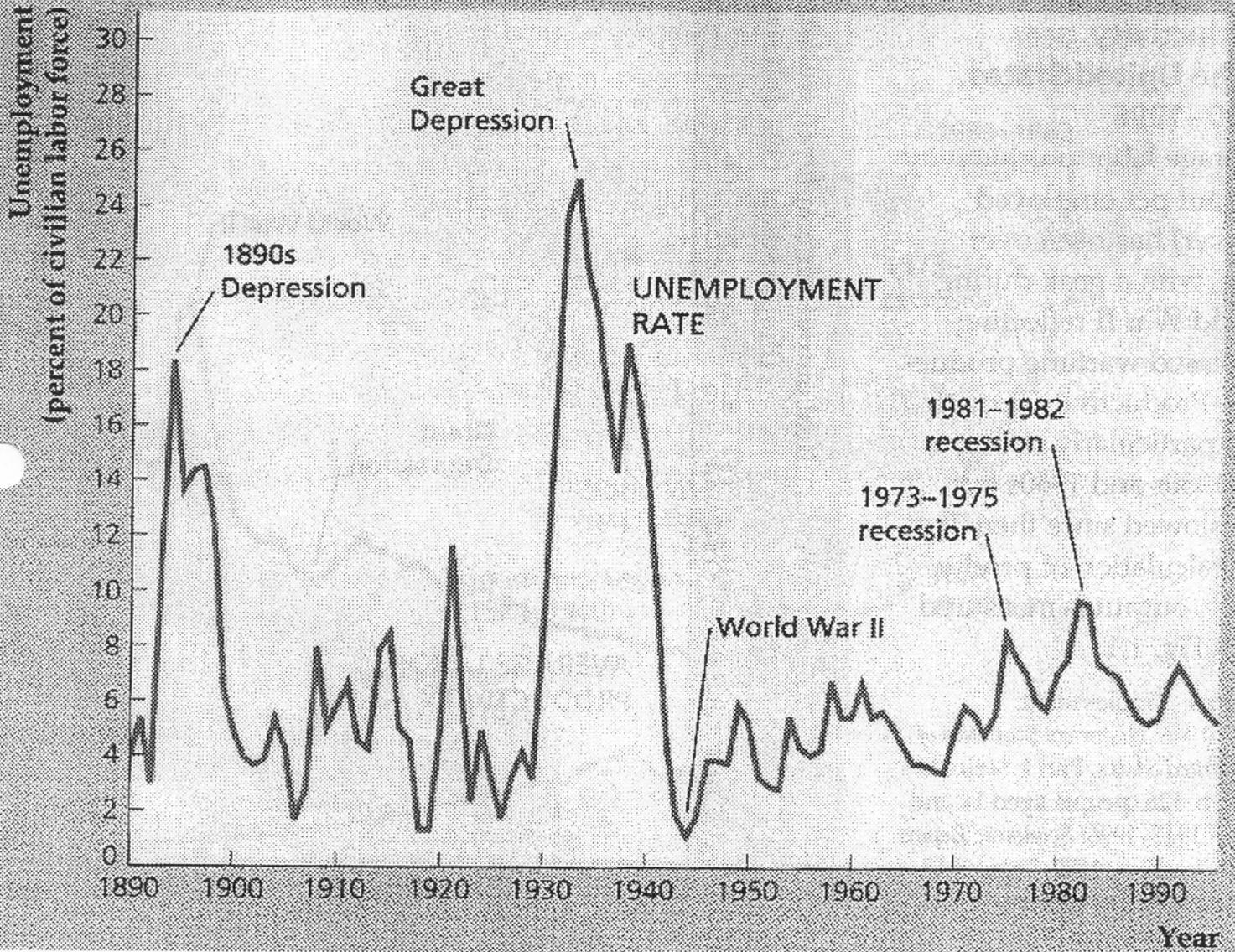
includes unpaid
employers in family
businesses.

sum of those employed
and those not employed
but actively seeking
work.

includes anyone who did
any part time paid work.

• Not often a good measure of the utilization of labor force:

- excludes those who are "discouraged."
- treats part-time workers who want to work full-time as employed.



Questions about unemployment.

① What determines the average rate of unemployment?

② What determines the fluctuations in the unemployment rate?

• Note the parallel here with the questions about GDP.

It should be as no surprise that unemployment and GDP are related:

a) If GDP grows faster than its trend, the economy is entering a boom, and unemployment falls.

b) If GDP grows below its trend, unemployment tends to rise.

- This relationship, when stated empirically is known as Okun's Law.