Chapter 1 Lecture Notes: Economics for MBAs and Masters of Finance

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GDP stands for "Gross Domestic Product."

Nominal GDP is the **dollar value** of all goods and services that are produced in the United States.

Real GDP is a measure of the **quantity** of all goods and services that are produced.

Example. Suppose everyone picks apples from trees.

Price of an apple in year t is $p_{a,t}$.
The number of apples picked in year t is a_t.

Nominal GDP in year t is $p_{a,t} * a_t$.

Real GDP in year t is a_t.

Growth in nominal GDP from year t to year $t+1$ is

$$\frac{p_{a,t+1} * a_{t+1}}{p_{a,t} * a_t}$$

and growth in real GDP from year t to year $t+1$ is

$$\frac{a_{t+1}}{a_t}$$

Real GDP increases when apples are more plentiful.

Nominal GDP increases by more than real GDP when the price of apples increases.

Suppose households get utility from apples. Then, when real GDP increases, utility has increased.

So in this simple example, growth in real GDP is informative about growth in living standards (utility).

Suppose now that households get utility from both apples and bananas.

Let's define set the year 2000 as year t. The price of bananas in the year 2000 is $p_{b,2000}$ and the number of bananas picked is b_{2000}.

Nominal GDP in 2000 is $p_{a,2000} * a_{2000} + p_{b,2000} * b_{2000}$

How do we define real GDP? And however we define it, will it be informative about living standards?

Note: This isn't so obvious. Suppose production of apples increases but production of bananas decreases? On net, is this bad or good?

Here is the procedure.

1. First, for some arbitrary year (currently 2000), nominal GDP is set equal to real GDP.

   This should tell you right away that the **level** of real GDP is meaningless – it is arbitrary.

2. However, **growth** in real GDP is not meaningless and is calculated as

$$\frac{\text{real } GDP_{2001}}{\text{real } GDP_{2000}} - 1.0 = \frac{p_{a,2000} * a_{2001} + p_{b,2000} * b_{2001}}{p_{a,2000} * a_{2000} + p_{b,2000} * b_{2000}} - 1.0.$$

Divide num. and denom. by price of apples in 2000, $p_{a,2000}$.

$$\begin{aligned}\frac{\text{real } GDP_{2001}}{\text{real } GDP_{2000}} - 1.0 &= \frac{p_{a,2000} * a_{2001} + p_{b,2000} * b_{2001}}{p_{a,2000} * a_{2000} + p_{b,2000} * b_{2000}} - 1.0 \\ &= \frac{a_{2001} + b_{2001} * \left(\frac{p_{b,2000}}{p_{a,2000}}\right)}{a_{2000} + b_{2000} * \left(\frac{p_{b,2000}}{p_{a,2000}}\right)} - 1.0\ .\end{aligned}$$

Numerator and denominator are equal to real GDP in 2000 and 2001 in units of apples at year-2000 prices (rather than real GDP in constant year-2000 dollars).

Year	a	p_a	b	p_b	$a * p_a$	$b * p_b$	Nom. GDP	Real GDP $2000	Real GDP apples
2000	5	$20.0	10	$15.0	$100.0	$150.0	$250.0	$250.0	12.50
2001	4	$25.0	11	$15.5	$100.0	$170.5	$270.5	$245.0	12.25

- Growth in real GDP, apple equivalents: 12.25/12.50 - 1.0 = -2.0%
- Growth in real GDP, constant year $2000: 245.0/250.0 - 1.0 = -2.0%

The book shows that the expression for real GDP growth reduces to

$$\widehat{\phi}_{2000}\left(\frac{a_{2001}}{a_{2000}}\right)+\left(1-\widehat{\phi}_{2000}\right)\left(\frac{b_{2001}}{b_{2000}}\right)-1.0.$$

- $\widehat{\phi}_{2000}$ is the fraction of nominal GDP accounted for by purchases of apples. This is called the measured "expenditure share" on apples.
- $\left(1-\widehat{\phi}_{2000}\right)$ is the fraction of nominal GDP accounted for by purchases of bananas

Note that expenditure shares are updated every period, that is real GDP growth from 2001 to 2002 is computed as

$$\widehat{\phi}_{2001}\left(\frac{a_{2002}}{a_{2001}}\right)+\left(1-\widehat{\phi}_{2001}\right)\left(\frac{b_{2002}}{b_{2001}}\right)-1.0$$

where $\widehat{\phi}_{2001}$ and $\left(1-\widehat{\phi}_{2001}\right)$ are the measured expenditure shares on apples and bananas in 2001.

Why does growth in real GDP tell us anything useful? Well, suppose that households get utility from apples and bananas in year 2000 and 2001 of

$$\begin{aligned} u_{2000} &= \phi \ln\left(a_{2000}\right)+(1-\phi)\ln\left(b_{2000}\right) \\ u_{2001} &= \phi \ln\left(a_{2001}\right)+(1-\phi)\ln\left(b_{2001}\right) \end{aligned}$$

Then, the book shows that

$$u_{2001}-u_{2000}=\phi\left(\frac{a_{2001}}{a_{2000}}\right)+(1-\phi)\left(\frac{b_{2001}}{b_{2000}}\right)-1.$$

So, if $\widehat{\phi}=\phi$, then utility increases whenever real GDP growth is positive.

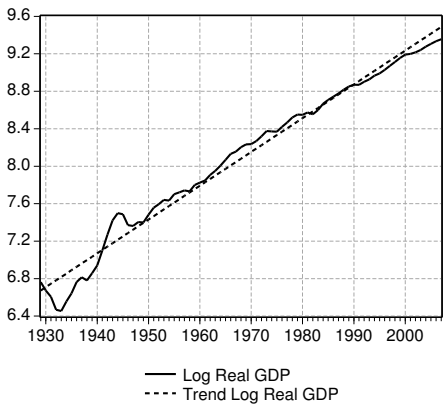
2 caveats:

1. GDP does not track all output produced in the U.S. It only tracks output sold in the marketplace. Work done at home that is "non-marketed" (child-care, laundry, etc) is not included as GDP.

2. Real GDP growth tracks changes in living standards only if all GDP is "consumed" each period. If some GDP is set aside as "investment", then changes in real GDP growth are not necessarily linked to changes in living standards.

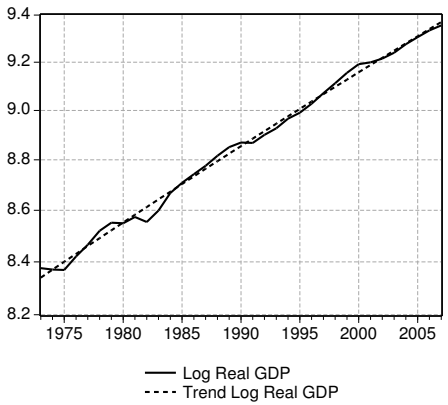
Historical behavior of GDP.

2007: Nominal GDP was $13,841.3 billion and real GDP was $11,566.8 billion (base 2000).



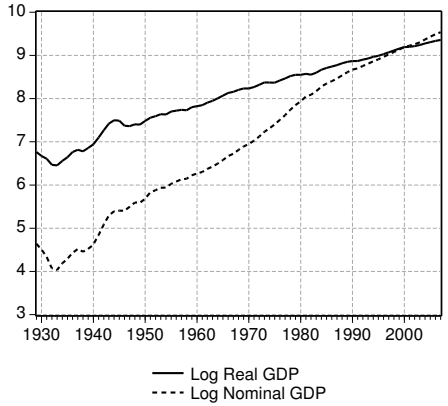
Real GDP has increased at a roughly constant rate of about 3.6% per year.

Figure: Annual Real GDP and Trend Real GDP, 1973-2007, Log Scale



The growth rate of trend real GDP slowed in 1973 to 3.0% per year.

Figure: Annual Real and Nominal GDP, 1929-2007, Log Scale



With few exceptions, nominal GDP has increased at a faster rate than real GDP. Especially after WWII and during the 1970s.

Economists find it useful to **disaggregate** GDP (total production) into a few key components.

$$GDP \equiv C + I + G + (X - M)$$

- C = private consumption
- I = private investment
- G = government spending
- X = exports, M = imports, and X-M = net-exports

This is called the "expenditure" side of measuring GDP, since subdivides output into categories based on how the output is spent.

Two more general notes about C, I, G, X-M before discussing in detail

1. Real C, I, G, X-M are each computed in an identical fashion to the apples-bananas example.
2. (technical) Although $GDP = C + I + G + X - M$ exactly holds for nominals, it does not exactly hold for reals.

Consumption is anything that, once enjoyed today, cannot be enjoyed tomorrow. We will assert (in future lectures) that households get utility from real consumption.

My French friends like to use the example of a "massage" for consumption. Maybe electricity is more appropriate.

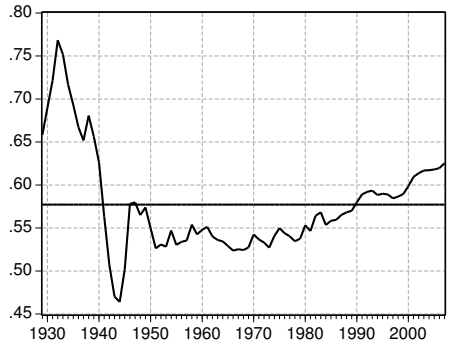
Sometimes consumption is hard to measure:

- Consumption of Housing Services: Do not want to count the value of a house as consumption. This is because a house lasts 80 years or more. So, measure the stream of rental services, count that as consumption.
- Consumption as defined by the BEA includes purchases of other durable goods. This is wrong.

2007 Consumption data:

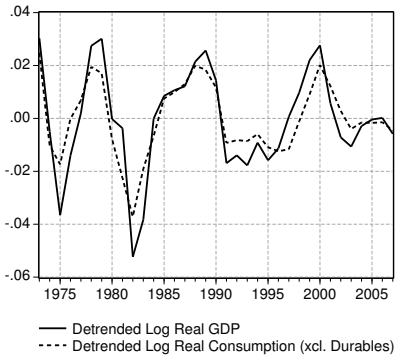
	Nominal	Real (base 2000)
Excluding Durables	\$8,627.4	\$7,010.4
Including Durables	\$9,710.2	\$8,252.8

Figure: Ratio of Annual Nominal Consumption (Excluding Durables) to Annual Nominal GDP, 1929-2007



Consumption share is about 60 percent. It is about 10 percentage points higher if we include durables.

Figure: Detrended Log Real Consumption (Excluding Durables) and Log Real GDP, 1973-2007



Importantly, real consumption is less volatile than real GDP. In this sample, real consumption is about 70 percent as volatile. This means that either I, G, or M-X must be more volatile than GDP.

Investment does not provide us with any utility today. Investment is anything we store away that provides us with the potential for consumption tomorrow.

Nominal investment in 2007 was \$2,130.4 billion and real investment was \$1,809.7 (2000 base).

Another way of saying this: investment adds to our capital stock; capital is a factor of production; thus investment enables us to produce more.

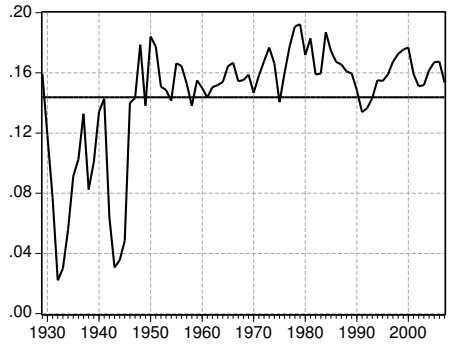
$$K_{t+1} = K_t - \delta K_t + I_t$$

The future capital stock equals the current stock, less depreciated capital, plus investment.

The big sub-categories of investment in the NIPA reflect this idea:

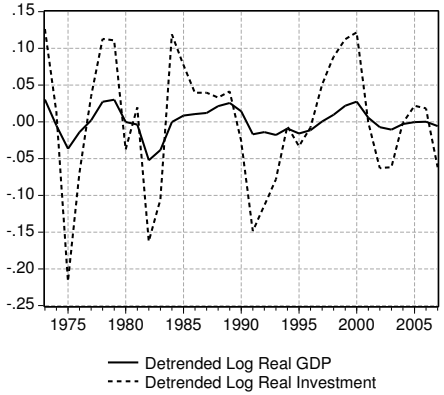
- Equipment and software spending (48% of I in 2007)
- Non-residential structures (23% of I in 2007)
- Residential structures (30% of I in 2007)
- Change in Inventories (0% of I in 2007)

Figure: Ratio of Annual Nominal Gross Private Domestic Investment to Annual Nominal GDP, 1929-2007



Since 1950, investment share of GDP has been about 16 percent.

Figure: Detrended Log Real Gross Private Domestic Investment and Detrended Log Real GDP, 1973-2007



Real investment is 4-5 times more volatile than real GDP.

Three main points about government spending:

1. The share of GDP accounted for by all government spending has been relatively stable at 20 percent since 1950.
2. Government spending (G) is itself subdivided into
   - federal and state and local governments,
   - government consumption and investment for feds and s-l,
   - consumption and investment for non-defense and defense for the federal government.

   The single-biggest line-item expenditure in 2007 is for state and local consumption (education spending).
3. Government spending is **not** necessarily related to tax receipts or government surpluses or deficits. Many of the tax receipts collected by the federal government is transferred back to people (Medicare, Social Security, etc.)

Explanation

- Denote income net of taxes as $Y - T$.
- Suppose households either consume (C) or save their income
- Suppose for saving households either invest in companies (I) or buy newly issued government bonds (B).

$$C + (I + B) \quad = \quad Y - T$$

Rearrange terms and add up across all households:

$$C + I + (B + T) \quad = \quad Y$$

If $Y = GDP$ (it does) and net exports are 0, then $G = B + T$.
Also note that B does not "crowd out" private investment, although G may.

In this chapter, we do not have much to say about net exports – Chapter 4 discusses trade in more detail – except net exports allow $C + I + G$ to be different than GDP.

Suppose $C = GDP$ (as is about true now), and $G = 0$ (as is NOT true now).

Then $I = -(X - M) = M - X$.

This means that our investment is not zero, but rather foreigners are financing our investment – they are buying our capital stock.

So far, we have talked about the "expenditure side" – we have sub-divided GDP into categories based on spending.

But every time a dollar is spent a dollar is earned. So we could have sub-divided GDP using the "income side."

In practice, the expenditure side does not exactly equal the income side, the difference is called the "statistical discrepancy."

In our models, we will specify that output is produced using technology, capital, and labor.

We will assume (yes) that the same technology is freely available to all firms.

This means that firms use only two costly inputs, capital and labor.

So in our income-accounting, it will be useful to see how much output (income) accrues to capital and how much accrues to labor.

The NIPA (National Income and Product Accounts) do not cleanly divided up income into "labor" and "capital income."

However, some categories of income are reported in the NIPA are clearly capital income.

Bureau of Economic Analysis
National Income and Product Accounts Table

Table 1.10. Gross Domestic Income by Type of Income

[Billions of dollars]

Today is: 6/24/2008 Last Revised on May 29, 2008 Next Release Date June 26, 2008

Line		2006	2007
1	**Gross domestic income**	**13,212.8**	**13,818.9**
2	**Compensation of employees, paid**	**7,454.8**	**7,888.2**
3	Wage and salary accruals	6,032.2	6,395.7
4	Disbursements	6,024.7	6,373.2
5	To persons	6,015.3	6,363.1
6	To the rest of the world	9.4	10.0
7	Wage accruals less disbursements	7.5	22.5
8	Supplements to wages and salaries	1,422.6	1,492.5
9	**Taxes on production and imports**	**967.3**	**1,008.5**
10	**Less: Subsidies** [1]	**49.7**	**47.1**
11	**Net operating surplus**	**3,225.3**	**3,282.7**
12	Private enterprises	3,239.2	3,297.2
13	Net interest and miscellaneous payments, domestic industries	791.3	837.4
14	Business current transfer payments (net)	90.2	94.2
15	Proprietors' income with inventory valuation and capital consumption adjustments	1,006.7	1,042.6
16	Rental income of persons with capital consumption adjustment	54.5	65.4
17	Corporate profits with inventory valuation and capital consumption adjustments, domestic industries	1,296.4	1,257.7
18	Taxes on corporate income	453.9	466.6
19	Profits after tax with inventory valuation and capital consumption adjustments	842.5	791.0
20	Net dividends	623.1	659.5
21	Undistributed corporate profits with inventory valuation and capital consumption adjustments	219.4	131.5
22	Current surplus of government enterprises [1]	-13.9	-14.5
23	**Consumption of fixed capital**	**1,615.2**	**1,686.6**
24	Private	1,347.5	1,398.7
25	Government	267.7	287.9
	Addendum:		
26	Statistical discrepancy	-18.1	22.4

Let's assume that the fraction of ambiguous income that should be attributed to capital is the same as the economy-wide capital share.

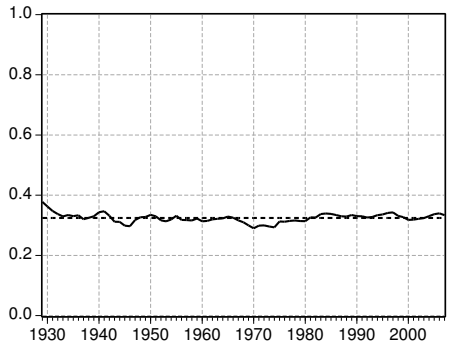
$$\alpha * \text{Total Income} = \text{Unambig Cap Income} + \alpha * \text{Ambig Income}$$

This implies

$$\alpha = \frac{\text{Unambig Cap Income}}{\text{Total Income} - \text{Ambig Income}}$$

The procedure produces a stable estimate for α of 0.32.

Figure: Capital's Share of Income (α), 1929-2007



- Why does this matter? Because politicians think that labor's share of income has fallen recently.
- This is because they are focusing on changes to only one component of income called "corporate profits."
- On the next page, text is copied from a recent speech by Hillary Clinton (May 29, 2007)

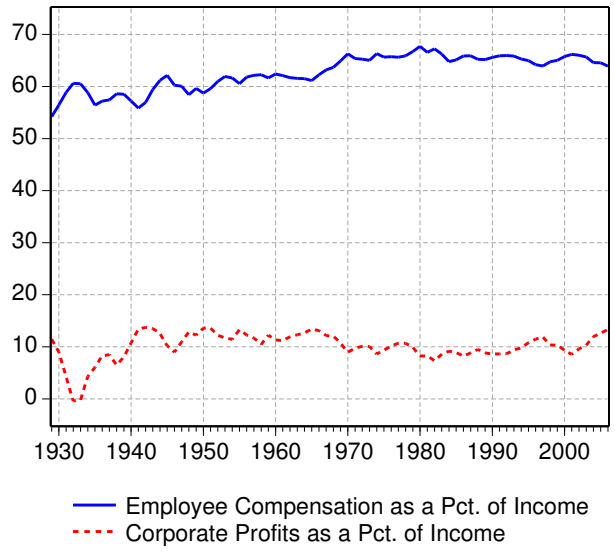
Unfortunately, we're not managing globalization properly. Instead of working for all of us, globalization is working only for a few of us.

Now, it is working for corporations. Corporate profits have grown an average of 13% a year since 2001, adjusted for inflation. It's working for CEOs who've seen their pay go from 24 times the typical worker's in 1965, to 262 times the typical worker in 2005. And it's working for Americans with incomes at the very top. In 2005, all income gains went to the top 10% of households, while the bottom 90% saw their incomes decline, in spite of the fact that worker productivity has increased for six years.

Now, in past economic expansions, that's not the way it was. In the past, about 75% of net corporate revenues have gone to employee compensation, and only 25% to profits. However, for the past five years, the comparable figures are 41% going to employee compensation and 59% going to profits. Think about this: last year, the share of America's national income going to corporate profits was the highest since 1929 – while the share going to the salaries of American workers was the lowest.

The next page shows you the facts!

(Note: The sum of the two lines is < 1.0)



Inflation is not the level of prices. It is the rate of change of prices.

In the media the use of the word "inflation" depends on the situation:

- Can refer to rate of change of all prices,
- rate of change of some prices,
- or the rate of change of one price.

Let's return to the scenario where GDP is all apples. The rate of change of apple prices and banana prices is

$$\begin{aligned} \text{apples} \quad & \frac{p_{a,2001}}{p_{a,2000}} - 1 \\ \text{bananas} \quad & \frac{p_{b,2001}}{p_{b,2000}} - 1 \end{aligned}$$

The inflation rate on a "basket" of apples and bananas is

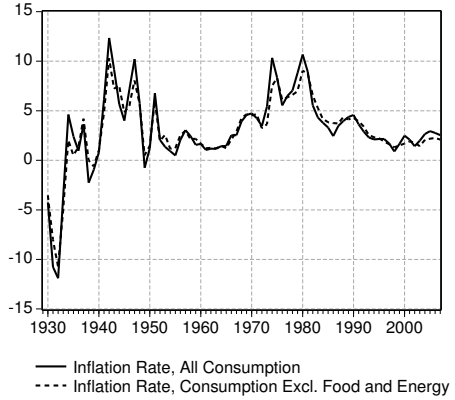
$$\widehat{\phi}_{2000}\left(\frac{p_{a,2001}}{p_{a,2000}}\right) + \left(1 - \widehat{\phi}_{2000}\right)\left(\frac{p_{b,2001}}{p_{b,2000}}\right) - 1,$$

exactly analogous to how we calculate real GDP growth.

Policy-makers tend to focus on the inflation rate for all consumption goods. Two sources:

- CPI, "consumer price index," collected the BLS. Sample of urban consumers. Technical Note: Expenditure shares are not updated every period.
- NIPA consumption excluding food and energy ("Core" consumption).

Figure: Annual Inflation Rate, All Consumption and Consumption Excl. Food and Energy,1930-2007



In measures of consumer price inflation, the price of investment goods is not taken into account. This can lead to confusion.

The biggest source of confusion: inflation to house prices is not counted as part of consumer price inflation. This is because housing is an investment. Rather, rental prices (including imputed rents to owner-occupied homes) are in the CPI, since rents are the consumption stream spun off by housing.

From 1997:1-2007:4 rents have increased by 46 percent but house prices have increased by about 90 percent. This is why the commentators think that the government is playing tricks.

Most of the rest of this book abstracts from inflation – that is, the inflation rate is assumed to be zero.

This is done for two reasons:

1. Inflation is easy to understand. If the government prints money, and real output has not increased, there will be inflation.
2. Inflation is too hard to understand. At 2 to 4 year horizons, inflation and GDP may be causally linked. We don't have a commonly-accepted theory for why this would be true, and there is still some debate about the size of the correlation (and whether it has changed over time).