Basic Concepts and Definitions

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Gross Domestic Product (GDP)

- Current dollar value of all goods and services produced within a country during a given period of time

\[ GDP_t = p_{1,t}y_{1,t} + p_{2,t}y_{2,t} + \cdots + p_{N,t}y_{N,t} = \sum_{j=1}^{N} p_{j,t}y_{j,t} \]

- Sometimes called “current dollar GDP”
Expenditure and Income Approaches

- As defined, GDP is a measure of production
- It is equivalently also a measure of both expenditure and income

\[ GDP_t = C_t + I_t + G_t + (X_t - IM_t) \]
\[ GDP_t = Wages_t + Profits_t + Interest_t \]

- \( C, I, G, X, \) and \( IM \) are expenditure by different types of agents
- Wages, profits, and interest are payments to factors of production
Expenditure Categories

- **C**: consumption. Expenditure by households except new residential construction
- **I**: investment. Expenditure by businesses on new capital, plus new residential construction plus net inventory accumulation
- **G**: government spending. Expenditure by government on purchasing things or providing services. Does not include transfers
- **X**: exports. Purchases of stuff made in a country by foreigners
- **IM**: imports. Purchases of a stuff made in a foreign country by people
- Caveats about inventories and imports
GDP and Its Components

Log Nominal GDP

Consumption/GDP

Investment/GDP

Gov Spending / GDP

Net Exports / GDP
Real vs. Nominal

- Money ($M$) a unit of account, acts as the numeraire
- Nominal price: denominated in units of money
- Price is relative: it is how many units of money it takes to get a unit of a good: e.g. $2 per soda
- Real price: denominated in units of a good: e.g. 2 sodas per burger
- In single good world, real is quantity, nominal is dollar value of quantity
Real vs. Nominal: Multiple Goods

- In multiple good world denoting in units of a good is problematic and arbitrary.
- NIPA accounts: “constant dollar” GDP = “real GDP”
- Pick a base year, $b$, and use fixed year prices to calculate “constant dollar” GDP:

$$Y_t = p_{1,b}y_{1,t} + p_{2,b}y_{2,t} + \cdots + p_{N,t}y_{N,t} = \sum_{j=1}^{N} p_{j,b}y_{j,t}$$

- Still denominated in units of money, but can make comparisons across time without worrying about general price changes driving them.
Implicit Price Index

- From calculating constant dollar GDP, we can define an implicit price index as the ratio of nominal to real GDP in any year:

\[ P_t = \frac{p_{1,ty_1,t} + p_{2,ty_2,t} + \cdots + p_{N,ty_N,t}}{p_{1,by_1,t} + p_{2,by_2,t} + \cdots + p_{N,by_N,t}} \]

- By construction, this is equal to 1 in the base period (when \( b = t \))

- If all prices rising over time, nominal GDP will grow faster than real, so \( P \) will rise

- Inflation: period-over-period growth rate of price index (or log first difference as approximation)
  
  - Frequency conversion: if you observe quarterly data, common to convert to annual frequency. Given quarterly observations, with \( \pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} \approx \ln P_t - \ln P_{t-1} \), conversion to annual is

\[ 1 + \pi_t^A = (1 + \pi_t)^4 \Rightarrow \pi_t^A \approx 4\pi_t \]
Chain-Weighting

- Choice of base year arbitrary
- Not innocuous if relative prices are changing over time: e.g. price of computers relative to food has fallen
- Chain-weighting tries to deal with this
- Basic gist: calculate real using different base years, translate into growth rates, and then average
Real GDP
Observations

- Upward trend really stands out. Blips minor in comparison
  - Caveat: recent decline relative to trend is large: \( \approx 15\% \)
- Tradition to study these separately: growth (trend) and business cycles (gyrations about trend)
- Different ways of detrending and isolating the cycles around the trend
  - For example, allow trend to be non-linear through some kind of smoothing. Doesn’t change qualitative picture, but would get different quantitative implications (e.g. not so far below trend at present)
Price Deflator

GDP Deflator

Inflation

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Observations

- Prices also increase over time on average
- Most notable in 1970s
- Inflation lower and more stable since early 1980s
Per Capita

- Common to express things as “per capita” – divided by population
- $L$: population
- $GDP_t = \frac{Y_t}{L_t} \times P_t \times L_t$
- $g_t^{GDP} \approx g_t^{Y/L} + \pi_t + g_t^L$
- Averages in data (annual): nominal GDP, 6%; real GDP, 3 percent; inflation, 3 percent; population, 1 percent
- Given this approximation: per capita real GDP grows by about 2% per year on average (in actuality about 1.8%)
Consumer price index: popular measure of average cost of living

Trying to measure same thing as GDP deflator, but conceptually different

Pick base year. Fix base year quantities of a defined “basket” of goods that avg. household consumes

Price index: ratio of cost of basket in year $t$ to cost in base year:

$$P_t^{CPI} = \frac{p_{1,t}x_{1,b} + p_{2,t}x_{2,b} + \cdots p_{N,t}x_{N,b}}{p_{1,b}x_{1,b} + p_{2,b}x_{2,b} + \cdots p_{N,b}x_{N,b}}$$

Can again measure inflation as period-over-period growth rate of price index
Observations

- Average annual CPI inflation 3.6 percent, higher than deflator
- Also more volatile
- Substitution bias: relative price changes cause people to substitute away from relatively more expensive goods. Fixing base quantities ignores this, leads to overstatement of inflation
- Can also do chain-weighting with the CPI – attempt to at least partially address the substitution bias. Politically relevant.
Aggregate Labor Market Notation

- $L$: population
- $E$: employment ($E \leq L$)
- $h$: average hours worked per employee
- $N = h \times E$: total hours worked
- $n = \frac{h \times E}{L}$: hours worked per capita
- $U$: unemployed, actively looking for work but not employed
- $LF = E + U$: labor force
- $u = \frac{U}{LF}$: unemployment rate
- $lf = \frac{LF}{L}$: labor force participation rate
Labor Market Variables

Hours per capita

Unemployment rate

Labor force participation

Employment-Population ratio

Average weekly hours
Observations

- No strong trend in hours per capita
- Downward trend in average hours per worker, upward trend in labor force participation
- Hours, average hours, and employment fall in recessions; unemployment rises
- Interesting longer run trends in labor force participation: rose from 1960-2000, has been declining since
Problems with Unemployment

- Unemployment popular in media, but hard to interpret
- Discouraged workers: unemployment can fall if people quit looking for work
- Unemployment does not reflect part time work
- Hours worked per capita most comprehensive measure of strength of labor market