

LECTURE NOTES

Chapter 2: Measurement of Macroeconomic Variables

1. The National Income Accounts

- National accounts: (1) production side and (2) income side
 - Income side measures the proceeds of the production side.
 - Production side = Income side
- Product side
 - GDP (Gross domestic product)
 - GNP (Gross national product)
 - For the U.S., $GDP \approx GNP$
- Income side
 - NI (National income)

2. Gross Domestic Product

- GDP “is a measure of all [domestically] currently produced final goods and services evaluated at market prices.”
 - Currently produced: A flow measure of output value per time period (quarter, year) of goods and services produced during this time period.
 - Exchange of already produced houses or cars do not enter GDP (already produced/measured)
 - Exchange of assets such as stocks or bonds do not enter GDP (no new production)
 - Final goods and services
 - The value of intermediate goods and services is already included in the value of final goods and services.
 - Two exceptions: (1) currently produced capital goods and (2) inventory investment.
 - Capital goods are only partially consumed in the production process (depreciation). $GDP - \text{depreciation} = \text{net domestic product}$
 - Currently produced goods (intermediate or final) that have not been sold. Because GDP measures the value of current production, this has to be included.
 - Clarification:
 - Intermediate goods: Consumed in the process of production (the flour used to bake a cake)
 - Factors of production: Not consumed, but depreciated, in the process of production; land, labor, and capital goods (the oven used to bake a cake)
 - Evaluated at market prices
 - Prices are the common denominator for all goods. Without prices GDP cannot be calculated. Therefore, non-prices goods (or unobserved activities) cannot be part of GDP (underground economy, environment, etc.)
 - In theory, an economy with n goods: $GDP = \sum_{i=1}^n p_i \cdot q_i$
 - Three goods economy example, let x , y , and z denote the three produced goods. Let production be $5x$, $10y$, and $20z$. Then GDP is:
 - $GDP = \frac{10\$}{1x} 5x + \frac{15\$}{1y} 10y + \frac{20\$}{1z} 20z = 10\$ \cdot 5 + 15\$ \cdot 10 + 20\$ \cdot 20 = 600\$$
 - **Remember: prices are ratios (not only a monetary value)!**
 - In practice: $GDP = C + I + G + (X - M) = \text{wages} + \text{rents} + \text{interests} + \text{profits}$
 - Real GDP: current production evaluated at constant prices
 - Nominal GDP (NGDP): current production evaluated at current prices
 - Expenditure approach: $GDP = C + I + G + NX$, where $NX = X - M$

- Consumption (C): household sector's demand for output for current use.
 - Durable goods (cars, TVs)
 - Non-durable goods (food, clothing)
 - Consumer services (medical services, haircuts.)
- Investment (I): purchases of the business sector plus residential construction (ie. houses)
 - Fixed investment
 - Residential construction
 - Inventories
- Government purchases (G): Current output that goes to the government (federal, state, and local)
 - Not all government expenditures are part of GDP
 - It has to be a currently produced good or service
 - Should not be a transfer such as Social Security (that's not production)
- Net exports (NX): Total exports minus imports
 - Exports add the current output that is consumed abroad (and therefore does not appear in C nor I).
 - Imports subtract the purchase of goods and services produced abroad.
 - Imports do not reduce GDP, it fixes its value to represent domestic output.
- What GDP is not?
 - Nonmarket product activities are left out
 - The underground economy is left out
 - GDP is a flow measure, not a stock measure. GDP is not a welfare (W) measure.
 - All else equal $\Delta W = GDP$
 - GDP is not intended to measure happiness

3. National Income

- $GNP =$
 $GDP + \text{foreign earning of U.S. residents and firms} -$
 $\text{earnings in the U.S. of foreign residents and firms}$
- National income is the earnings by the factors of production (land, labor, and capital) from current production
- $NI = \underbrace{GNP - depreciation}_{\text{net national product}} - \text{statistical discrepancy}$

4. Personal and disposable income

- Personal Income is the income received by persons (not firms) from all sources (not only wages -> different from labor income)
- Disposable Income is Personal Income after taxes
- $\text{Personal Income} = \text{National Income} - \text{income that is not received by persons (firm profits not distributed as dividends, employer retentions)} + \text{income received by persons from sources other than current output (ie. interests, dividends, transfers, etc.)}$
- $\text{Personal Savings} = \text{Disposable Income} - \text{Taxes} - \text{Consumption} - \text{Interest paid} - \text{Transfers to foreigners (net)}$

5. Some National Income Accounting Identities

- Simplifications
 - The foreign sector (NX) is omitted
 - Indirect taxes and other discrepancies between GDP and GNP are ignored, output (Y) equals income.
 - Depreciation is ignored, $GNP = NNP$
 - All business profits are paid as dividends, all taxes are assessed by the household.
 - Therefore, *personal disposable income* $= GNP - Tx + Tr$
 - Then, net taxes: $T = Tx$ (taxes) $- Tr$ (government transfers)
- $Y_D = Y - T$
 - Personal disposable income equals income (output) minus net taxes
- $Y = C + I_r + G$
 - $I_r = \text{realized investment}$ (different from desired investment)
- $Y_D \equiv Y - T \equiv C - S$
- $Y \equiv C + S + T$
- Because output equals income
- $C + I_r + G \equiv Y \equiv C + S + T$
 - Expenditures equals income
 - $I_r + G = S + T$
 - $G - T = S - I_r$

6. Measuring Price Changes: Real versus Nominal GDP

- GDP changes only when quantity produced changes
- NGDP changes when either quantity produced or prices change
- Let $t = 1 \dots T$ denote the years
- Let $t = 2$ be the base year.
- Let $i = 1 \dots n$ be the number of goods and services produced
 - $GDP_T = \sum_{i=1}^n p_{i,T} q_{i,T}$
 - $NGDP_T = \sum_{i=1}^n p_{i,2} q_{i,T}$
 - $GDP_2 = NGDP_2$
- Implicit GDP deflator: A price index that measures the prices of goods and services included in GDP
 - If $t = T$
 - $GDP \text{ deflator}_T = \frac{NGDP_T}{GDP_T} \cdot 100 = \frac{\sum_{i=1}^n p_{i,T} q_{i,T}}{\sum_{i=1}^n p_{i,2} q_{i,T}} \cdot 100 = \frac{p'_T q_T}{p_2 q_T} \cdot 100$
 - $GDP \text{ deflator}_2 = 100$ [note: there are no units associated to the GDP deflator]
 - GDP deflator measures accumulated inflation since the base year
- GDP deflator vs CPI
 - GDP deflator measures all prices
 - The prices weights in each price index differ. GDP deflator, depends on output. CPI, depends on household consumption
- Chain-Weighted Real GDP
 - Two problems with GDP (when looking at a time series)
 - The weights given to different sectors change. Goods and services produced in 1900 is significantly different from goods and services produced in the year 2000
 - Changes in relative prices affect consumption. For example, the fall in relative prices in computers shifts the expenditures of households (substitution and income effects)
 - The Chain-Weighted Real GDP solves these two issues by moving the base year. It is calculated as a growth rate, not as total value
 - Three steps:
 - Step 1: Calculate a Laspayre growth rate: $g_L = \frac{\sum_{i=0}^n q_{i,1} p_0}{\sum_{i=0}^n q_{i,0} p_0} - 1$
 - Step 2: Calculate a Paasche growth rate: $g_P = \frac{\sum_{i=0}^n q_{i,1} p_1}{\sum_{i=0}^n q_{i,0} p_1} - 1$
 - Step 3: Calculate the Chain-Weighted Real GDP: $g_{chained} = \sqrt{g_L g_P}$
 - Note. Apply log: $\ln(\sqrt{g_L g_P}) = \frac{1}{2}(g_L + g_P)$
 - The Chain-Weighted Real GDP is the average of two growth rates

7. The Consumption Price Index and the Producer Price Index

- CPI (Consumer Price Index) measures the retail prices of a fixed “market based” of several thousand of goods and services purchased by households
- Core-CPI is the CPI without the price of energy and food (commodities). This isolates CPI from prices defined in the international markets
- PPI (Producer Price Index) measures the wholesale prices of approximately 3,000 items. PPI includes intermediate goods
 - Movements in PPI may signal future movements in CPI

8. Measures of Cyclical Variation in Output

- Potential output is the level of output at the natural rate of unemployment of factors of production
- Business cycle is output fluctuations around potential output
 - Can output be more than potential output? Yes, because the natural rate of unemployment is more than zero
 - No unique way to “define” a cycle
 - Ex-post: You can measure peak-to-trough
 - Ex-ante: How do you know you’re in a recession?
- Remember: Economic growth is an increase in potential output (GDP) not an increase in output
 - After a crisis, an increase in GDP but not in potential GDP is economic recovery, not economic growth