Lecture Notes 4

Measurement Issues

In these notes I will review some basic concepts associated with measuring macroeconomic activity. Some of these terms have been used already; here I will be more precise about what they mean.
Gross Domestic Product

Gross Domestic Product (GDP) may be thought of in two ways.

First, it is a measure of the total income of all individuals in the economy.

Second, it is a measure of the total value of expenditures on goods and services in the economy.

These two measures must be equal. Why? The distinction between the two has to do with whether one measures output from the perspective of supply (the first definition) or demand (the second definition).
A more formal definition is given in Parkin (pg. 108)

“**GDP or gross domestic product** (GDP), is the market value of all final goods and services produced within a country in a given time period.”

This is a useful definition as it embodies several important features of national income accounting.

These are:
Issue 1: Market Value

Market value: market value means that individual goods and services are weighted by their market prices when computing GDP. This is what renders different goods and services “comparable” from the perspective of the national income accounts.

Notice that this creates some complexities if and when prices change.
One problem is inflation. If the price level moves up over time, then GDP will increase even though the goods and services that are produced remain the same.

Another problem is relative price change. If computers become less expensive over time and the quality improves, it may be difficult to compare GDP numbers at different years.

The former problem can be addressed more easily than the latter.
Why?

If the properties of a good are the same in 2005 and 2010, (think of a single grape) one can compare the prices and adjust for inflation. This is what is meant to measure things in 2000 dollars, for example. This leads to the difference between real and nominal GDP.

But if the properties of a good evolve, as occurs for computers, it is more difficult to determine how to measure price changes.

Silicon Valley joke: state of the art computer always costs $4000
Issue 2: Final Goods and Services

GDP is designed to measure the total value of all goods and services. But these values need to account for the fact that some goods are used to produce other goods. Suppose I purchase a car and a compact disk player. If I create a new good that consists of a car with a compact disk (CD) player placed on the front seat and sell it, how should the three items be incorporated into GDP?

If we count the bundled pair as part of GDP, then clearly, we cannot count the others.
The solution is to measure goods net of the goods that are used as inputs. This means that GDP measures *value added* across all goods and services.

So, the value added of the car+CD player depends on the difference between the price of two and price of the inputs, which will presumably be close to zero (assume I don’t need compensation for putting the CD player on the seat)

But if I install the cd player, then price of the car with installed cd player will exceed the price of each in isolation. This adds to GDP.
Alternative Ways to Think About GDP

1. Expenditure approach: expenditures on all final goods and services in the economy
2. Income approach: all incomes that are paid out. These include wages, interest, rent, corporate profits, proprietor income.

Wages are compensation for labor services

Interest is compensation for loans

Rent is for land, etc.

Corporate Profits included dividends and retained earning

Proprietor’s income covers owner operated firms
Related Definitions

1. **Gross National Product.** GNP is defined as is the total income of a nation’s permanent residents. This definition is different from GDP because it includes income earned in other countries by Americans and excludes income earned in the US by noncitizens.

2. **Net National Product** equals GNP less depreciation of the capital stock (equipment and structures)
3. **Personal Income** equals the income of households and nonincorporated businesses. The key here is to avoid measuring income of corporations that is retained by the corporations and not given to owners.

4. **Disposable Personal Income**: Personal income minus tax and other obligations (eg. fines) to the government. This is relevant for defining the income available for spending.

Comment: Different definitions are useful according to context. We will focus on GDP and to a lesser extent, disposable income.
Components of GDP

The following decomposition of GDP is very useful in studying macroeconomics. Define the following variables:

\[ Y = GDP \]
\[ C = \text{Consumption} \]
\[ I = \text{Investment} \]
\[ G = \text{Government Purchases} \]
\[ NX = \text{Net Exports} \]

Then,

\[ Y = C + I + G + NX \]

This is called the GDP identity.
Identities

When an equation is called an identity, that means that it “always” holds.

The GDP identity does not say that if the government chooses to increase $G$ by 1 unit that $GDP$ will rise by 1 unit in equilibrium.

What the identity states is that for a given level of output, there is a way to split it into 4 distinct parts.
To understand why an identity cannot tell us anything “substantive”, there is an identity that describes how much I spend on CD’s each year:

\[
EXP_{CD} = P_{CD} \times Q_{CD}
\]

For any level of expenditure, I can divide into price times. number of units Suppose at the price level \( P_{CD} = $15 \) I bought 20 CD’s. The identity tells us

\[
$300 = $15 \times 20
\]

If the price level rises to $1000 per CD, does this mean that I will spend $15000 on CD’s?
Of course not, the identity does not reflect my decisionmaking. If \( P_{CD} = \$1000 \), I may decided to buy 0 CD’s. The identity will still hold, i.e.

\[
0 = \$1000 \times 0
\]

If I am a music fanatic, I may buy 1 CD. The identity will still hold

\[
1000 = \$1000 \times 1
\]

The point to take home is that identities do not allow us to study counterfactuals, i.e. “what if” analyses.
Defining GDP Components

Consumption: Consumption measures the expenditures by households on goods and services.

Investment: Investment measures expenditures on goods that are used in production. It includes equipment, structures, and inventories. Housing is included here.
**Government Purchases**: Government purchases measure the total expenditures on goods and services at all levels of government: local, state, and federal. This does not include *transfer payments* such as social security which represent transfers to individual incomes but not any form of government consumption of goods and services per se.

**Net Exports**: Net exports equals the value of total exports (purchases by foreigners of American goods and services) minus total imports (purchases of foreign goods and services domestically)
Prices

Measuring the price level in the aggregate economy is complicated because of the many different goods and services that comprise GDP. Much interest exists in the overall price level and inflation, but it is important to observe that there are in fact millions of distinct prices that are involved in discussing these terms.
Consumer Price Index

The consumer price index (CPI) is the most commonly used measure of the price level. Its purpose is to provide a measure of the overall cost of goods and services; changes in the CPI in turn may be used to calculate the inflation rate.
The calculation requires several steps.

First, the Bureau of Labor Statistics (BLS) fixes a basket of commodities whose costs it will assess. The BLS uses survey data to construct a list of goods and services and associated quantities that make the basket representative.

Second, prices for each component of the basket are identified for each year. These number allow one to calculate the cost of the basket for a given year.

Third, one year is identified as a baseline; the cost of the basket is normalized to equal 100 for the year. Other years are measured relative to the baseline.
Why is the CPI used at all? After all, the calculation of nominal GDP would allow one to measure price levels as well.

In fact, a second measure of the price level that is often used by economists is the GDP deflator.

**GDP deflator.** The GDP deflator is defined as

\[
100 \times \frac{\text{nominal GDP}}{\text{real GDP}}
\]

where real GDP is measured in terms of some baseline year prices.
The answer is that the CPI measures prices as relevant to consumers as opposed to how prices as they impact the measurement of the value of all goods and services.

One example where they differ concerns the role of changes in import prices. Such changes affect the CPI but not GDP.
Inflation

Consider any measure of the price level at time $t$, denoted as $P_t$. Inflation between time $t$ and $t-1$, often denoted as $\pi_t$ is measured as:

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

It is thus the percentage change in prices between tomorrow and today.
Real and Nominal Interest Rates

One use of inflation measures arises in the analysis of interest rates.

Suppose that one is offered an asset that will pay off $100 + i_t$ dollars at time $t+1$ for every 100 dollars invested at time $t$.

The nominal interest rate on this asset is $i_t$

However, the real interest rate on the asset, denoted as $r_t$ is

$$r_t = i_t - \pi_{t+1}$$

Why does the difference between the real and nominal interest rates matter?
Real interest rates measure the return on assets in terms of what can be consumed, not in terms of dollars.

One asset that individuals hold is money.

What is the nominal interest rate on money?
Answer: 0

What is the real interest rate on money?
Answer: $-\pi_{t+1}$

What is the difference in real returns between the asset I described and money
Answer: $i_t - \pi_{t+1} - (-\pi_{t+1}) = i_t$

Message: for some purposes, individuals do care about nominal interest rates.