Lecture Notes 5

Macroeconomic Markets: Initial Ideas

In this lecture, I will begin to develop the modeling of macroeconomic markets. After some overview remarks, I will initially analyze the market for output.

As the course progresses, we will integrate financial and labor markets into the analysis.
Initial Ideas

As I have discussed, at an abstract level, short run macroeconomic models (i.e. models that are designed to explain the current level of economic activity) may be understood as models of three markets:

1. The market for output
2. The market for financial assets
3. The market for labor

What are the units in which prices are understood in each of these markets?
Prices and Quantities in the Output Market:

These have already been discussed; we measure the units and prices in ways discussed in previous lectures. The main issue here is aggregation across different types of goods and services.

Prices and Quantities in the Labor Market:

Labor may be measured in terms of hours worked, or in terms of workers; what is appropriate depends on context. (Firms find it easier to adjust hours than number of employees, so sometimes this will matter). The price for an hour of work is the real wage.
Prices and Quantities in the Money Market:

The market for money is a bit less directly defined. It is straightforward to discuss the idea that there is a supply and a demand for money. But what is meant by price in this market? After all, the price of a dollar bill is, by definition, 1!

The answer is that the money market is equilibrated by nominal interest rates. What do I mean by this? Suppose that an individual has a certain level of assets, with nominal value \( A \). We can think of him as facing a portfolio allocation decision, i.e. how much to hold in money and how much in bonds.
The nominal interest rate describes the rate of return differential between money and bonds. Nominal interest rates adjust to equilibrate these markets.

Of course, there are many other assets besides government bonds and money. However, for our purposes, it is sufficient to focus on these two.

We will discuss these other assets later in the course.
Interest Rates and Bond Prices

Before we continue, I want to clarify how interest rates may be interpreted as prices. Suppose that a bond exists that pays $1 at time $t+1$. It sells for price $P$ at time $t$. What is the nominal interest rate on the bond?

We can solve for the interest rate by recognizing that we can think of the bond as taking $P$ dollars at $t$ and paying $(1+i)P$ dollars at $t+1$. Further, we know that the bond by assumption pays $1$. Therefore the nominal interest rate is implicitly defined by

$$(1+i)P = 1$$
This equation may be rearranged, i.e.

\[ 1 + i = \frac{1}{P} \] so that

\[ i = \frac{1}{P} - 1 = \frac{1}{P} - \frac{P}{P} = \frac{1 - P}{P} \]

This makes intuitive sense; \( 1 - P \) is what one receives beyond the price of the bond at \( t + 1 \).

Notice that the price of bonds is inversely related to the interest rate.

This type of reasoning may be applied to more complicated assets.
How Are These Markets Interconnected?

The labor market is important in understanding the aggregate supply schedule.

Example 1: the quality of workers available to an economy will affect the location of the aggregate supply schedule.

Example 2: The sensitivity of supply to price will depend on how nominal wages adjust to prices.
The money market primarily affects aggregate demand

Example 1: optimal investment calculations are affected by interest rates.

Example 2: consumption/savings decisions are affected by interest rates.

Of course, one can also see how the money market can affect aggregate supply, since the capital stock of the economy is affected by investment decisions.

Describing all these interactions is complicated, so we start with the simplest specification of the output market.
Aggregate Output Determination

Using previous notation, we can think of the aggregate output market via an aggregate demand schedule

\[ D(P) \]

and an aggregate supply schedule

\[ S(P) \]

So, at first glance, the determination of the equilibrium price and quantity level in the macroeconomy is determined by the intersection of these schedules, as illustrated in Figure 1
Figure 1
Equilibrium in Output Market
Our objective will be to understand how aggregate demand and aggregate supply are determined and in particular, how this determination reflects interactions with the labor and money markets.

In order to do this, it is useful to begin by analyzing the level of output that is produced when prices are fixed.

This is an important deviation from standard micro modeling. Why do we want to do this?
Reasons Why Prices May be Rigid in the “Short Run”

1. Menu costs. Firms may face production costs if they want to change prices.

2. Preservation of customer loyalty. Firms may avoid frequent price adjustments in order to avoid the creation of incentives for its customers to search for lower prices at other firms.

3. Downward price rigidity induced by wage rigidity. If nominal wages are downward rigid, prices may reflect this because of cost plus pricing.

4. Ambiguity. Firms may not know what changes to make.
Suppose that the price level is fixed at a level higher than the equilibrium level. What happens?
One way to think about the problem of output determination when prices fail to equilibrate markets is that output is determined by the minimum of supply and demand. We draw on ideas that were reviewed in the discussion of price regulation.

Suppose that prices are fixed at $\bar{P}$. This means that aggregate demand is $D(\bar{P})$ and aggregate supply is $S(\bar{P})$. The short side rule says that the level of output in the market, $Y$ is determined by

$$Y = \text{minimum } \left( D(\bar{P}), S(\bar{P}) \right)$$
This short side rule says that no one is forced to produce or purchase more than he or she desires to. The short side of the market determines the level of output; the other side of the market is happy to accommodate that level (and in would like to do more!)

This is an appealing rule in that agents still maximize subject to constraints.

When applied to the case where the price level is higher than the equilibrium price level, output is determined by demand. This is illustrated in Figure 2.
Figure 2
Output Determined by Demand
This case, in which aggregate output is determined by aggregate demand, is the first one we will study.

To be clear, however, one should not assume that short run price rigidity is always a good assumption. In fact, some of the controversies in macroeconomics derive disagreements about the degree of price rigidity in the economy.

Comment: prices essentially adjust instantaneously in asset markets and slowly in labor markets (once per year? Think about labor contracts). Output prices are somewhere in between.
For completeness, we should also note that it is possible for output to be determined by the supply beside because prices are too low. This is illustrated in Figure 3.

This sort of case may be associated with rationing equilibria, as occurred in the Soviet Union.
Figure 3
Output Determined by Supply
Aggregate Demand

If prices are set above market clearing levels, then aggregate demand will determine the level of output. This will provide our first model of macroeconomic equilibrium.

For this model, we look at the output market in isolation. We take prices as *exogenous*, output is *endogenous*. 
The GDP accounting identity may be used to study how aggregate demand determines output. This identity is, following the last lecture

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

Recall that these components are

\[ C = \text{consumption} \]
\[ I = \text{investment} \]
\[ G = \text{government purchases} \]
\[ XM = \text{net exports} \]

Once we have a theory of how each of these components is determined, then we will have a theory of aggregate demand.
Feedbacks

For simplicity, we first consider the case where interest rates are fixed. This is again a simplification. Unlike the assumption that prices are rigid, assuming interest rates are rigid is a bad assumption, even in the short run. To the extent that individuals react to interest rates less quickly than changes in other variables then the assumption might not be so bad.

There is one variable that naturally affects each of the components of GDP and one that we cannot assume is constant—namely the level of output itself.
Why Would Each of the Components of Output be Functions of Output: Some Intuition

Consumption. The level of income is informative about the budget constraint an individual faces. Different theories exist about the nature of this relationship.

Investment. Investment may be related to income because of the links between capital accumulation and production requirements and because of expectations, i.e. higher income has implications for perceptions of the state of the economy in the future.
Government Spending. The level of government purchases may depend on taxes. One reason for this is political economy: governments may react to deficits caused by economic contractions by reducing expenditures.

Net exports. Export demand will be influenced by income in ways similar to consumption. One would expect net exports to decline when income is higher.
Equilibrium

These arguments imply that aggregate demand may be thought of via the equation

\[ Y = C(Y) + I(Y) + G(Y) + XM(Y) \]

This is no longer an identity. It is one equation in 1 unknown. Analysis of this equation will be the basis of the first macro model we study-the income/expenditure model.