Business Cycles: Financial Markets and Asset Pricing

Having studied economic growth, the class now turns toward an understanding of short run fluctuations in the macroeconomy, a field known as business cycles. Before focusing on the determinates of business cycles, however, it is useful to develop an understanding of two other types of markets: financial markets and money. These notes focus on the former. In particular, we are interested in how different assets are priced and how these assets interact with the conduct of fiscal and monetary policy.

Bonds

Firms and governments borrow by issuing bonds. There are many types of bonds. For now, consider the following example: A bond promises to pay $1 to the holder in one year. Denote the price of this bond as P_b, the subscript contrasting this price to the overall price level. The price of the bond allows us to calculate the bond yield, denoted y_t:[1]

$$P_b = \frac{\$1}{1 + y_t} \tag{1}$$

The bond yield is a type of interest rate. To see this, suppose that $P_b = \$0.80$. Using (1), we see that the bond yield is 25%. If I purchase 1000 of these bonds ($800 worth), hold them for a year, and if the issuer does not default, then I collect $1000 in one year.

Bonds may be of different terms (time until maturity). Now suppose that a bond promises to pay $1 in two years. The bond yield is now defined as:

$$P_b = \frac{\$1}{(1 + y_t)^2} \tag{2}$$

Because this bond has a different term, y_t is a different interest rate than (1). Were I to save $1 at y_t, I would yield $\$(1 + y_t)$ after one year and $\$(1 + y_t)^2$ after two years.

It is often useful to examine the *yield curve* which simply shows different bond yields for different terms. Doing this allows us to examine expectations of future interest rates. Suppose for example that the same bond issuer offers one and two year bonds and that the risk of default is zero. I want to save my wealth for two years through this issuer. I have two options:

i. Buy the two year bond. In this case, the bond yield is determined by (2). The return on $1 is $\$(1 + y_{2,t})^2$. The expanded subscript indicates the bond's term.

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[1]Be careful to note that in this context, y does not indicate per capita output as it did earlier in the class..

ii. Buy one year bonds twice. After one year, I return $\$(1 + y_{1,t})$. I then re-invest this amount. I do not know, however, what the next period's bond yield is going to be. I can only form an expectation, a guess at the true bond yield. We will often denote an expectation with a superscript e. The term $y_{1,t+1}^e$ is therefore the expected bond yield (for the one year bond) one period in advance. My expectation of the return after two years is thus $\$(1 + y_{1,t})(1 + y_{1,t+1})^e$.

In this example, I only care about the two year return. The expected return for both options should therefore be the same.

$$(1 + y_{2,t})^2 = (1 + y_{1,t})(1 + y_{1,t+1})^e \tag{3}$$

This is known as an *arbitrage condition*. Suppose that the right hand side of (3) were greater than the left hand side so that two one year bonds offered a better return than one two year bond. In this case, savers would flock to one year bonds and shun two year bonds. Extra demand would drive the price of one year bonds up, and using (1), the bond yield down. Likewise, diminished demand for two year bonds would reduce their price and using (2), increase their yield. This arbitrage process should equalize the two returns.[2]

Suppose we look at the yield curve and observe that $y_{2,t} > y_{1,t}$. Using (3), it must be the case that $y_{1,t+1}^e > y_{1,t}$. Bond markets thus expect short run (1 year in this example) interest rates to increase. The yield curve is upward sloping.

The current yield curve is upward sloping. Short term riskless interest rates are near zero. 10 year interest rates, however, are about 3% at the time of my writing these notes. This suggests that bond markets expect rates to increase (they can't decrease) over the next ten years.

Finally, consider a 30 year bond. The bond yield is now:

$$P_b = \frac{\$1}{(1 + y_t)^{30}} \tag{4}$$

Macroeconomists are often interested in the short term riskless interest rate, the rate on savings if there is no chance of default. Throughout the class, we will denote this variable as i_t. There is no such thing as a fully risk free asset.[3] Typically, economists have relied on the bond

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[2]In reality, these returns need not be exactly equal. If savers do not like the uncertainty (they are "risk averse") of relying on the expected yield, then they may require a higher yield to choose the second option. It is also possible that the risk of default may be greater under the first option, which would require a higher yield.

[3]For example, all bonds will default if the Earth is destroyed by a comet. Such an event, however, does not affect the due date for any homework assignments in this class.

yields of U.S. Treasury Bonds as essentially risk free.[4] The U.S. Federal Government routinely spends more than it collects through taxation and other revenue sources. The difference each year (the budget deficit) is borrowed through new issues of Treasury Bonds. Although there are some some other methods of borrowing, the bulk of Federal debt consists of outstanding Treasury Bonds.

The market for U.S. Treasury Bonds may be modeled using simple supply and demand.

Graph: Bond Market

The U.S. Treasury Department supplies these bonds, and the position of the supply curve primarily depends on the size of the current budget deficit. Demand for Treasuries comes from agents looking to save without assuming much risk. The largest source of demand is from U.S. households. Foreigners and other parts of the government (*e.g.* The Federal Reserve, Medicare, Social Security, and Medicaid) also contribute to this demand. Suppose that a spike in the budget deficit increases supply. This change, all else equal, reduces bond prices driving up the interest rate (bond yield).[5] Increased demand has the opposite effect.

Other governments (foreign, state, and local) may issue bonds as well. Often, these bonds are perceived as riskier than Treasuries, meaning that there is a higher likelihood that the holder may not receive all of the face value of the bond. As a bond becomes riskier, it must offer bond holders a higher yield to compensate them for that risk. As of August 2011, for example, Ireland must pay interest rates over 10% on its bonds due to an elevated default risk.

Corporations also borrow through bond issues. Some corporate bonds are almost as risk

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[4]Treasury Bills are the same thing as Treasury Bonds, but refer to terms of 3 months or less.

[5]This is why most macroeconomists worry about excessively large budget deficits. The current large deficits, however, have not yet had this effect, probably because demand has also increased as investors seek safe assets instead of more volatile stocks.

free as Treasuries and the bond yield may therefore be close to i_t. Other corporate bonds are much riskier. Very risky bonds are sometimes called *junk bonds*. These offer very high yields. Corporate bonds are an example of *commercial paper*.[6]

Bonds and Financial Crises

The United States government does not directly make interest payments to its creditors. Instead, it repeatedly rolls over ts debt by issuing new Treasuries. Suppose for example, that $8 billion (face value) of Treasuries are maturing in a given month. Further suppose that the price of one year, $100 Treasuries is $80. In order to pay off these maturing bonds, the government will have to issue and sell $8 billion worth of bonds with a face value of $10 billion. As time passes, the nominal value of the debt increases thorough this process. If interest rates are higher, then bond prices are lower, the face value of $8 billion worth of bonds is greater, and debt accumulates faster. Many corporations borrow in this same manner.

Many financial crises occur when a borrower is suddenly unable to continue to rolling over its debt through the issuance of new bonds. When a government is unable to further roll over its debt, it has three main options: 1) default, 2) abruptly balance its budget through higher taxes or lower government spending, 3) print money. As we will see later in the course, all of these may have serious adverse consequences.

When a private firm is no longer able to roll over its debt, it may fail. A recent example of this type of failure is Lehman Brothers in September 2008. As we will discuss later in the class, this event is often seen as the defining event of the recent financial crisis and recession.

There are three major ratings agencies which evaluate the riskiness of various types of bonds. In the Summer of 2011, one of these (Standard and Poors) downgraded U.S. Treasuries from its highest rating of AAA, to its second highest rating of $AA+$. This was done as a result of increased concern over long run debt to GDP ratios, as well as an increase on the part of American policymakers to consider defaulting on the U.S. national debt. Most experts still view Treasuries as very low risk bonds, but this downgrade does suggest that their riskiness has increased.

Stocks

Stocks represent ownership of a firm. Saving (remember that investing has a different meaning in macroeconomics) by acquiring stocks entails additional risk beyond buying a nearly

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[6]Those of you going to law school will learn to hate this term with every fiber in your being.

riskless bond. As a result, the expected return on a stock is higher in order to compensate the shareholder for this risk. The difference in expected returns is known as the *equity premium.* Economists have struggled to explain why the equity premium is as high as it is.

We will briefly develop a simple model that allows us to price a risky asset. This model yields the *fundamental value of an asset.* An asset may offer the holder a fundamental return in a given period. For a stock, the fundamental is a dividend payment, often a share of firm profits.[7] For residential housing, the fundamental is the utility that a household gets from living in the home. Denote the fundamental of the asset in period t as γ_t.

The asset holder has the option to hold the asset for one period and then sell it. If she does this, then she obtains the fundamental in period t, plus the sale price in period $t+1$. She does not know this price, however, she must rely on her expectation. denote this expected price as $E_t[s_{t+1}]$, the expectation in period t, of the share price, s, in period $t+1$.[8]

Suppose that this asset holder saves $\frac{E_t[s_{t+1}]}{1+i_t}$ in period t at the risk free interest rate, i_t. When period $t+1$ arrives, she yields $E_t[s_{t+1}]$. The *expected present discounted value*, the market price of the fundamental, is thus $\frac{E_t[s_{t+1}]}{1+i_t}$. This is known as discounting. One dollar tomorrow is worth less than one dollar today. Our theory posits that the price of this asset should be the fundamental plus the expected present discounted value of the nest period's asset price:

$$s_t = \gamma_t + \frac{E_t[s_{t+1}]}{1+i_t} \tag{5}$$

Equation (5) is rather intuitive. It simply equates the cost of the asset (its price) to all of the discounted benefits that the owner will receive if she sells it in period $t+1$.

Now suppose that this asset holder is trying to form an accurate expectation of the next period's share price. Suppose that she understands (5). Then she may also understand that this relationship must also be true if we move all variables up one period:

$$E_t[s_{t+1}] = E_t[\gamma_{t+1}] + E_t[\frac{[s_{t+2}]}{1+i_{t+1}}] \tag{6}$$

Assuming that the asset holder is not Miss Cleo, she cannot see the future and must rely on expectations of all future variables. Combining (5) and (6) yields:

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[7]Traded firms usually do not pay of their profits as dividends. Some or all profits may be used to expand the firm. Other firms pay dividends even when they lose money, these must come out of assets or increased debt. In theory, it should not matter whether profits are dispensed as dividends or retained.

[8]This is a more precise way of denoting expectations than using the superscript e. It allows us to denote when the expectation was formed. When this information is important, it is better to use this notation.

$$s_t = \gamma_t + \frac{E_t[\gamma_{t+1}]}{1+i_t} + E_t\Big[\frac{[s_{t+2}]}{(1+i_t)(1+i_{t+1})}\Big] \tag{7}$$

This process is known as iterating forward. And the best part is that we can do it a million times if we want to. Supposing that we do it forever, we get the assets fundamental value:

$$s_t = \gamma_t + E_t\Big[\frac{\gamma_{t+1}}{(1+i_t)}\Big] + E_t\Big[\frac{\gamma_{t+2}}{(1+i_t)(1+i_{t+1})}\Big] + ... \tag{8}$$

The price of an asset is the discounted stream of fundamentals going infinitely far into the future. For a stock, this is the stream of dividends. For a house, it the stream of utility that its residents obtain. According to this theory, if a stock does not currently pay a dividend, it can only have a positive price if the market expects it to start doing so in the future.

Most economists believe that this theory is accurate in the long run; asset prices eventually return to their fundamental values. In the short run, however, asset prices do not always equal their fundamental values. This results in excess volatility in financial markets, although it is difficult to predict and profit from this volatility. Occasionally, asset prices remain above their fundamental values for a sustained of time. These are known as *speculative bubbles*. Recent speculative bubbles include technology stocks in the 1990s and real estate from about 2003-2007. When these bubbles burst and asset prices fell toward their fundamental values, a recession ensued in both cases.

Stock Prices and the State of the Economy

Stock prices are positively correlated with the state of the macroeconomy. When economic growth is strong, stock prices tend to increase and when growth is poor, stock prices tend to suffer. Stock prices are, however, a mediocre measure of overall economic health. There are plenty of instances where the stock market declines when the state of the economy improves and vice-versa. So does a better stock market cause a better macroeconomy or does a better economy cause higher stock prices? The answer is probably both.

The main mechanism by which the economy affects the stock market is straightforward. The fundamental value of a stock is the discounted stream of dividends. Dividends are closely related to corporate profits, a variable that is positively correlated with economic growth.

It is less obvious how stock prices affect the economy. We will consider three such mechanisms:

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1. Stocks are part of the net worth of the households that own them. Suppose that you suddenly owned $2,000,000 in stocks. I suspect that you would increase your consumption. There is considerable evidence that aggregate consumption, as well as expenditures on new housing, increase along with net worth.

2. Firms can raise capital by issuing new shares. This is one method by which they can finance investment, a component of national income. Lower stock prices make raising capital in this manner less effective.

3. Lower stock prices may reduce consumer confidence which then reduces consumption and investment.

Most macroeconomists believe that most movements in the stock market follow the economy. Rarely, however, major declines in stock prices (often through the bursting of a speculative bubble) have major effects on the economy. The technology stock bubble of the 1990s is one such example. The Great Stock Market Crash of 1929 is another, although the popular memory of that crash as the single greatest cause of the Great Depression is likely erroneous.