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Exercise: A Components Model of Interest Rates

Due: October 26, 2006

There are thousands of debt instruments trading daily in U.S. financial markets. For each instrument, one can compute a yield to maturity. There are thus thousands of interest rates determined by financial markets every day. Yet economists often use the expression "the rate of interest" as if there were a single rate determined by credit markets.

In this exercise you will: (1) Use a components model of interest rates to explain why interest rates move together; (2) Explain what sort of events can cause interest rate differentials to increase and decrease; (3) Determine whether data for U.S. interest rates support or contradict the components model.

The Components Model

Let R (i, t, m) be the nominal yield to maturity at time t of debt instrument i that matures in m periods. If we vary index "i" while holding m and t unchanged, variation in nominal yields is due to differences in the properties of the securities. If we vary index t while holding i and m unchanged, variation in nominal yields is due to changes in market conditions that occur over time. If we vary index "m" while holding i and t unchanged, variation in nominal yields is due to agent forecasts of future market conditions and variation in the willingness of agents to hold longer maturity debt.

The components model for interest rates says that most variation in interest rates can be attributed to variation in three components that all interest rates share: The components are:

$r(t)$	=	the real rate of interest (the price of patience)
$\mathbf{A}(t, m)$	=	the rate of inflation expected between time t and time t+m
$\mathbf{D}(i, m)$	=	the risk premium associated with instrument type and maturity

The components model for interest rates is embodied in the following equation.

$$R(i, t, m) = r(t) + \mathbf{A}(t, m) + \mathbf{D}(i, m) + \boldsymbol{\varepsilon}(i, t, m)$$

where $\boldsymbol{\varepsilon}(i, t, m)$ is an idiosyncratic component that accounts for specific features of the debt instrument such as whether or not its interest payments are taxable income.

The inflation component captures the effect on nominal yields of changes in the expected rate of inflation. The risk component captures the effects of differences in default risk and interest rate risk. Default risk is the risk that a borrower will not pay the full amount owed. Interest rate risk is the risk that interest rates may change in a disadvantageous way after a bond is purchased. For the model to be useful, it must be the case that the idiosyncratic component is small for most yields. Put another way, the components model will only be useful if the three components account for most of the variation in yields.

Exercise

I have placed on the course web page and emailed to each of you an excel work book that contains data on nine different measures of the interest rate. These are:

Three-month Treasury Bill Yield
Yields on Five, Ten, and Twenty Year Treasury Bonds
The Yield on Thirty Year Mortgages
The Yield on Inflation Indexed Bonds
Moodys AAA and Baa Yields
The Prime Rate

I also include data on the consumer price index and CPI inflation.

Please do the following and bring your results to class on October 26, 2006. We will discuss your results in class.

1. Make sure you understand what security underlies each of the nine measures of the interest rate. If necessary, use your text or online resources to complete your understanding.

2. According to the components model, some of the components should play a larger roll in explaining variation in some yields than in others. For example, one would expect that risk premia play a larger roll in explaining the twenty year Treasury Bond Rate than in explaining the Three-month Treasury Bill yield. Before you look at the data, write down your hypotheses of which components should be most important in explaining variation in each of the nine yields.

3. Use the data to test your hypotheses. I am not asking for a formal test. I am asking for you to check whether the data seem to confirm or contradict the hypotheses you set out in part two.

4. Do the interest rate data support or contradict the components model itself? Why or why not? How do you know?

    a. What evidence is present in the data for the existence of an inflation component?
    b. What evidence is present in the data for the existence of a risk component?
    c. Does the data suggest much variation in the real rate component? Why or why not?

5. Write a two page report on the results that you obtain in completing this exercise. Turn the report in at the beginning of class on October 26.