PROJECT TEMPLATE: MUNICIPAL BOND SPREADS

Municipal bond yields give data for excellent student projects, because federal tax changes in 1980, 1982, 1984, and 1986 affected the yields. This project template for municipal bond spreads suggests ideas for a student project. We focus on the statistical analysis. You do not need to know corporate tax law to complete this student project.

Step #1: Define the Spread

You can define the municipal bond spread two ways for the student project:

~ Municipal bond yield minus Treasury bond yield (for bonds of similar duration): This spread is negative, since the tax advantage of municipal bonds outweighs their higher risk.
~ Municipal bond yield minus corporate bond yield for bonds of equivalent grade: This spread is more negative, because corporate bonds have higher yields than Treasury bonds.

You can use either definition. The first definition is more common; the second definition adjusts for economic conditions that widen or narrow the spread.

If you prefer to work with positive figures, use the Treasury bond yield or the corporate bond yield minus the municipal bond yield.

Take heed: Examine if a multiplicative spread is more stable than an additive spread. Either type of spread is fine for the student project.

The spread reflects tax law, which is a multiplicative factor applied to the pre-tax yield. The tax advantage is twice as great when the pre-tax yield is 12% as when it is 6%. You may use multiplicative spreads or spreads of the logarithms of the yields. No method is perfect.

We do not tell you the optimal way of forming the spread to get a stationary time series. You may try two methods and compare their correlograms.

Financial economists do not agree on the best definition of the spread. You might use a simple additive spread or a multiplicative spread. Ideally, use a method that gives a stationary time series.

Step #2: Graph the Spread

Using a spread offsets the distorting effects of changing inflation rates and interest rates. The changing trends, means, and volatilities of interest rates don't appear in the spreads. This makes the modeling easier. An AR(1), AR(2), MA(1), or ARMA(1,1) process should fit well.

Step #3: Spread Eras

Tax law relating to municipal bond yields changed in 1980, 1982, 1984, and 1986. A time series spanning all years is not stationary, since the spread narrowed between 1980 and 1986.

Your student project can examine the graph of the full series and fit an ARIMA process to one time period. You can also compare the ARIMA process for pre-1980 vs post-1986.

~ In 1986, the corporate tax rate declined from 46% to 35%, reducing the tax advantage of municipal bonds, and raising the required yield on municipal bonds.
~ Tax law changes in 1980, 1982, and 1984 eliminated almost all the tax advantages for commercial banks. Banks bought over 50% of municipal bonds before 1980, but they buy about 1% now. The elimination of the tax advantage for commercial banks raises the required yield on municipal bonds.
~ Tax law changes in 1986 reduced by 15% the tax advantage for property-casualty insurance companies, who had been the second largest clientele for these bonds before 1980 and the largest clientele after 1984. They remain the primary clientele even now, since other investors have less use for these bonds. The reduction in their tax advantage raises the required yield on municipal bonds.

Step #4: Fit ARIMA Processes

Fit an ARIMA process to (i) the years before 1980 and/or (ii) the years after 1986.

Use the NEAS step-by-step guide on the discussion board. Some items are simpler for municipal bond spreads.

Seasonality has almost no effect, for three reasons:

~ The FED adjusts the money supply to remove the seasonality in short rates.
~ Long duration rates smooth any remaining seasonality.
~ The spread eliminates any seasonality that survives the smoothing.

The trend of interest rates is much reduced in the spreads and may not appear at all. The reduction (or elimination) of the trend differs for additive vs multiplicative models. Using an additive model on the logarithms of the rates gives a multiplicative model.

Taxes are multiplicative, but they apply only to the interest component of the rate. If the pre-tax yields of two bonds are 20% and 30%, for a 10% difference, the after-tax yields are 13.0% and 19.5%, for a 6.5% difference. If the 20% bond is tax exempt, the after-tax difference is –0.5%.

For the student project, think through how the municipal bond tax exemption might be modeled as a function of the municipal bond pre-tax yield. Instead of fitting an ARIMA process to the municipal bond spread, a financial economist might fit the process to the difference between the spread and the tax exemption. Do not worry about the optimal method. Explain what you do and show how you use the statistical tools.

Financial economists do not agree on the best way to define the spread or model the spread. For the student project, you can use a simple additive model or a complex multiplicative model using differences between the spread and the tax exemption.

The optimal ARIMA process depends on your definition of the spread. A simple additive model shows a discrete jump in 1986 to 1987. If you use monthly rates, the jump occurs on August 6, 1986. Examine your graph of the spread, identify the eras, choose the time period or periods you will model, and fit ARIMA processes.

Step #5: Compare the Processes

The pre-1980 and post-1986 eras have different means. You can compare the means and relate them to the tax advantages in the two eras. The tax law is intricate, and the student project is not graded on your analysis of tax law. We examine if you properly apply the statistical techniques to fit an ARIMA process to the spreads.