Interest Rate Shock Model

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What is the *Interest Rate Shock Model*?

It's a multi factor model with only two factors: the benchmark (B) and the bond index (F for factor):

$$r_t = \alpha + \beta_B r_{B,t} + \beta_F r_{F,t} + \theta_t$$

Anyone familiar with the CAPM model might recognise this formula if we drop the F term: $r_t = \alpha + \beta_B r_{B,t} + \theta_t$

For every stock, I run a **multilinear regression** using three years of weekly historic data to determine the values of α and the two β's. (The θ_t is a residual term which we assume will always average out to zero. The α ought to be very close to zero.)

The result is a simple linear model where, if we plug in returns of the factors, we get an estimated return of the stock.

The factors and the shock parameter

For the benchmark, I use the *MSCI AC World* total return index.

For the bond, I use the total return of the *Citigroup US Broad Investment-Grade Bond Index* (as does Northfield).

For the yield, I use the *U.S. 10y Treasury Yield*.

When I shock the yield (by increasing it by 100 bp), I actually compute the return of the latest yield:

$$3.39\%/2.39\% = 1.41841$$

How yield changes affect bonds

Changes in yield (which I compute as *arithmetic returns*) are highly correlated to bonds: saying "The *(return of the)* yield goes up $x\%$" is almost the same as saying "The bond index goes down $-0.096x\%$":

bond vs yield, r–squared = 0.92, beta = –0.096
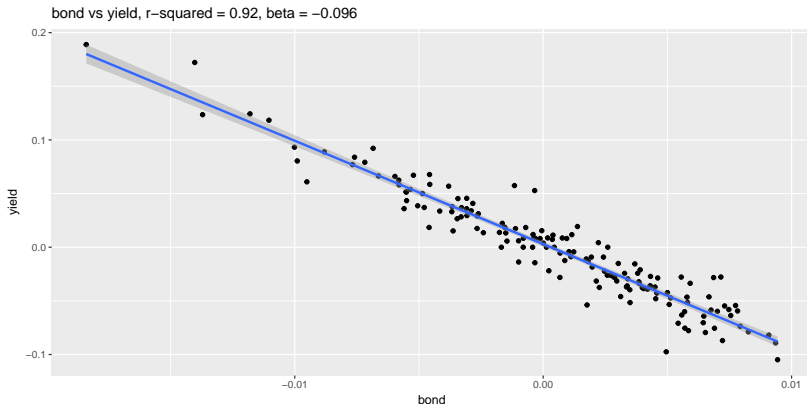
How yield changes affect benchmarks

TO DO 1: Show the bond vs yield regression chart

TO DO 2: "Don't forget correlation". This will get more complicated as the number of factors blows out.

Slide with Bullets

- Bullet 1
- Bullet 2
- Bullet 3

Slide with R Output

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Slide with Plot