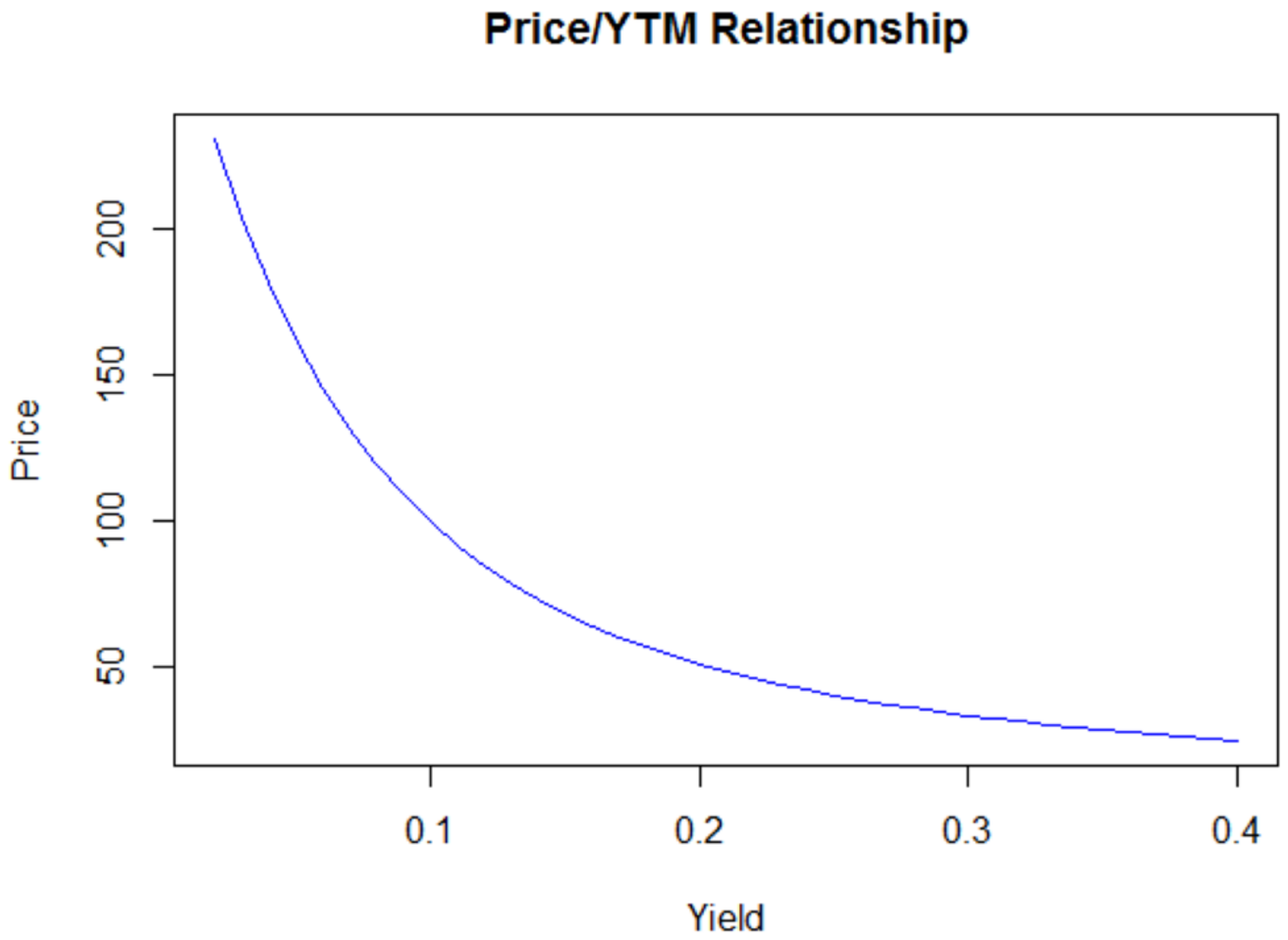
BOND VALUATION AND ANALYSIS

Price/Yield Relationship

Inverse Relationship



Credit Ratings

	S&P	Fitch	Moody's
Investment Grade	AAA	AAA	Aaa
	AA	AA	Aa
	A	A	A
	BBB	BBB	Baa
High Yield	BB	BB	Ba
	B	B	B
	CCC - Lower	CCC - Lower	Caa - Lower

Determining a Bond's Yield

- Use yields of bonds with same credit rating
- If we want to value a Baa-rated bond, we can get the data from `Quandl` package

```
> library(Quandl)
> baa <- Quandl("MOODY/DBAAYLD")
> head(baa)

        DATE VALUE
1 2016-10-07  4.36
2 2016-10-06  4.36
3 2016-10-05  4.36
4 2016-10-04  4.35
5 2016-10-03  4.29
6 2016-09-30  4.29
```

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Let’s practice!

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Components of Yield

Baseline Component of Yield

- Risk-free yield (baseline rate)
  - Yield on recently issued US Treasury with similar maturity
- Risk-free yield is not constant
  - Affected by economy, market interest rates, and inflation

Obtaining Treasury Data

- Use quantmod package
- Obtain 10-Year Treasuries ("DGS10") from FRED


```
> library(quantmod)
> t10yr <- getSymbols("DGS10", src = "FRED", auto.assign = FALSE)
> head(t10yr)

            DGS10
1962-01-02  4.06
1962-01-03  4.03
1962-01-04  3.99
1962-01-05  4.02
1962-01-08  4.03
1962-01-09  4.05
```

Spread Component of Yield

- Spread
  - Primarily the **credit spread** = risk that issuer will default
  - May contain premiums for other risks

Risks of Investing in Bonds

- **Credit Risk:** Risk of default by issuer
- **Inflation Risk:** Risk that inflation eats up value of cash flows received from bond
- **Call Risk:** Risk that issuer will buyback the bond at a time that is disadvantageous to the investor
- **Liquidity Risk:** Risk that you cannot sell the bond for a price that is at or near its value

Time-Varying Risk Premiums

- Depends on market's current appetite for risk
  - Nervous markets ⟶ larger risk premium
- One measure is Investment Grade spread (i.e., difference in Baa and Aaa yields)
- We can obtain Moody's Aaa and Baa Index yields from the `Quandl` package

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Estimating the Yield of a Bond

Finding the Yield By Trial-and-Error

- For traded bonds, we can imply the yield
- If you know the price and the bond's cash flows, you can make "guesses" as to what the yield is
- The "correct" yield equates the **price of the bond** with the **PV of the bond's cash flows**

Iterating Through Different Guesses

- Consider bond with $100 par value, 5% coupon rate, 10 years to maturity, and a price of $92.64
- **1st Guess:** 5% ⟶ Price is $100 (too high)
- **2nd Guess:** 7% ⟶ Price is $85.95 (too low)
- **3rd Guess:** 6% ⟶ Price is $92.64 (correct)

Automating the Process

- Trial-and-error is inefficient
- Fortunately, we can use the `uniroot()` function in R to help us automate the process

Create Function Using uniroot()

```
> ytm <- function(cf) {
    uniroot(bval, c(0, 1), cf = cf)$root
  }
```

- Create the `ytm()` function using `uniroot()`
- Function takes a modified cash flow vector (`cf`) and uses a modified bond valuation function (`bval`)
- `c(0,1)` limits the interval for the search to a yield between 0% and 100%

Modified Cash Flow Vector

```
> cf <- c(-92.64, 5, 5, 5, 5, 5, 5, 5, 5, 5, 105)
```

- First element is bond's price **entered as a negative number**
- Second element onwards are the bond's cash flows - coupons plus par value
- Same bond: Price is -$92.64, par value is $100, 5% coupon rate, and 10 years to maturity

Modified Bond Valuation Function

```
> bval <- function(i, cf,
      t = seq(along = cf))
      sum(cf / (1 + i)^t)
```

- Need to create bond valuation function `bval()` that uses the modified cash flow vector (`cf`)
- Same logic as our `bondprc()` function
- Create time indicator (`t`)
- Discount cash flow using interest rate (`i`)

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