Part I: Checking the Data

EQUITY VALUATION IN R

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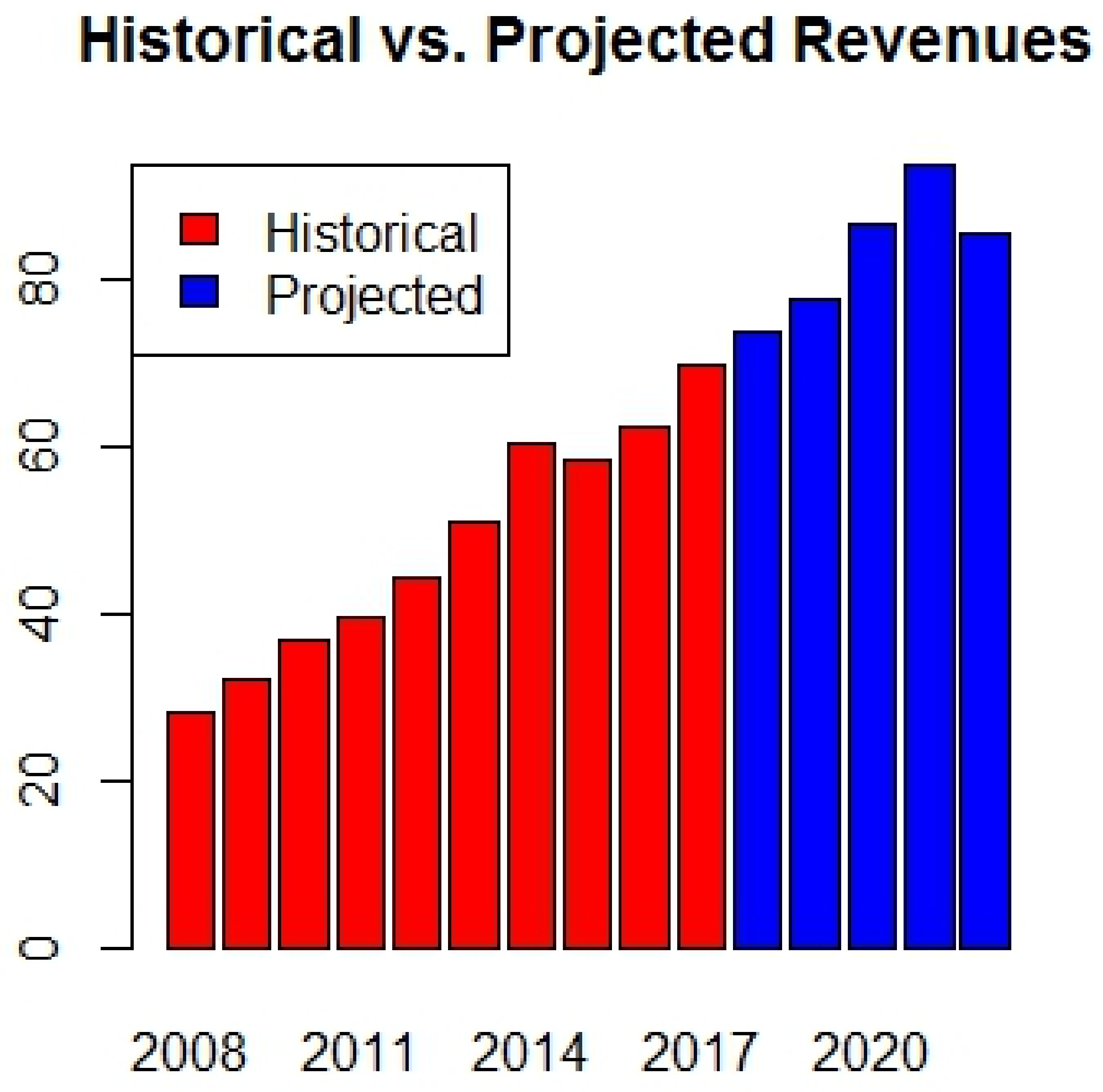
Importance of Checking Projections

- Garbage-In $\rightarrow$ Garbage-Out
- You have to get comfortable with all elements of the projections
- Most elements are modeled as a percentage of revenues or percentage of change in revenues

Visually Inspecting the Data

```
# Create two vectors: one for historical (hist) revenues
# and another for projected (proj) revenues
hist <- c(28.4, 32.2, 36.8, 39.8, 44.3, 51.1, 60.4,
            58.4, 62.5, 69.9, rep(0, 5))
proj <- c(rep(0,10), 73.7, 77.8, 86.8, 93.6, 85.3)
rev_all <- rbind(hist, proj)
colnames(rev_all) <- seq(2008, 2022, 1)
# Create bar plot of revenues data
barplot(rev_all, col = c("red", "blue"), main = "Historical vs. Projected Revenues")
legend("topleft", legend = c("Historical", "Projected"), fill = c("red", "blue"))
```

Bar Plot


Historical vs. Projected Revenues
Historical
Projected
0
20
40
60
80
2008
2011
2014
2017
2020

Using Trend Analysis

```
# Create one vector of historical and projected revenues
rev <- data.frame(c(28.4, 32.2, 36.8, 39.8, 44.3, 51.1, 60.4,
                    58.4, 62.5, 69.9, 73.7, 77.8, 86.8, 93.6, 85.3))
rownames(rev) <- seq(2008, 2022, 1)
names(rev) <- "rev"
# Add trend and shift variables
rev$trend <- seq(1, 15, 1)
rev$shift <- c(rep(0, 10), rep(1, 5))
```

```r
reg <- lm(rev ~ trend + shift, data = rev)
summary(reg)
```

```
# Call:
# lm(formula = rev ~ trend + shift, data = rev)
#
# Residuals:
#     Min      1Q  Median      3Q     Max
# -7.2232 -1.5508 -0.2843  0.7700  5.6184
#
# Coefficients:
#             Estimate Std. Error t value Pr(>|t|)
# (Intercept)  23.4011     2.2066   10.61 1.89e-07 ***
# trend         4.5416     0.3511   12.94 2.09e-08 ***
# shift         0.9978     3.2179    0.31    0.762
# ---
# Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
#
# Residual standard error: 3.377 on 12 degrees of freedom
# Multiple R-squared:  0.9777,    Adjusted R-squared:  0.974
# F-statistic: 263.3 on 2 and 12 DF,  p-value: 1.222e-10
```

Let's practice!

EQUITY VALUATION IN R

Part I: Checking the Perpetuity Growth Rate

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Checking the Perpetuity Growth Rate

Perpetuity Growth Rate (PGR) is a ***sustainable growth rate***

- It cannot be greater than the overall growth rate of the economy
- It is a growth rate that is financed by the operations of the firm

Determinants of the Perpetuity Growth Rate

The PGR is bounded by the following relationship:

PGR = Reinvestment Rate * Return on Equity,

where

- Reinvestment Rate = (CapEx + Incr. in WC - D&A) / After-Tax Income
- Return on Equity equals the Cost of Equity in steady-state

Example

Suppose you have a firm with a reinvestment rate of 20% and an ROE of 10%. Can the firm sustain an assumed PGR of 4%?

```
reinvestment <- 0.20
roe <- 0.10
reinvestment * roe
```

```
0.02
```

```
pgr <- 0.04
pgr / roe
```

```
0.4
```

Let's practice!

EQUITY VALUATION IN R

Part II: Dividend Discount Model

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Single-Stage Dividend Discount Model

There are two types of stocks firms issue: preferred stocks and common stocks

Many preferred and common stocks pay dividends

- Dividends are typically the "cash flows" that investors receive from holding stocks
- We can then discount this stream of dividends to value the stock

Discounting Dividends

Constant Dividend Stream

$$V = div_{t+1}/k$$

Suppose div_{t+1} = $\$50$ and k = 6.25%.

```
div <- 50
k <- 0.0625
div / k
```

```
800
```

Dividend with Constant Growth

$$V = div_{t+1}/(k - g)$$

Suppose div_{t+1} = $\$50$, k = 6.25%, and g = 2%.

```
div <- 50
k <- 0.0625
g <- 0.02
div / (k - g)
```

```
1176.471
```

Two-Stage DDM - No Dividends During First Stage

- You can still use a DDM even for firms that do not currently pay dividends
- Firms with high growth may not pay dividends now, but one can reasonably expect the firm's growth to slow down and begin paying dividends at some point in the future

What to do then?

- Use a 2-stage Model
  - 1st stage: No dividends for T years
  - 2nd stage: Expect firm to pay dividends beginning Year T + 1

Mathematically:

$$V = 0 + (div_{T+1}/(k - g)) * (1/(1 + k)^T)$$

Example

Year	1	2	3	4	5	6	7	...
Dividends	0	0	0	0	0	$50	$51	...

```
div6 <- 50
g <- 0.02
k <- 0.0625
0 + (div6 / (k - g)) * (1 / (1 + k)^6)
```

```
817.7253
```

Let's practice!

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