

# Cost Measurements (Ch 5)

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## Depreciation

## Review from Intro to Costs

Assets cost a lot and while purchased in one year provide benefits over many years. We would like to allocate cost of purchasing that asset over the years we use it (Matching principle).

- ▶ When you buy the asset (Balance Sheet) it is in the rate base and earns interest
- ▶ Every year some of the purchase price turns into depreciation (Income statement) and passed on the consumers.
- ▶ Ideally, sale of an asset should result in no income changes but it almost always happens.

# Extended Numerical Example

- ▶ Data Needed to Depreciate an Asset
  - ▶ Service Date
  - ▶ Cost Basis
  - ▶ Asset Life
  - ▶ Salvage Value
  - ▶ Method, accelerated, straight line, etc.

## Example

- ▶ Asset goes into service now.
- ▶ Cost 10K
- ▶ Will last five years
- ▶ Salvage for 2K
- ▶ Tax uses MACRS but we will use straight line.

Depreciation each year:

$$\frac{(\text{Cost} - \text{Salvage})}{\text{Life}} = \frac{10K - 2K}{5} = 1.6K$$

The book spends a few pages doing this in percentage terms but that is more about the “Iowa Curve” methodology, what survival analysis looked like in the 1950s

## Example Continued

Year	Depreciation	Book
0	0.0	10.0
1	1.6	8.4
2	1.6	6.8
3	1.6	5.2
4	1.6	3.6
5	1.6	2.0

The Book Value is the cost basis less accumulated depreciation.  
This is in the rate base and earns the allowable return.

## Example to Revenue Requirement

All the depreciation is part of the revenue requirement and with an allowable rate of return of 10%.

Year	Depreciation	Book	RR
0	0.0	10.0	0.00
1	1.6	8.4	2.44
2	1.6	6.8	2.28
3	1.6	5.2	2.12
4	1.6	3.6	1.96
5	1.6	2.0	1.80

$$\text{Revenue Requirement} = \text{Depreciation} + (.1)\text{Book Value}$$

## Asset Retirement Obligations

Now lets add in that a site will need to be cleaned up or that it is expensive to decommission. In this case 5K.

- ▶ Every year, take an equal amount as an expense.
- ▶ Add to the rate base, it earns interest in the rate base.
- ▶ When you decommission, remove it from the rate base but don't add it as an expense since you already did.
- ▶ *Revenue Requirement =*  
*Depreciation + Decommission + .1(Book Value + ARO)*

Year	Depreciation	Book	RR	Decomission	ARO
0	0.0	10.0	0.00	0	0
1	1.6	8.4	3.54	1	1
2	1.6	6.8	3.48	1	2
3	1.6	5.2	3.42	1	3
4	1.6	3.6	3.36	1	4
5	1.6	2.0	3.30	1	5



Disallowance

# Examples of Dissallowance and the Reasons Why

Disallowance is the technical term for not including an expense or an asset in the rate base.

Key terms:

- ▶ Used and Useful: Comes from *Smyth v. Ames* (1898) and says physically used and useful to current rate payers before they can be asked to pay for it. There are some exceptions.
- ▶ Prudent: Makes sense at the time it was made. Not penalized for not knowing the future.

For an overview of ratemaking <http://www.puc.state.or.us/water/water%20home%20page/Ratemaking%20Explained.pdf>

## Examples of Dissallowance in Orgon

- ▶ Trojan Nuclear Power Plant (PGE) as part of a larger rate case. [http://www.puc.state.or.us/admin\\_hearings/key\\_puc\\_cases/95\\_322.pdf](http://www.puc.state.or.us/admin_hearings/key_puc_cases/95_322.pdf)
- ▶ Multiple Wind Projects (PacifiCorp) as part of a larger rate case. Costs associated with Rolling Hills was excluded. <https://apps.puc.state.or.us/orders/2008ords/08-548.pdf>

# Trojan

- ▶ 1976 - 1992
- ▶ Only commercial Nuclear plant built in OR
- ▶ Main issue is management problems often around maintenance
- ▶ Many interesting aspects to this case, beyond disallowance as well as controversy.
  - ▶ Public protests
  - ▶ Two dissenting opinions
- ▶ Theodore Barry and Associates (TBA)

# Trojan Key Dissallowance Part 1

After an examination of the net benefits analysis, we conclude that the premature closure of Trojan resulted in a negative net benefit of approximately \$20.4 million. We find that continued operation of Trojan would have cost less than immediate shutdown but for steam generator defects and management problems at Trojan. Management problems resulted in avoidable costs that should be borne by shareholders, not ratepayers.

## Trojan Key Dissallowance Part 2

We adopt TBA's finding that PGE behaved prudently with respect to the steam generator degradation. However, we disallow the steam generator costs incurred since 1991 and exclude the cost of replacing the steam generators from the imputed costs of running Trojan in the net benefits analysis. Although PGE's behavior was not faulty, PGE and the ratepayers are the only two parties to whom we can assign or impute steam generator costs. As between those two parties, PGE is better situated to recover its costs from the manufacturer of the steam generators. Moreover, it is fair that shareholders bear some of the consequences of management investment decisions.

## Trojan Key Part 3

These conclusions result in a disallowance of 13.0 percent of the remaining Trojan costs, which will be borne by shareholders, not ratepayers. That result approximates a scenario in which Trojan was reasonably operated and managed. In the main, the disallowances correct for avoidable costs.

## Trojan Key Part 4

PGE would incur decommissioning and transition costs regardless of when the plant was taken out of service, and the company has already been paying into a decommissioning fund. Because Trojan was shut down before the end of its license life, however, payments into the fund will have to increase for a time.



# PacifiCorp Wind Projects

- ▶ Many projects but two “Rolling Hills” and “Glenrock” were very close.
- ▶ Appeared that project:
  - ▶ Avoid bidding rules and other standards used to show prudence.
  - ▶ The capacity factor, average divided by nameplate, was only 31%, which is very low for wind in WY.
  - ▶ Rushed to get tax credits and meet the new Renewable Portfolio Standard

## Acronyms:

- ▶ Industrial Customers of Northwest Utilities (ICNU)
- ▶ Renewable Adjustment Clause (RAC)

## Rolling Hills Key Part 1

Where the utility avoids the Guidelines, the burden of producing evidence remains with the utility. Pacific Power bears that burden of producing evidence in this case that its actions were prudent.

. . .

Because we find that Pacific Power failed to prove that it prudently acquired the Rolling Hills project, all costs associated with that project are excluded from the RAC cost recovery mechanism.

## Rolling Hills Key Part 2

ICNU suggested that Pacific Power be allowed to “cure” its “imprudence,” depending on the results of a future competitive bidding process. The finding that the Company failed to prove the prudence of its Rolling Hills project acquisition in this case applies only to the Company’s right to recover the costs of these projects in this RAC. Future ratemaking treatment of the Rolling Hills project will be taken up as appropriate.

## Rolling Hills Dissent by Beyer (Now OR Senate)

Not putting the Rolling Hills investment in rate base allows the Company to attempt to recover its investment by selling Rolling Hills output in the market or, perhaps, bidding the project or its output into a subsequent request for proposal to see how it stacks up against the competition.

## Regulated Rate of Return

# What we will look at

- ▶ The effects of capital structure on the rate of return
- ▶ The rarity of using actual structure and a framework for choosing one in a regulatory framework.
- ▶ Technical problems:
  - ▶ Subsidiaries
  - ▶ Used assets
- ▶ Three ways to estimate ROE and a critique.

# Earnings Volatility and Debt

The capital structure plays a big part in the return on common equity (ROE).

Consider a firm with:

- ▶ Some capital,  $K$ .
- ▶ A return on assets,  $\beta$ , that is random with a mean of 10% and a known standard deviation, 3%.
- ▶ Some,  $\alpha$ , of the capital was funded by bonds that have an interest rate of 8%.
- ▶ There are no other costs

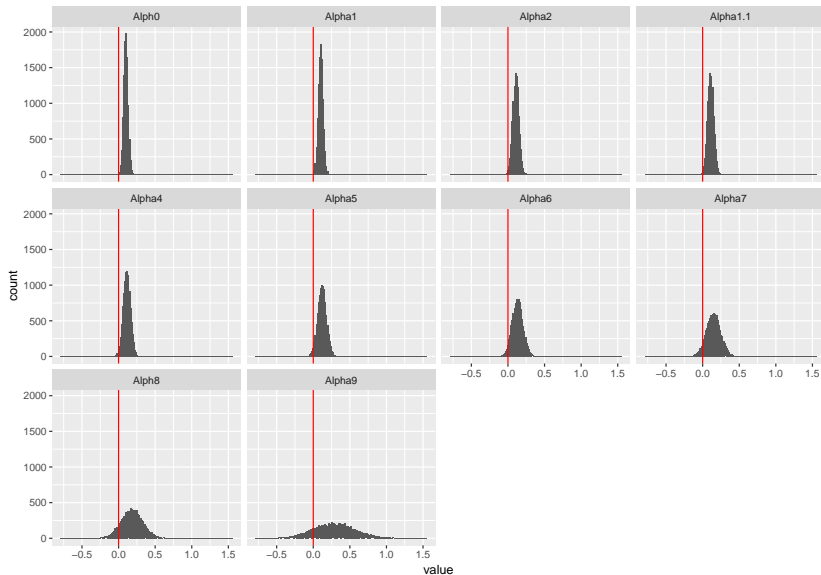
# Earnings Volatility

- ▶ When the firm runs, profits should be,  $\beta K$ .
- ▶ Then when you pay the bond holders interest you have,  $\beta K - .08\alpha K$ .
  - ▶  $\alpha K$  is the capital financed by bonds
  - ▶  $.08\alpha K$  is the interest.
- ▶ Dividing by the capital owned by shareholders,  $(1 - \alpha)K$  gives the return on equity

$$ROE = \frac{\beta K - .08\alpha K}{(1 - \alpha)K}$$



# Simulated Earnings Volatility



# Volatility

- ▶ As the debt ratio, fraction of capital funded by bonds, increases:
  - ▶ The average return increases.
  - ▶ The variance of returns increases.
  - ▶ The probability of negative returns increases

## Regulated rate of return

The usual system for the regulated rate of return is to use a weighted average of the returns on all sources of funds. In our simple model, we have just bonds and equity.

$$RRR = \alpha.08 + (1 - \alpha)ROE$$

Clearly, the mix is a choice variable for the firm but new bond and stock issuance typically need to go through the regulator.

# Bond Rate

The bond rate is usually not controversial:

- ▶ Bonds issued by the utility complete with other firms on the basis of the probability of default.
- ▶ Bonds come with a face value, usually 1K and a coupon rate.
- ▶ If the coupon rate is too low for the risk the price of the bond falls, i.e., they trade at a discount.
- ▶ If the coupon rate is too high the price of the bond rises, i.e., they trade at a premium.

The number used is called the yield to maturity which is just the internal rate of return on the bond.

# Yield to Maturity

Simple case of a bond:

- ▶ You buy now for  $P_0$
- ▶ Has face value of  $P$
- ▶ Matures in  $N$  years.
- ▶ No coupons. These are typically purchased for way less than face value

$$\left(\frac{P}{P_0}\right)^{\frac{1}{N}} - 1$$

The case with coupons is more complex but you are finding the internal rate of return for the current purchase price and the face value and the coupon payments. EC314 Material if you are interested.

## Where things Get Ugly

- ▶ The capital structure is a choice and you can manipulate the RRR by changing the capital structure.
- ▶ The ROE is circular:
  - ▶ The value of the stock is determined by prices and profits
  - ▶ Prices and profits are determined by the revenue requirement
  - ▶ Which is determined on the change in the value of the stock and dividends
- ▶ Key point, you should not really use the firm's own ROE and capital structure, but one constructed from what similar firms with competitive pressure, a quasi-experimental control group.

Return on Equity (ROE)

# Usual Methods and an Unavoidable Assumption

Methods:

- ▶ Discounted Cash Flow (DCF)
- ▶ Capital Asset Pricing Model (CAPM)
- ▶ Risk Premium Model (RPM)

Sitting under all of them is one of the efficient market assumptions.

BTW a nice discussion of ROE be found at

<http://stats.lib.pdx.edu/proxy.php?url=http://www.sciencedirect.com/science/article/pii/S1040619011001722>



# Three Basic Kinds of Efficient Market Assumptions

Usefulness of information to predict future prices

- ▶ Weak: All past price data will not help.
- ▶ Semi-Strong: Public data does not help
- ▶ Strong: No data public or private can help

# Grampa Ish and Betting on Horses

- ▶ You don't know who will win.
- ▶ Calculate your own odds of each horse.
- ▶ Bet the horse that is paying off more than you think it should.
- ▶ You win more often if you have your grandson talk to the jockeys.

# Behavioral Finance

- ▶ Behavioral Economics has a brother.
- ▶ There are plenty of anomalies
  - ▶ Monday Effect, French (1980)
  - ▶ January Effect, Roll(1983)
  - ▶ Firm Size, Banz(1981)
  - ▶ Mean Reversion, DeBondt and Thaler (1985)
  - ▶ Momentum, Jegadeesh (1990)
- ▶ Anomalies get smaller after a paper about it is published.
- ▶ Many critiques have to do with statistical details.

# Comparable Data

The intent is to have observations of a firm just like the one being regulated but without the effect of regulation.

- ▶ The intent is a quasi-experimental control.
- ▶ Comparability is easier to work with for populations but harder for an individual.
  - ▶ There is no perfect match
  - ▶ The Parable of the Cookie and Parent's Problem.

# Typical Variables Used to find matches

- ▶ Same industry
- ▶ Bond rating
- ▶ Beta (A measure of market risk)
- ▶ Market Capitalization
- ▶ Fraction of revenues from regulated operations
- ▶ MORE

# Quasi-Experimental Methods is hot in Econ

- ▶ Many fields have very strong standards for establishing causality
- ▶ We often use
  - ▶ Coarsened Exact Matching
  - ▶ Propensity Score Matching (General)
  - ▶ NN matching
  - ▶ Kernel ...
- ▶ Regulators are still not there with this.

Key observation is to use several methods to get a reasonable range.  
If a proposed mix or ROE is in your range, stipulate.

DCM

# CAPM



RPM