

Mythology in Regulatory Finance

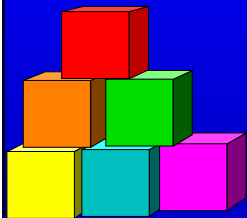
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Mythology in Regulatory Finance Roadmap

- State of the Art: Theory & Practice
- New Developments
- Regulatory Alternatives



Cost of Equity Methodology



Cost of Equity Measurement

- Discounted Cash Flow (DCF)
- Risk Premium
- **Asset Pricing Models**
- Comparable Earnings



Asset Pricing Models

- CAPM
- Arbitrage Pricing Model (“APM”)
- Multi-Factor Model
- Fama-French Model
- Empirical CAPM (“ECAPM”)
- Market-Derived CAPM (“MCAPM”)

CAPM Practical Application

$$K = R_f + \beta(R_m - R_f)$$

- Risk-free rate: maturity
- Beta estimate
- Market risk premium
 - Historical
 - Prospective



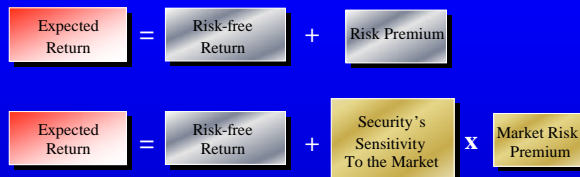
Bias in Estimating Beta From Historical Data



Arbitrage Pricing Model (APM)

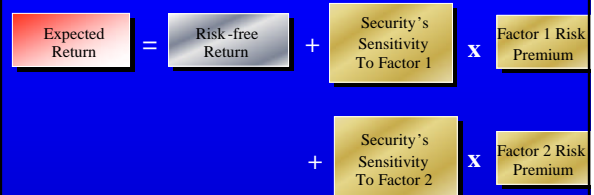
- Multiple-factor CAPM
- Systematic elements of risk, other than market risk (beta), permeate across all securities
 - Ex. Changes in economic activity
 - Changes in inflationary expectations
 - Changes in interest rates

CAPM



$$K = R_f + \beta (R_m - R_f)$$

APM



$$K = R_f + \beta_1(r_1) + \beta_2(r_2)$$

APM Example

Consider the 3-factor APM

$$K = R_f + \beta_1 r_1 + \beta_2 r_2 + \beta_3 r_3$$

$R_f = 4\%$

Risk coefficients for the 3 factors:

$$\beta_1 = 0.40 \quad \beta_2 = 0.10 \quad \beta_3 = 0.80$$

Risk Premiums:

$$r_1 = 7\% \quad r_2 = 2\% \quad r_3 = 5\%$$

$$K = 4\% + 0.40 \times 7\% + 0.10 \times 2\% + 0.80 \times 5\% = 11\%$$

APM Empirical Test

- Factors used by Chen, Roll, and Ross.
 1. % change in industrial production,
 2. % change in expected inflation,
 3. % change in unanticipated inflation,
 4. long-term corporate bond rate minus long-term government bond rate,
 5. long-term government bond rate minus T-bill rate.

Fama-French 3-Factor Model A Better Mouse Trap?

CAPM: Investor Returns is the sum of:

- The zero risk return
- The market premium
- A return for individual security risk proportional to its volatility relative to the market (Beta)

Fama-French Model: Investor Returns is the sum of:

- The zero risk return
- The market premium
- A return for individual security risk proportional to its volatility relative to the market (Beta)
- Size Premium
- Value Premium

Fama-French 3-Factor Model

$$K = R_f + \beta_m r_m + \beta_s r_s + \beta_v B_v r_v$$

where:

β_m = market coefficient in FF regression

r_m = market risk premium

β_s = small-minus-big (SMB) coefficient in FF regression

r_s = SMB risk premium (hist mean returns small-cap less large-cap portfolios)

β_v = high-minus-low (HML) coefficient in FF regression

r_v = HML risk premium (hist mean returns high B/M less low B/M portfolios)

CAPM vs Fama-French

CAPM: Investor Returns

- +5.00 The zero risk return
- +7.00 The market premium
- 1.40 Beta (-0.2 x 7.0)

+10.60 Expected Total Return

Fama-French Model: Investor Returns

- +4.00 The zero risk return
- +7.00 The market premium
- 1.40 Beta (-0.2 x 7.0)
- +1.00 Size premium
- +0.50 Value premium

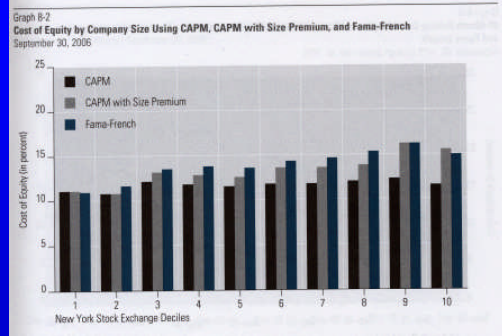
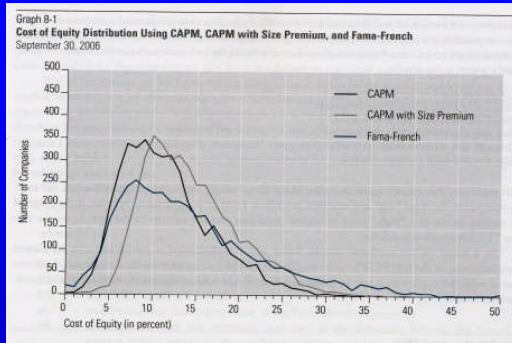
+12.10 Expected Total Return

Fama-French Estimates Integrated Electric Utilities

ticker	Coefficient Estimates				E (t)
	a	b	s	h	
NEE	0.0045	0.4304	-0.0917	0.6518	10.96%
CHG	0.0050	0.4545	-0.0416	0.4259	10.16%
CIN	0.0032	0.4554	0.0280	0.6620	12.49%
CV	0.0049	0.1732	0.4748	0.6849	10.86%
D	0.0031	0.6382	-0.0656	0.8671	13.54%
DGE	-0.0027	0.4813	-0.1118	0.6411	8.60%
DTE	0.0032	0.3194	-0.1170	0.5735	9.73%
EAS	0.0040	0.6108	-0.0007	0.3663	11.07%
ED	0.0029	0.1892	-0.2782	0.5867	8.43%
EDE	-0.0020	0.3405	0.0717	0.5257	10.16%
EE	-0.0050	0.3748	0.4399	1.0116	13.79%
EIX	-0.0014	0.2715	0.4240	0.6345	11.17%
ETR	0.0119	0.3101	-0.2365	0.7729	10.31%
EXC	0.0058	0.4768	0.1279	0.9711	13.45%
FE	0.0108	0.2980	-0.5049	0.5861	8.58%
FPL	0.0058	0.5858	-0.2176	0.6489	11.55%
GXP	0.0142	0.7472	-0.5316	0.7652	9.55%
HE	0.0120	0.5798	-0.1423	0.4481	9.47%
IDA	0.0032	0.6613	-0.1602	0.5818	11.95%
IA	-0.0193	0.8015	-0.0908	0.7885	14.23%
MDU	0.0050	0.8094	0.0199	0.8677	14.98%
NGEE	0.0090	0.3165	0.1152	0.2874	8.94%
NST	0.0015	0.5193	0.0328	0.5342	11.32%
NU	-0.0068	0.6852	0.0124	0.6237	12.89%
DGE	-0.0002	0.6772	0.0509	0.8680	14.14%
DTR	-0.0021	0.2294	-0.3898	0.8504	10.84%
GN	-0.0008	0.5875	0.0875	0.9324	13.87%
PSD	0.0046	0.3709	-0.1298	0.4561	9.46%
SCS	0.0026	0.5146	-0.0536	0.6006	11.40%
SRE	0.0077	0.5087	0.0505	0.7194	12.23%
VVC	0.0051	0.6086	-0.5780	0.3898	9.49%
WEC	0.0029	0.3450	-0.0093	0.7473	11.05%
WPS	0.0045	0.3554	0.0822	0.5504	9.86%

Average 11.23%

Factors	Expected Value
Rf	5.0%
MRP	7.0%
SMB	2.7%
HML	4.9%

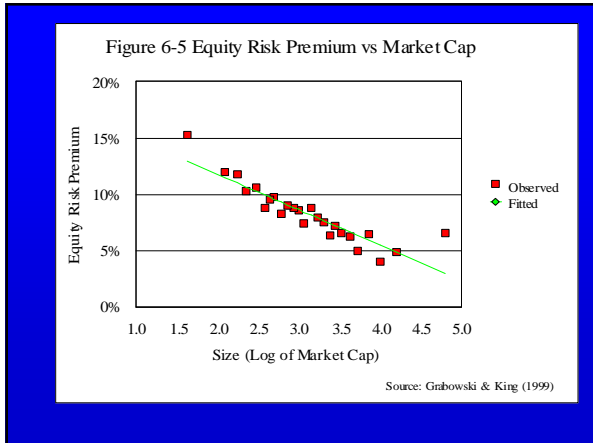


Size-Adjusted CAPM

$$K_e = R_F + \beta (\text{MRP}) + \text{Size premium}$$

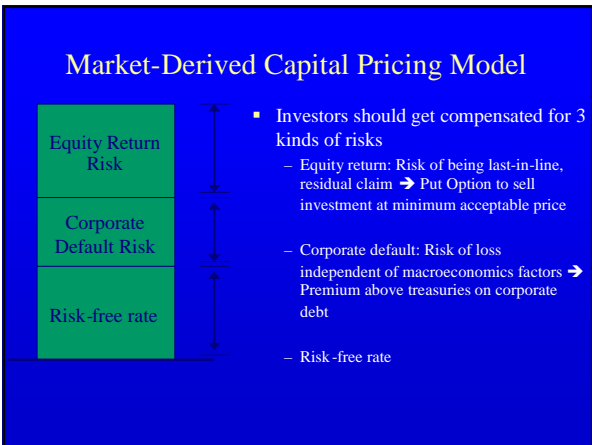
Ibbotson Estimates of Size Premium

Size	Market Cap	Premium
Large-cap	\$4,794,027	0.00%
Mid-cap	\$1,167,040	0.91%
Low-cap	\$330,797	1.70%
Micro-cap	\$0.332	4.01%



Market-Derived Capital Asset Pricing Model (MCAPM)

- ### Is there a better Beta ???
- CAPM is 40 years old
 - Very popular, simple to understand and apply
 - Historical Beta could be misleading
 - During hype of late 90' s correlations of non-tech sectors with the market were historically low
 - ♦ Tobacco, food sector
 - Total Market (1998 – 2001) = 0.02
 - Total Market ex. Tech's (1998 – 2001) = 0.65
 - Historical (1980 – 1998) = 0.85
 - Size-effect is unaccounted for
 - Beta is sensitive to length of holding period



Equity Risk

4 Steps:

1. Calculate forward breakeven price

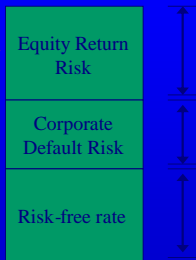
$$P_1 = P_0(1+r)^t$$

where $r = r_{\text{debt}} - r_{\text{dividends}}$

2. Estimate stock's future volatility
(ISD on call option prices)

3. Calculate cost of downside insurance:
Cost of put option (insurance premium)

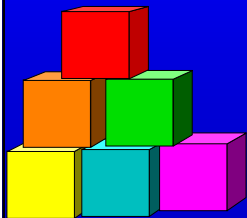
4. Derive annualized excess equity return



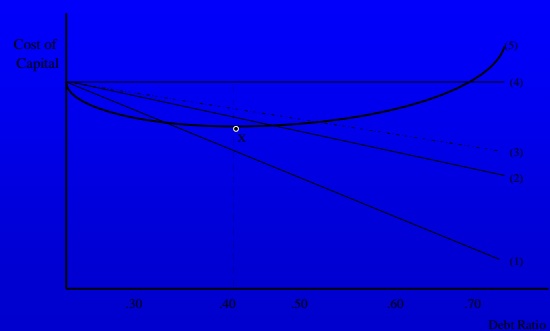
Will Beta ever be Beaten?

- MCAPM is less than a year old
- Addresses fundamental issues
 - Forward looking
 - Dissects risk composition
 - ◆ National confiscation, corporate default, equity return
 - Arbitrage/pricing-based
 - ◆ Black-Scholes
- Hard to say, jury still out

Capital Structure Issues

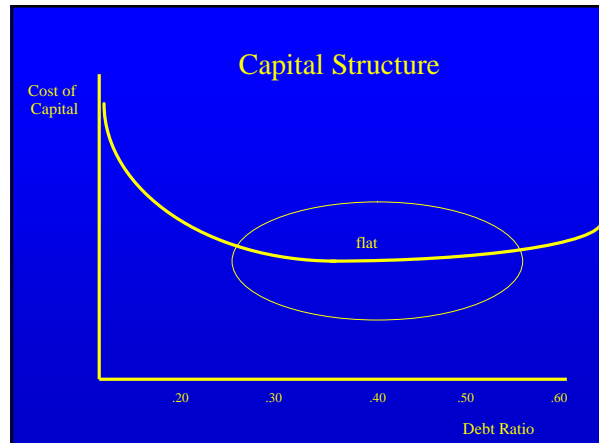


Tax Saving vs. Distress Trade-off Theory



Capital Structure Views

- (5) WACC considering all tax and financial distress effects. This curve nets the benefits against the costs of using debt. It represents the position of most academics.
- (4) M&M no tax. Miller position: WACC not affected by capital structure. Personal tax effects offset corporate tax effects.
- (3) Modified Miller view, but recognizing that the expected corporate tax rate will fall as the debt ratio rises, lowering the expected tax shelter benefits of debt.
- (2) Modified Miller view, netting personal tax benefits of equity against corporate tax benefits of debt, but with no consideration of financial distress.
- (1) M&M position considering corporate tax shelter benefits only.



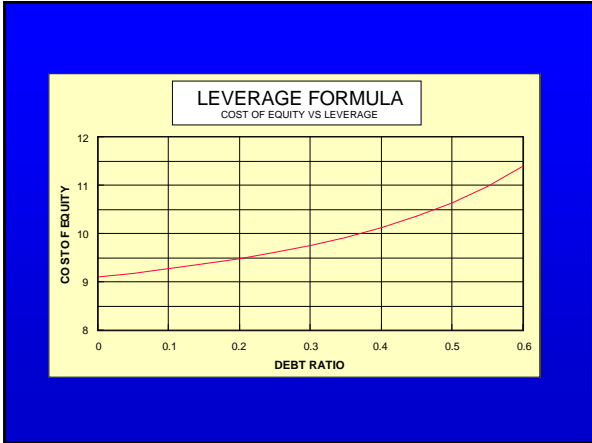
Capital Structure Applications

- FPSC Leverage Formula
- Alberta Board generic proceeding

FPSC Leverage Formula ROE

$$\text{ROE} = 6.95 + 1.933 / \text{ER}$$

Range: 8.90% - 11.78%



Leverage Formula	
Summary of Results	
CAPM ROE for Natural Gas Index	10.61%
DCF ROE for Natural Gas Index	9.04%

AVERAGE	9.83%
Bond Yield Differential	0.43%
Private Placement Premium	0.50%
Small Utility Risk Premium	0.50%

ROE for Average Florida Water Utility	11.26%
Adjustment to Reflect ROE at a 40% Equity Ratio	0.52%

ROE for Average Florida Water Utility at a 40% Equity Ratio	11.78%

Calculations to Determine the Cost of Capital				
Average Water Utility				
Component	Amount (000\$)	%	Cost	Weighted Cost
equity	\$4,485	44.85%	11.26%	5.05%
debt	\$5,515	55.15%	6.95%	3.83%
WACC				8.88%

Calculations to Determine the Cost of Capital				
@ 40% Common Equity Ratio				
Component	Amount (000\$)	%	Cost	Weighted Cost
equity	\$4,000	40.00%	11.78%	4.71%
debt	\$6,000	60.00%	6.95%	4.17%
WACC				8.88%

Algebraic Solution

$$0.40 X + 0.60 \times 6.95\% = 8.88\%$$

solve for X: $X = 11.78\%$

More generally:

$$ER \times ROE + (1-ER) \times 6.95\% = 8.88\%$$

solve for ROE: $ROE = 6.95 + 1.933/ER$

FPSC Leverage Formula ROE

$$ROE = 6.95 + 1.933 / ER$$

Range: 8.90% - 11.78%

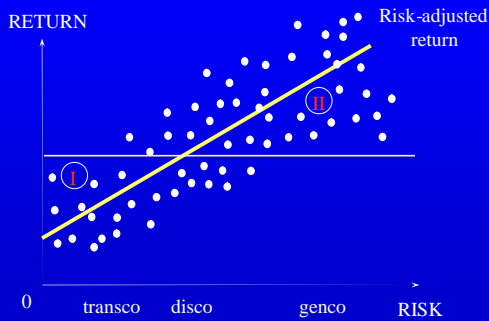
Formula Appraisal

- Relies on DCF and CAPM methodologies
- Allows for differences in risk
- Includes flotation cost adjustment
- Small size adjustment 50 b.p.
- Private placement adjustment 50 b.p.
- Natural gas distribution companies as proxies

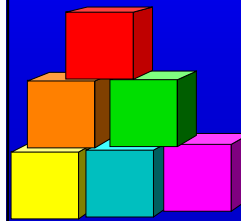
Formula Key Assumptions

- Business risk is similar for all WAW utilities
- k_e rises exponentially with the debt ratio
- WACC is constant over the equity ratio range of 40% to 100%
- Cost of debt = Baa3 + private placement premium + small size premium

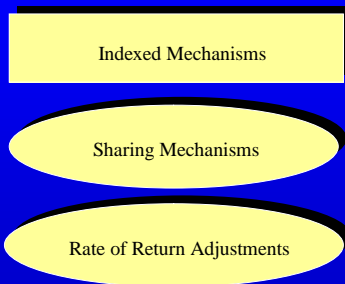
Unbundled Cost of Capital



Regulatory Alternatives



3 Types of Incentive Mechanisms



Mississippi Power Company Performance Evaluation Plan ("PEP")

- Indexes the allowed range of return to performance
- Purpose: To lessen the impact, frequency, and size of rate increase requests by permitting limited rate adjustments in order to maintain an approved return while providing an incentive to be efficient, reduce costs and improve productivity

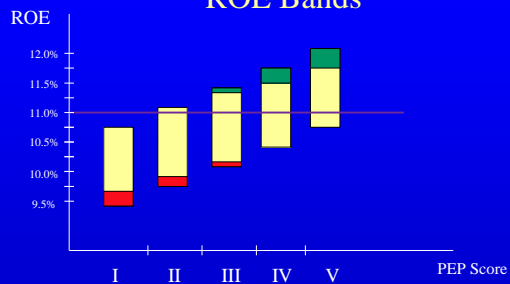
Mississippi Power Company Performance Evaluation Plan (“PEP”)

- Annual Rate Adjustment Procedure
 - Calculate weighted average of performance indicators
 - Calculate allowed ROI based on formula
 - Develop performance adjustment to allowed ROI
 - Develop Range of No Change around allowed ROI
 - Compare company’s projected ROI for the next 12 months with allowed range of ROI

Benchmark ROE

- Simple average ROE
 - ◆ DCF
 - 30-day stock price
 - IBES growth forecast
 - ◆ Risk Premium
 - ◆ CAPM
- A-Rated Non-nuclear Electric Utilities

Mississippi PEP Plan ROE Bands



Mississippi Power Company Original Performance Measures

- Residential rate comparisons 20%
- Equivalent availability 16%
- Service reliability 16%
- Customer satisfaction 15%
- Safety 11%
- Contribution to load factor 11%
- Construction performance 11%

Mississippi Power Company Revised Performance Measures

- Average rate comparisons 25%
- Equivalent availability 25%
- Service reliability 25%
- Customer satisfaction 25%

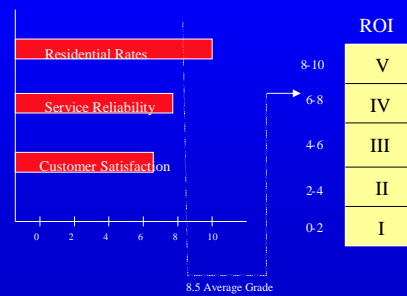
Mississippi Power Company Current Performance Measures & Weight

- Average rate comparisons 40%
- Service reliability 40%
- Customer satisfaction 20%

PEP Scoring

- Performance-adjusted ROI equals Benchmark ROI plus 10% of performance score
- Example:
 - Benchmark ROI = 9%
 - Performance score = 8.5 (out of possible 10)
 - Performance-adjusted ROI = 9.85%

PEP Scoring



Mississippi Power Company Performance Evaluation Plan (“PEP”)

- Accomplishments since 1986 inauguration:
 - Limited scope and frequency of rate cases
 - Provided incentives considerably higher than orthodox RORR for cost minimization and innovation
 - Improved administrative efficiency through simplicity, predictability and flexibility
 - Equitable to all parties
 - Reduced investor risk perceptions
 - Reduced regulatory lag by incorporation of future test year (occurred in 2004)

Mississippi Power Company Performance Evaluation Plan (“PEP”)

- Drawbacks
 - Performance standards somewhat arbitrary
 - Weights of performance components arbitrary
 - Measurement difficult (agreeing on what to measure is the most difficult; the actual measurement mechanisms have been institutionalized)
 - Scarcity of benchmarks
 - Scarcity of comparable companies (issue in ROE but not in performance measurement)
 - No additional flexibility to adjust prices in response to competitive forces (this flexibility can be provided through other legislation, not through PEP)

Other Regulatory Mechanisms

- Zone of ROE Reasonableness
- Return Adjustment Formulas

Zone of Reasonableness/Sharing Overview

- Range of return is authorized instead of point estimate following a traditional rate hearing
- Frequently accompanied by a sharing mechanism
- Frequently accompanied by a set of conditions and privileges

Zone of Reasonableness

Advantages

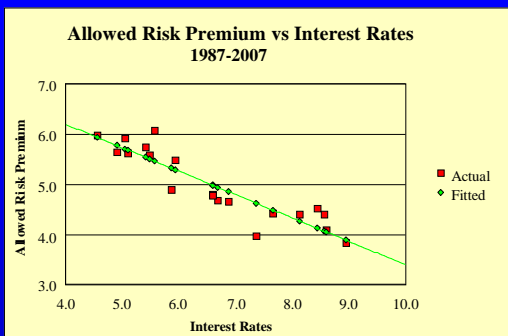
- No single scientific ROE - permits regulator flexibility to focus on other factors
- Accommodates capital markets volatility
- Incentives to reduce costs
- Ratepayers benefit from cost savings
- Paired with profit sharing
- Consistent with RORR

ROE Adjustment Formulas

Bond Yield

+

Risk
Premium



Risk Premium vs Interest Rates

$$RP = 0.080 - 0.50 \text{ YIELD} \quad R^2 = 0.80$$

(t=9.4)

Risk Premium vs Yield

TREASURY BOND		RISK PREMIUM	
0.00	- 2.49	6.50	- 8.50
2.50	- 3.49	6.00	- 8.00
3.50	- 4.49	5.50	- 7.50
4.50	- 5.49	5.00	- 7.00
5.50	- 6.49	4.50	- 6.50
6.50	- 7.49	4.00	- 6.00
7.50	- 8.49	3.50	- 5.50
8.50	- 9.49	3.00	- 5.00
9.50	- 10.49	2.50	- 4.50
10.50	- 11.49	2.00	- 4.00
11.50	- 12.49	1.50	- 3.50
12.50	- 13.49	1.00	- 3.00
13.50	- 14.49	0.50	- 2.50
14.50	- AND ABOVE	0.00	- 2.00

Conclusions on Formula Approach

- reduces direct costs
- lacks incentive for efficiency
- adequate investor returns ??
- predictability and consistency
- potential for inaccuracy and unreliability
- conceptual foundation ??

Risk-Adjusted ROE Formula

$$K = R_f + RP \times D/P / R_f \times a$$

Price Cap Index

Compensation and Incentive Principles

$$\text{INDEX} = \text{INFLATION} - \text{PRODUCTIVITY}$$

COMPENSATION

Company Specific
Inflation and Productivity

INCENTIVE

Exogenous Inflation

Exogenous Productivity

Price Cap Index

Should incorporate:

- Effects of changes in the cost of production factors, ie. inflation
- Differences between industry productivity growth and that of the economy as a whole
- Exogenous cost changes adjustment factor

$$\text{GDPD} - X [+ \text{ or } - Z]$$

Price Cap Formula

$$P_t = P_{t-1} \times (1 + \text{infl \%} - \text{prod'y \%}) \pm Z$$

Price Cap Variations

- Baskets of services or individual services
- Weighted average rate
- Can include:
 - Profitability constraints
 - Sharing mechanisms
 - Constraints on individual rates

Indexed Mechanisms: Issues

- Starting points
- Index of allowed changes in costs or revenues
- Index of output changes

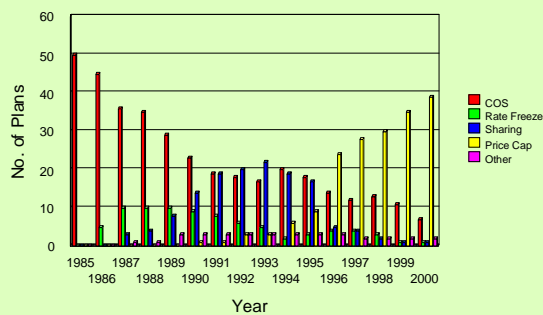
Price Cap Regulation Advantages

- Reduced regulatory costs
- Pricing flexibility
- Incentive to minimize costs
- Reduced incentive for over-capitalization
- Breaks link between rates and costs
- Protection against market price changes
- Possible reduction in real rates
- Reduced incentives for cross-subsidization

Price Cap Regulation Disadvantages

- Errant indices
e.g. productivity index, cost index
- Managerial effort vs. exogenous factors
- Reduced incentives from regulatory lag
- Incentives to reduce service quality
- Gains or losses may exceed acceptable level

Evolution of PBR in U.S. Telco



Some Lessons

- Use simple models
- Use more than one model
- MPT is more than the CAPM
- Beta is useful for qualitative risk comparisons
- All models provide useful evidence
- Consistency
- Beware of academics bearing gifts
- Beware of consultants receiving gifts

THE END

