NEW ZEALAND INSTITUTE FOR THE STUDY OF COMPETITION AND REGULATION INC.

The Required Rate of Return with Sunk Investments

Prepared for the ISCR Seminar:
The Cost of Capital for the Regulated Firm

Professor Lewis Evans

Dr Graeme Guthrie

http://www.iscr.org.nz

Outline

- The economic environment of the incumbent
- Regulating for earlier (more) investment when the firm chooses the amount of its investment
- Regulating the incumbent when it is forced to supply.
  - Traditional rate of return regulation
  - Incentive regulation
- Conclusions

Economic background

- Networks: high proportion of cost are *sunk*: equivalently much investment is *irreversible*
- Future network costs are uncertain
- Future demand/surplus (welfare) is uncertain
- Modern regulation seeks to facilitate competition yielding prospective demand uncertainty

Regulation and the incumbent

- Regulation seeks to induce:
  - Financial viability
    - i.e. the expected net return from investment should not be negative
  - Lowest cost provision
    - Replacement cost or
    - Historical cost
  - The right timing (quantity) of investment
- Incumbent firm may under regulation
  - Choose the timing of investment
  - Have its timing constrained

Regulation when the firm chooses investment timing 1

- Applicable to an extent in all regulation: asymmetric information: eg maintenance
- Regulator seeks to induce a monopoly to invest earlier (more)
- In *"Regulation, Investment Timing, and the Choice of Rate Base" (www.iscr.org.nz)* which has
  - Uncertainty about the total of consumer and producer benefits
  - Uncertainty about future network costs
  - Irreversible investment
  - The regulator choosing historical or replacement cost rate base
  - An incumbent with no competition

  we reach the following conclusions

Regulation when the firm chooses investment timing 2

- Generally the regulator seeks earlier investment
- Variation in demand and cost really matters with irreversible investment
- Whether replacement cost or historical cost is desirable depends on the industry
  - Little variation in costs suggests preference for replacement cost
  - Much variation in cost, and cost declines associated with increased consumer benefits, suggest preference for historical cost
- Using the historical cost base can induce earlier investment than the unregulated firm would make
- The appropriate allowed rate of return is higher with replacement (vs historical) cost and generally higher than the WACC
- Setting the allowed rate of return too low leads to very substantial reductions in consumer benefits as compared to setting it too high

Regulation when the firm is forced to supply

- The firm has no options: must supply
- Future demand is uncertain (uncertain cost will also matter)
- Regulation
  - Seeks financial viability & lowest cost
  - May be Rate-of-return or Incentive Regulation

The set up

- First we consider reversible investment (second irreversibility)
- capacity S≥*X* demand or customers: forced investment
- P_t is the price of the network at time *t*
- *r* is the (systematic) risk adjusted required rate of return
- *R* is net revenue
- Suppress depreciation

How much "profit" is "reasonable"?

Required to supply:reversible

"Traditional" regulation: Revenue based on historical cost

$$E_0[R_1] = (1+r)P_0S_0 - P_0S_0 = rP_0S_0$$

i.e Revenue Requirement = rate of return times cost at the beginning of the period

How much profit is “reasonable”?

Required to supply: reversible

“***Incentive***” regulation

Revenue based on replacement cost

$$E_0[R_1] = (1+r)P_0S_0 - E_0[P_1S_0]$$

$$= rP_0S_0 + P_0S_0 - E_0[P_1S_0]$$

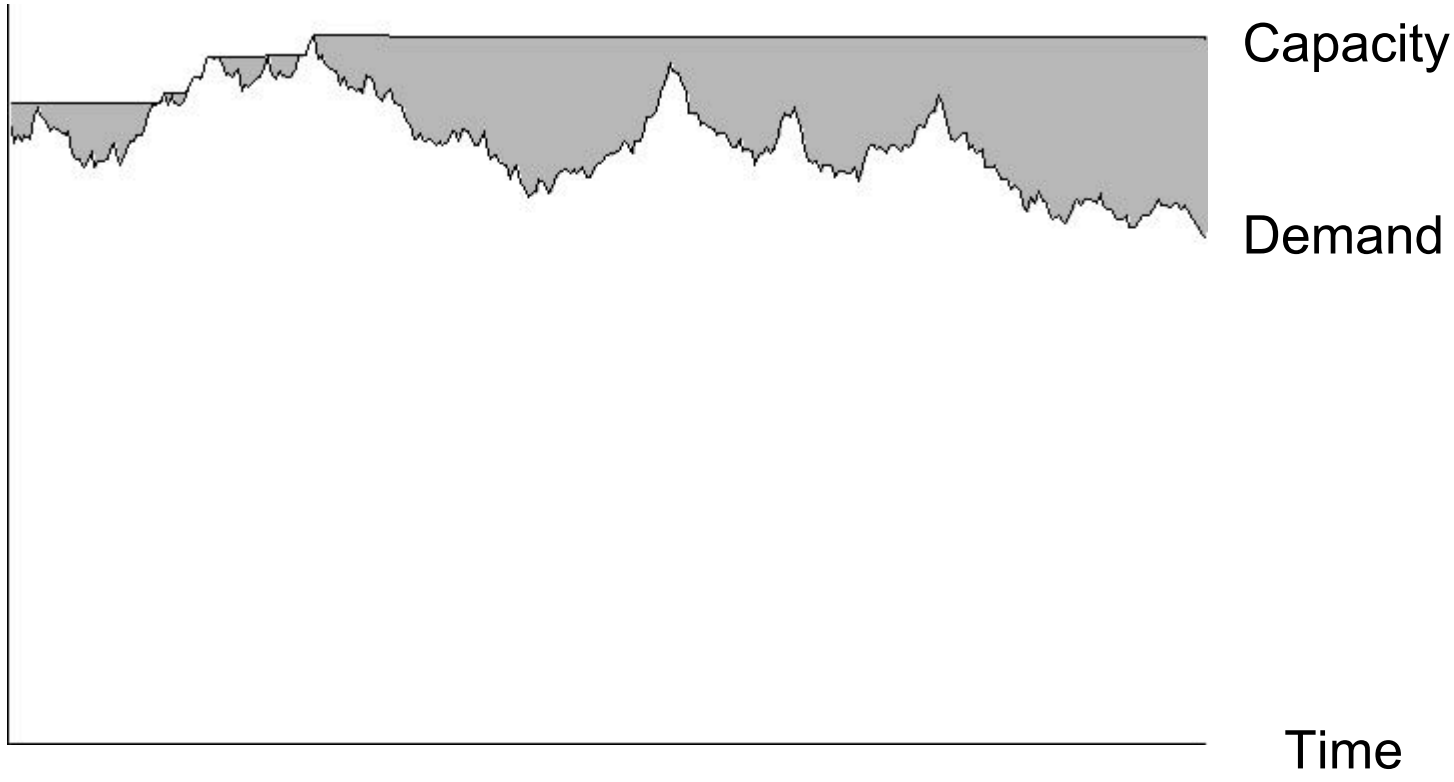
Revenue Requirement = rate of return times cost at the beginning of the period, adjusted for expected capital gain or loss over the period

Irreversibility
Required to supply

- Capacity
  - Can never fall
  - Grows when required to meet demand
- Leads to stranding
- Distinguish between capacity and demand (number of subscribers):

  i.e. *Capacity (S)* at least *Demand (X)*

Adjusting the capacity of the regulated network under irreversibility when demand must be served



Demand volatility

- Typical volatility in “business as usual demand”
- Telecom NZ Ltd (residential customer numbers)
  - Average growth rate: 1.5%
  - Std dev growth rate: 6.1%
- Electricity distribution networks (total traffic)
  - Average growth rate: 2.0%
  - Std dev growth rate: 4.5%

Reasonable returns when costs are sunk when required to supply

Revenue Requirement

$$E_0[R_1] = (1+r)P_0S_0 \square E_0[P_1 \min\{S_0, X_1\}]$$

Revenue requirement is historical cost times the risk adjusted rate adjusted for expected capital gains/losses resulting from price and/or demand reductions

Reasonable returns when costs are sunk when required to supply

$$E_0[R_1] = (1+r)P_0S_0 - E_0[P_1 \min\{S_0, X_1\}]$$

- Depend upon the future
- "Reasonable" allowed rate of return depends on
  - Systematic risk (in profit and replacement cost)
  - Uncertainty in technology and prices
  - Uncertainty in demand
- Lowest cost of "what"?
- Allowed rate of return on "what"?

Reasonable returns when costs are **sunk** when required to supply

$$E_0[R_1] = (1+r)P_0S_0 - E_0[P_1 \min\{S_0, X_1\}]$$

Based on historical cost

$$\text{Allowed rate of return} = r + \left(1 - \frac{E_0[P_1 \min\{S_0, X_1\}]}{P_0S_0}\right)$$

which may be much above *r*

Our approach

"Asset Stranding is Inevitable in Competitive Markets"
(www.iscr.org.nz)

- Demand evolves with (potential) trend and volatility
- Regulation requires:
  - Financial viability
  - Lowest cost provider given existing customers
- Traditional regulation
  - Existing customers pay for capacity
- Incentive regulation
  - Connected customers pay fixed fee

Results

- Traditional regulation
  - Customers absorb the risk
  - Prices vary over time
  - Reasonable return may be as low as risk-free rate
- Incentive regulation
  - Firm absorbs the risk
  - Prices constant over time: allows firm-price long-term contracts
  - Reasonable return typically exceeds risk-free rate
- Welfare
  - Incentive regulation exceeds that of Traditional regulation

Reasonable rates of return

- Risk-free rate is 5%
- No systematic risk

		Standard Deviation		
		0.000	0.050	0.100
Trend	-0.020	0.070*	0.074	0.083
	0.000	0.050	0.059	0.069
	0.020	0.050	0.053	0.060

* i.e. tilted annuity adds 2%

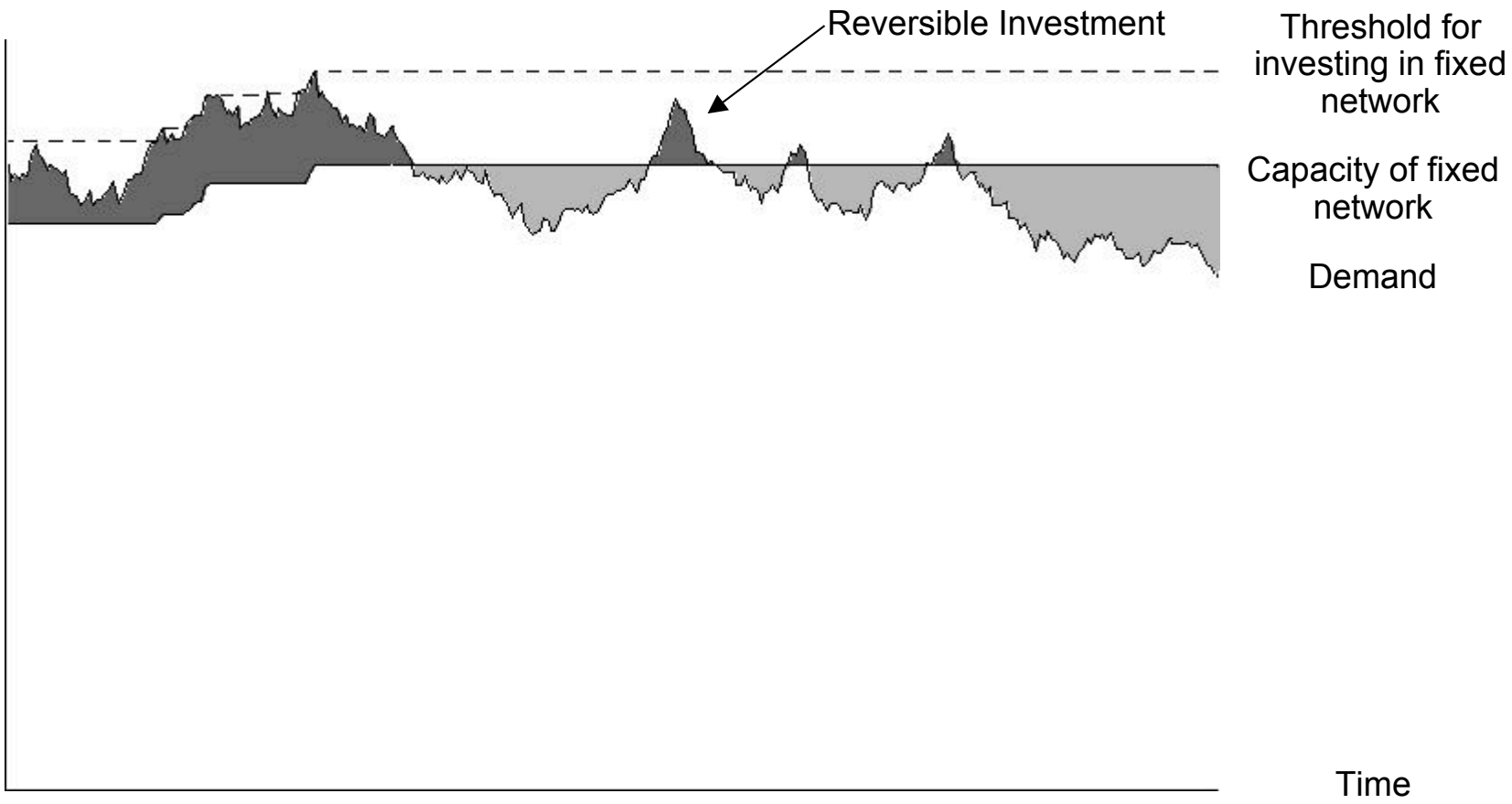
Examples

- Telecom NZ Ltd (residential customer numbers)
  - Average growth rate: 1.5%,Std dev growth rate: 6.1%
  - Reasonable rate of return requires 50 basis point premium
- Electricity distribution networks (total traffic)
  - Average growth rate: 2.0%, Std dev growth rate: 4.5%
  - Reasonable rate of return requires 24 basis point premium

Network configuration

- Mixture of technologies
    1. Flexible, but expensive
    2. Inflexible, but cheap
- E.g. mobile generation and maintenance
- Network configuration can be used to manage future demand risk

Adjusting network composition over time



NEW ZEALAND INSTITUTE FOR THE STUDY OF COMPETITION AND REGULATION INC.

Regulation and network configuration

- Traditional regulation
  - Either
    - All flexible technology
    - Or all inflexible technology
- Incentive regulation
  - Optimal mixture of two technologies
  - Information requirements differ

Conclusion: when firm must supply

- Summary
  - Traditional regulation:
    - —Inefficient risk allocation
    - —Inefficient investment
    - —Low required rate of return
  - Incentive regulation
    - —Efficient risk allocation
    - —Efficient investment
    - —Higher required rate of return

Conclusion

- Regulation involves both encouraging the timing of investment and seeking that where investment is forced the firm is just financially viable and low cost
- Variation in demand is part of the businesses and it can be substantially increased by competition
- Both imply that uncertainty and variation matter for risk and that specific risks importantly raise allowed rates of return above WACC even if no regulatory risk is present:
- The WACC is but an element of the investment decision and thus the allowed rate of return

NEW ZEALAND INSTITUTE FOR THE STUDY OF COMPETITION AND REGULATION INC.

Meridian Energy
The Power of Nature

RESERVE BANK OF NEW ZEALAND

POWERCO

Westpac Institutional Bank

Fonterra
Co-operative Group

New Zealand Post

ngc

Telecom
NEW ZEALAND

Victoria University of Wellington, New Zealand
Te Whare Wānanga o te Ūpoko o te Ika a Māui
Aotearoa

CONTACT