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Why ODV (ODRC) Regulation Inhibits Investment and can anything be done about it?

Prepared for the CEEM and ISCR Workshop on

Electricity Restructuring

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Drawing on work with Graeme Guthrie

Overview

1. **Approaches to regulation**
2. **The importance of irreversibility, risk and time**
3. **Investment in advance: illustrates many of the most relevant issues**
4. **Summary**
5. **The NZ Scene**

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The Regulatory Approaches

Rate of Return Regulation

1. *Expected revenue set by*
   - *a) expected operating costs plus*
   - *b) allowable rate of return x quantity of assets*
2. *allowable rate of return determined by the WACC*
3. *WACC being the weighted average costs of capital (determined by an average of the opportunity cost of funds to investors and lenders)*

All these elements jointly interact (Marshall et al 1981): eg systematic risk affected by the regulatory review period

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The Regulatory Approach: *Incentive Regulation*

Prices set as

- *Rate of Inflation (RPI) - some factor (x)* ***or***
- *To produce the revenue that a hypothetical firm that replaced the incumbent would require to break even (efficient entrant test)*

For the efficient entrant test the ODV Asset Base for demand q is

ODV = min {ODRC or EV}

* ODRC is optimised replacement cost (depreciated)
* EV is Economic Value

equals the present value of cost-saving in delivering q because the network is in place.

Note: ODV means that prices and firm's cash flows depend on demand

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The Regulatory Approach: Implications

- *Regulation was/is greatly complicated by the requirement to allow entry*
- *Regulation was/is applied to setting prices for incumbents and for entrants' access to networks*
- *The shift from rate-of-return to incentive regulation was essential if competition was to work*

But both

- *incentive regulation, and*
- *admitting competition*

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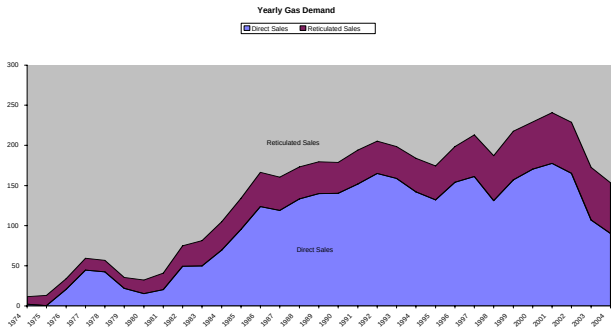
Irreversibility and Risk: gas

Much of infrastructure investment is sunk once made

Volatility is important

Gas Demand

MED Data file



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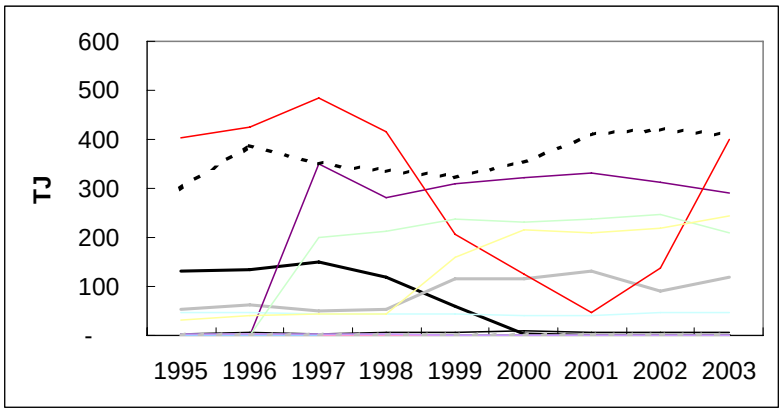
Volatility: Gas Example

Gate Station Demand: NGC



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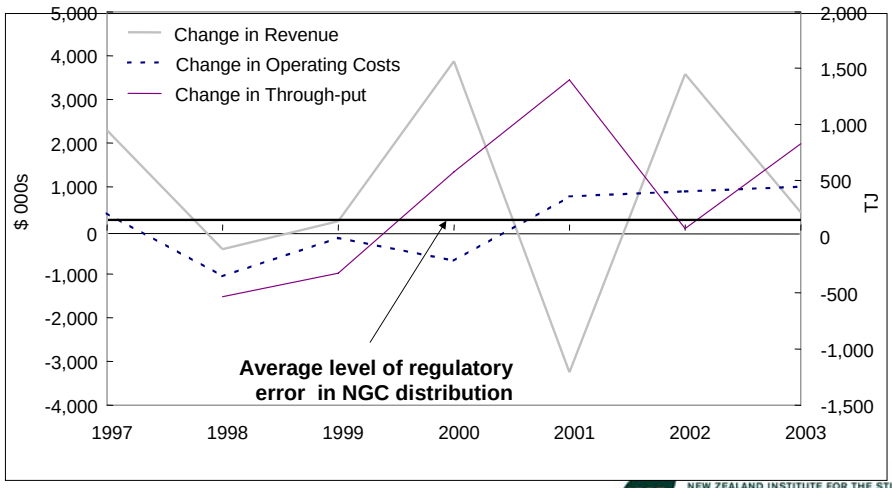
Volatility: Gas Example

NGC Distribution (*$ Nominal)*



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Irreversibility and Risk: Telecommunications and Electricity

Telecom intra-network exchange volatility 765 Exchanges 2000-2002

	Growth in Customers	***Volatility of***
Business	***- 3%***	***6.9%***
Residential	***1.5%***	***6.1%***

Electricity lines throughput 1995-2002

growth rate 2%

volatility of 4.5%

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"Incentive" Regulation

For a regulated firm to have zero economic profit looking forward

1. ***Requires expected revenue*** *to cover*

   a) expected operating costs plus

   b) rate of return times quantity of assets, plus

   c) expected cost of stranding (budgeted for)

   Where allowable rate of return *determined by the WACC which is in turn affected by demand & cost volatility, valuation of assets, and regulatory resets,* ***or***

2. *a), plus* ***b) and c) combined jointly*** *in calculating a payment for capital as regulatory rate*value of assets (it too will depend upon all these factors)*

Irreversibility and volatility combine to affect expected costs, the allowable regulatory return, and the appropriate valuation of

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The Regulatory Approach: examples

Examples: If we want the regulated firm to meet demand, minimise costs and break even on its investment then (on the earlier data)

The regulatory rate of return when the WACC is 5% is

Telecommunications exchanges

Business 8.6%, Residential 5.5%

Electricity Lines 5.24%

(this excludes the effect on the wacc of demand (see Evans and Guthrie (2003), for details))

Investment in Advance And Economies of Scale

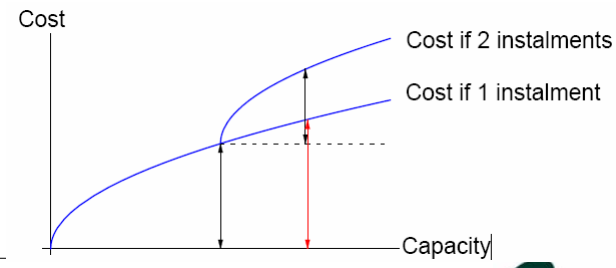
- Economies of scale in investment: the greater the capacity provided at any one time the lower the average cost of the capacity
- Set-up
  - Requirement to serve
  - Set price path pricing at intervals according to the hypothetical efficient firm (TELRIC)
  - Cost minimising yielding "reasonable" revenue requirement
  - Examines implication of reasonable revenue for firm's investment incentives

(draws on Evans and Guthrie Incentive *Regulation of Prices When Costs are sunk* (JRE, 2006))

An example for starters

Investment with scale economies

- Customers demand 1 unit of capacity this period
- Demand equals 1 plus or minus σ units next period with probability 1/2
- It costs $\sqrt{s}$ dollars to build s new units of capacity



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Firm's timing and quantity of capacity

Suppose a firm *must* meet demand in *both periods*

- It can build 1+ σ units now, costing $\sqrt{1+\sigma}$ at the outset **or**
- It can build 1 unit now, and only expand if needed: yielding expected cost

$$\text{PV[cost]} = 1 + \frac{1}{2}\frac{\sqrt{\sigma}}{1+r}$$

(r is one period interest rate)

- The cost to the firm is the smaller of

In Advance		Delayed i.e. flexible
$\sqrt{1+\sigma}$	and	$1+\frac{1}{2}\frac{\sqrt{\sigma}}{1+r}$

- Choice: Very small σ (cost) or high probability of expanded demand implies build in advance: otherwise wait

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Incentive (ODV) regulation: the hypothetical firm

- Consider a replacement firm next period
  - If demand is *high*, a replacement firm builds 1 + σ units, costing

$$ORC_h = \sqrt{1+\sigma}$$

  - If demand is *low*, a replacement firm builds 1 - σ units, costing

$$ORC_l = \sqrt{1-\sigma}$$

- The replacement firm has an informational advantage: it knows whether demand turns out to be high or low

Incentive regulation: the regulated firm

- If the existing firm <u>locked in the economies</u> of scale last period then,

$$\text{Hist cost}_h = \text{Hist cost}_l = \sqrt{1+\sigma}$$

h high demand 2nd period
l low demand 2nd period

and

$$\text{Hist cost}_h = ORC_h \quad \text{Hist cost}_l > ORC_l \quad (\text{\& capacity is "stranded"})$$

- If the existing firm <u>retained flexibility</u> last period,

and $$\text{Hist cost}_l = 1, \quad \text{Hist cost}_h = 1+\sqrt{\sigma}$$

- The hypothetical replacement firm always faces lower costs.

$$\text{Hist cost}_h > ORC_h \quad \text{Hist cost}_l > ORC_l$$

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The Lessons so far

- Sometimes it is best to invest ahead of demand
- Sometimes it is best to retain flexibility (i.e. not invest too far ahead of demand)
- It may be ex ante efficient to invest in advance of demand, even though there is some probability of stranding
- The *regulated firm is always looking forward in decisions*
- The *hypothetical replacement firm has no sunk asset concern, is only looking forward in re-set periods* and has a cost and informational advantage

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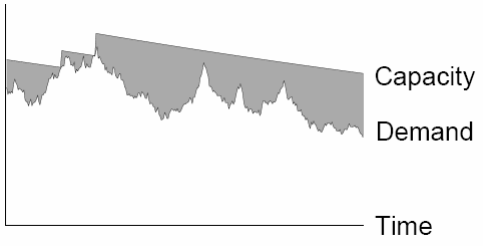
Implications For Regulation

- The consequences investment in (anticipatory) lumps:



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Incentive Regulation: three possibilities

Lets look at the *reasonable* revenue: revenue that only just allows the regulated firm to:

1. continue in business (Poss #1),
2. start and continue in business (Poss #2),
3. start, continue and not lose value when customers are added (Poss #3).

and the associated *reasonable* value of the firm being the expected present value of its profits derived from *reasonable* revenue

Case A: no investment economies

Case B: investment scale economies

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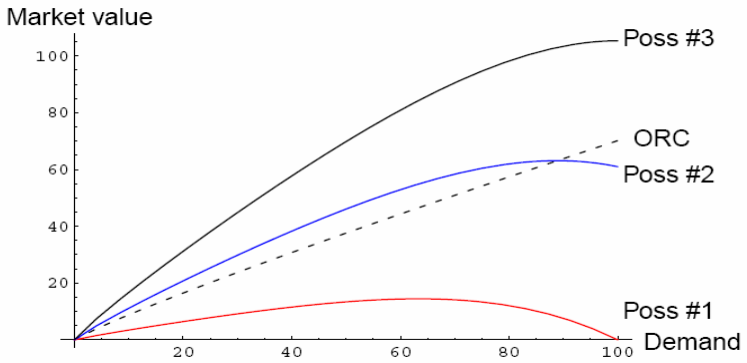
What is the firm worth at capacity 100 and a particular demand: with (10%) scale economies?



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Summary

- Optimized replacement cost is artificially low as a cost measure, due to uncertainty, irreversibility and economies of scale in investment
- A firm that is *ex ante* just breaking even (P. #2) should have a reasonable firm value greater than ORC, and an allowable rate of return greater than the wacc. It should generally be given some credit for assets unused but potentially usable;
- P. #2 will still have conflict with the regulator as it expects to lose on investment in capacity because the regulator (looking backwards) will ignore the (potentially) iterative investment that results from trading off economies of scale in investment and the option to delay and find out more information. P. #3 does not.
- P. #2 requires a higher, and P. #3 a higher yet again regulatory return than the wacc
- Extent of the higher required return may be mitigated by allowing excess demand

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Concluding remarks

- Results that are appropriate for rate of return regulation or reversible investment do not generally apply to firms subject to incentive regulation, and risk: particularly risk of competition and stranding by regulation.
- These complications imply an asymmetric risk in that the “missing markets” engendered by a 10% “too” low revenue requirement are much more welfare costly than a revenue requirement that is 10% “too” high
- The issues posed by volatility, and irreversibility should be taken seriously under regulation otherwise investment (quantity and quality) will be adversely affected
- The relevant issues/inputs can be modelled in ways that provide quantitative evidence that is robust.

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The Quandary

- Incentive regulation is desirable
  - it can allow competition where possible
  - it provides incentive for efficiency
- But incentive regulation cannot work under ODRC regulation unless rates of return are significantly bigger than have been allowed to date: perhaps even bigger than an unregulated firm would go for
- Rate of return regulation
  - shifts (most of) the risk to consumers
  - has weak incentives for cost saving
  - Does not admit viable competition

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Concluding remarks

- The present ODRC approach will (continue to) materially inhibit investment as it will be assigned too low rates of return
- Alternative is to set a price/revenue path that allows
  - the firm to be viable looking forward
  - investment plans to be implemented
  - prices on some historical cost basis but for a period (and mechanisms) that incentivise efficiency and performance gains
- No scheme will approximate perfection

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The NZ Scene: an exemplar

- The Commission has notionally applied ODV regulation in its regulatory deliberations (evaluations of price paths and assessment of regulation): to consumer trust/municipality and investor owned firms
- Its analyses have called transfers a benefit (even between consumers and the tax base)
- It has paid no attention to
  - the risk of incentive regulation
  - The economies of scale of networks in
    - initial construction
    - Maintenance (construction in networks in place)
- It has not treated the hypothetical replacement firm as stand alone with the effect of reducing prices below that which would just sustain this firm.
- Cash flow analyses have shown that the resultant price paths do not sustain required investment
- The Commission's subsequent "settlements" suggest it is "back to the drawing board"

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