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

NOTE: THERE ARE SOME OVERLAYS WHICH ARE CLARIFIED IN THE SLIDE SHOW

Risk, Economies of Scale and Irreversibility in Regulation and Competition Law

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NZ Government Officials

Industrial Organisation and Competition Policy Course

25 January 2011

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Outline

- Time and risk
- Implications for the economic framework
- Applications
  - natural monopoly
  - workable competition
  - electricity

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Time and Risk

- The future is uncertain
- All private and regulatory decisions concern the future and hence uncertainty or risk
- The implications for competition law and regulatory economic frameworks or models depends on the extent of uncertainty, the extent decisions are irreversible, and the nature of the industry.

Time, Risk and Economic Framework

- The textbook supply/demand diagram is
  - static, timeless
  - convenient (normative basis)
  - useful where it yields good predictions
  - where there is *risk* and *irreversibility* good predictions require incorporating timing and *these features* in supply and demand
- Incorporating time, risk and irreversibility produces a dynamic efficiency framework

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Time and no risk: and the Economic Framework

- (Even) where risk is negligible a timeless approach may have limitations
  - decisions are forward looking
  - costs and benefits should be weighted according to when in time they arise
  - Inter-temporal competition may matter
    - e.g. in durable good industries

Risk and no Time: the Economic Framework

- Although there is contemporaneous risk (e.g. quantum of gas remaining in the Maui field), risk in the economic framework is only of interest where there is some time dimension.

- Risk can interfere with the separation of supply and demand in the standard model. Where there is uncertainty about features of demand or supply and production takes time and/or storage is possible, demand (supply) decisions may be affected by expectations of price and thus incorporate supply (demand) features breaking the convenient dichotomy of separate demand and supply factors.

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Time, Risk and Natural Monopoly

Review of the standard framework

- Monopoly created by the cost advantages of one supplier
  - Based on technology – assumes technology is fixed
  - No combination of two or more producers could operate with lower costs than the incumbent
- Firm has downward sloping AC over the feasible range of output
  - Pricing at average cost means the firm earns rents
  - Pricing at marginal costs means the firm does not cover its average costs of production and makes a loss
  - Pricing greater than average cost is possible and the firm makes above normal profits

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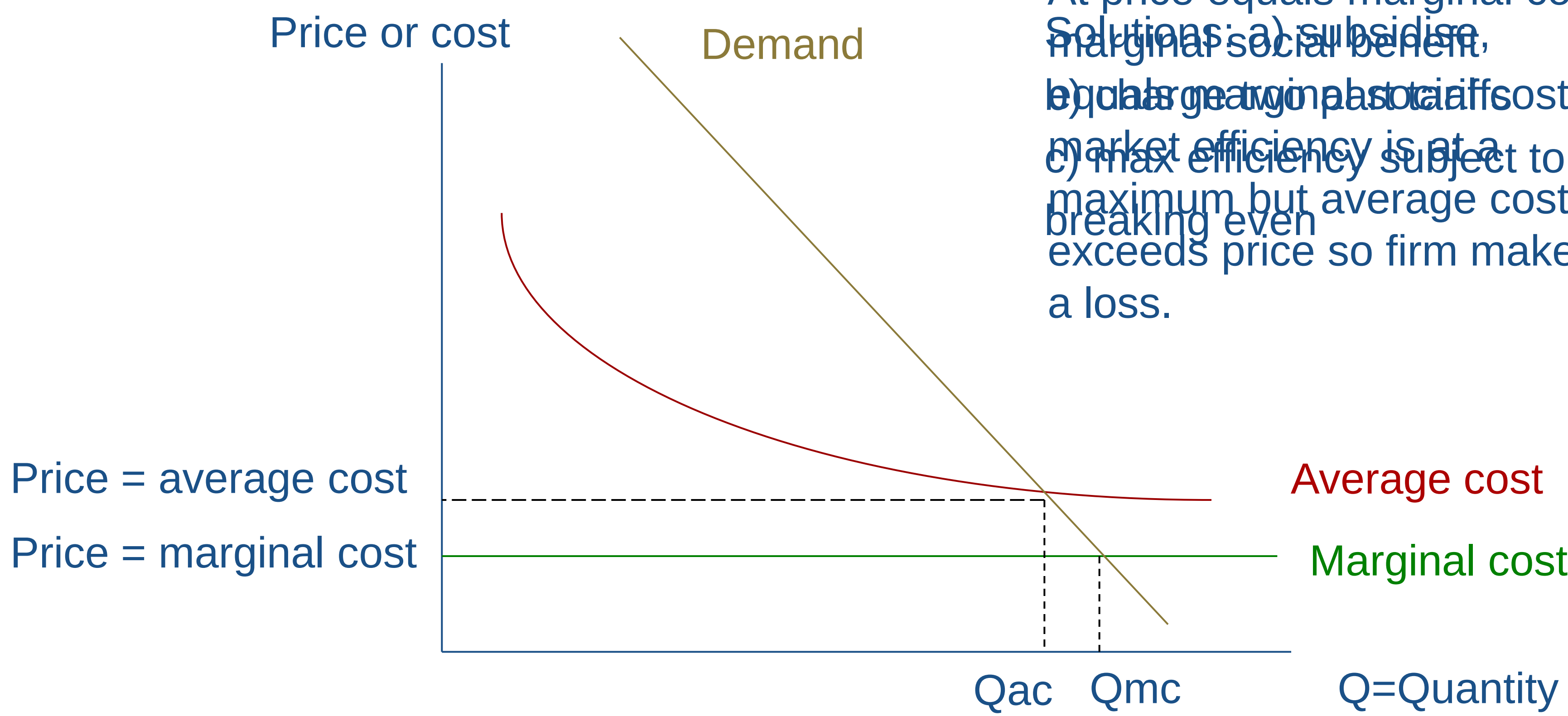
Natural Monopoly

Review: is “first” best possible?



At price equals marginal cost marginal social benefit equals marginal social cost: market efficiency is at a maximum but average cost exceeds price so firm makes a loss.

Solutions: a) subsidise,
b) charge two part tariffs
c) max efficiency subject to breaking even

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Two Approaches to Natural Monopoly Price Regulation

- Rate of return (cost plus) regulation
  - means periodically set tariffs so that (annualised)

    revenue = operating costs + (regulatory rate of return + depn rate)*capital
  - Means that consumers carry all the risk, and
  - Makes little sense if there is any competition: history has been to prevent entry

- Incentive regulation
  - Theory:
    - Set price independently of firm's decisions at a level that mimics a competitive market
    - Set price as the costs of a hypothetical efficient firm, or inflation less x
    - Can have competition
  - Firms must carry risk and must have a higher rate of return (than under cost plus) if investment is not to be inhibited

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What Are the Characteristics of Natural Monopoly?

e.g. physical infrastructure

- cost structure
  - Substantial share of cost is capital
  - irreversible
  - economies of scale
- network effects (won’t consider)
- volatile utilisation
  - means capacity is not 1:1 with usage
  - means investment is risky
- cost/technical change risk

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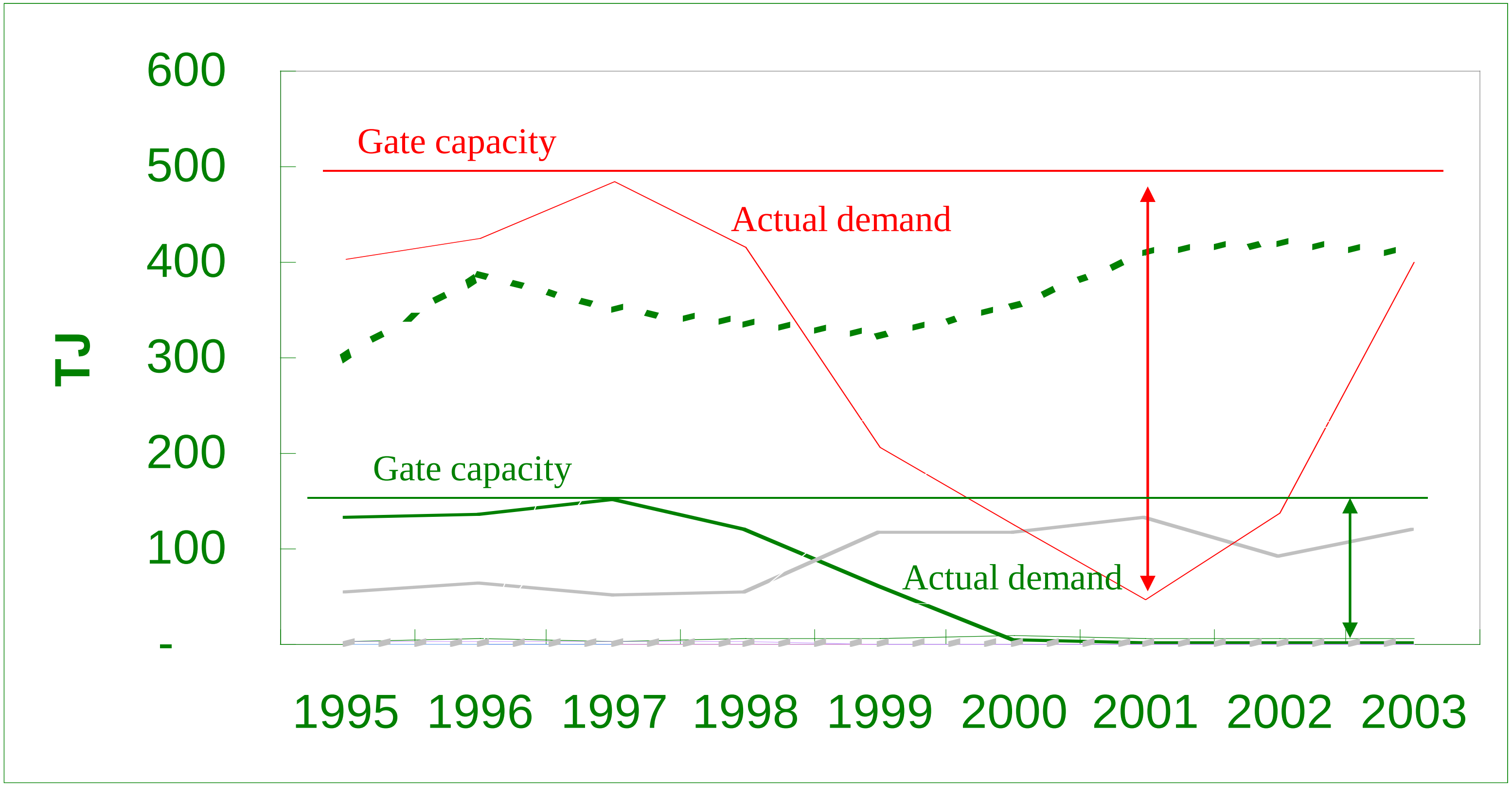
Demand Volatility

DEMAND is volatile although it varies across infrastructures:

- **electricity lines: is relatively low (managed)**
- **telecom exchange much higher (less managed)**
- **Gas pipes**

Demand Volatility: Gas Pipelines Example

Capacity Determined by Historical Maximum Throughput



NGC Gate Station Gas Flows

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Source of Cost Volatility I

Technical change; plus (cited by PHB (2004))

- price of inputs, such as labour and materials
- competition and level of demand/supply
- project size and location
- Legal and regulatory requirements, and constraints imposed by local authorities
- As between new construction sites and established locations
- Design and construction standards
- The efficiency of project and contract management

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Cost Volatility II
Examples

- Transit NZ (2006) for thirty projects in Auckland Wellington and Christchurch: range of tenders spans 26% of the maximum tender.

- PWC (2004) Data on project quotes for categories of investment across six lines companies

Investment	Coefficient of Variation
Undergrnd.	17.8%
Trnsfm.UpGrd	40.1%
11kV urban	27.8% (rural 27.62%)

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Irreversible Decisions

- Decisions that entail commitment to the extent they are not able to be reversed, or that are very costly to reverse
- Examples
  - Advertising: may be used strategically
  - Investment in gas pipelines
  - Transpower could sell the Cook Straight electricity transmission cable: does this imply the cable is not sunk (i.e. not an irreversible investment)?
- Irreversibility is particularly important where there is uncertainty

Uncertainty and Irreversible Decisions Entail Real Options

- Real option is the right but not the obligation to take action (e.g. invest)
- Value of a real option is a function of expected payoffs and uncertainty
- Delay: the firm gets more information,
- Requires both irreversibility and uncertainty
- May have positive or negative value

The Investment Timing Problem

- Two things can go wrong
  - Investing, when you should wait
  - Waiting, when you should invest
- "Bad news principle"
  - It is the first mistake that matters
  - Expected profits must compensate the firm for any future bad news
  - If the potential for bad news becomes greater, the firm is more likely to delay investment
- Invest when the (present) value of expected return exceeds expected future costs *and* the value of delay

Access Regulation of Natural Monopoly

The Option To Use A Network

- Regulation grants entrants an option to use the incumbent’s network
  - Using incumbent network preserves the option to invest yourself
- Analogy with contracting out vs producing inside the firm
  - Contracting out preserves the option to invest later
- Regulatory prices set desirably reflect all significant options: typically are not set this way
- Affects investment by all parties: including the natural monoply provider

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The Origins of Natural Monopoly: Economies of Scale in Investment

- Often depicted as fixed cost plus very low marginal cost: but how does this relate to capacity?

- Where does declining average cost come from
    - organisational economies: unlikely given capital intensity
    - input price scale effects:
    - economies of scale in investment
- Economies of scale in investment
    - Definition: the larger the investment to expand services the lower the average incremental cost
    - Add that the investment is irreversible (sunk)
    - Accords with the static form of natural monopoly

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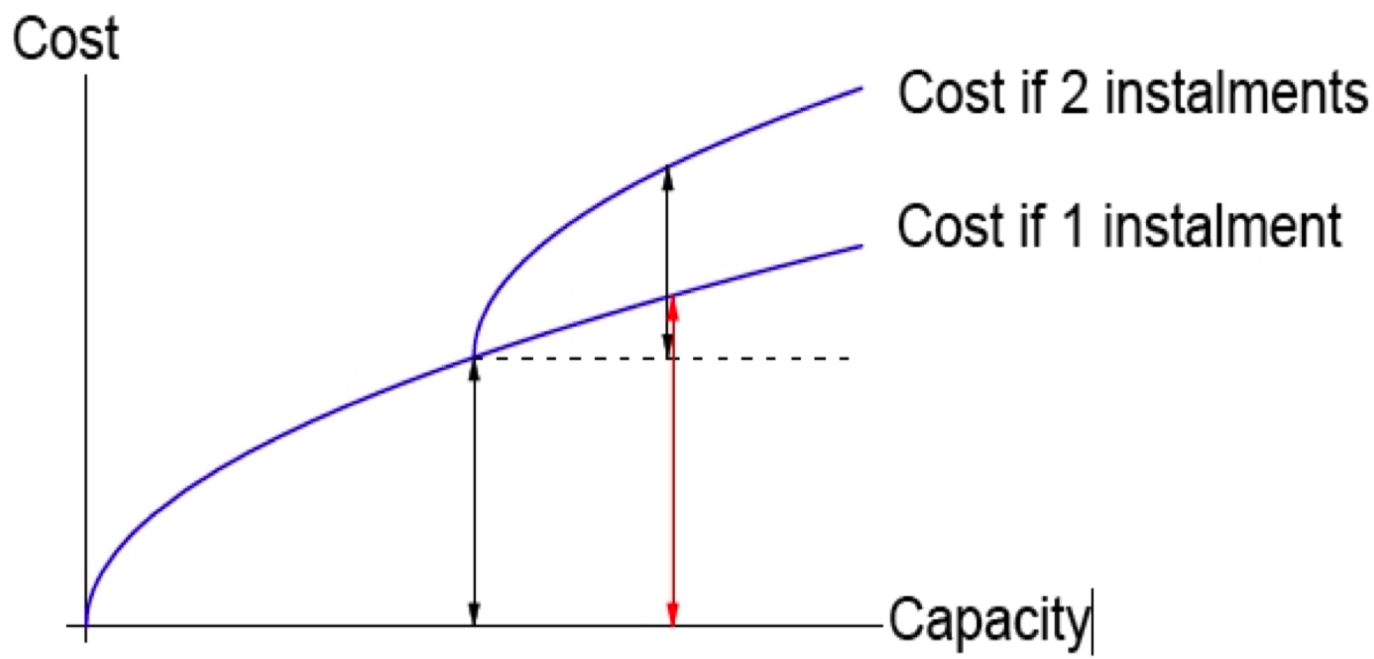
Economies of Scale in Investment

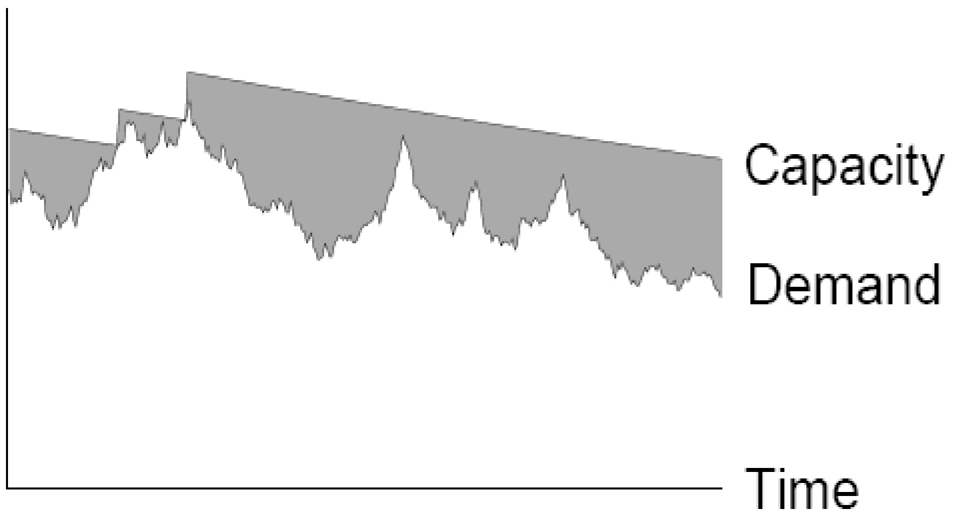
Present in maintenance as well as green-fields investment



Putting Together Uncertainty, Irreversibility and Economies of Scale
(with depreciation)

Invest when demand = capacity (no delay option)

When invest, optimal with economies of scale to put in more capacity than immediately demanded



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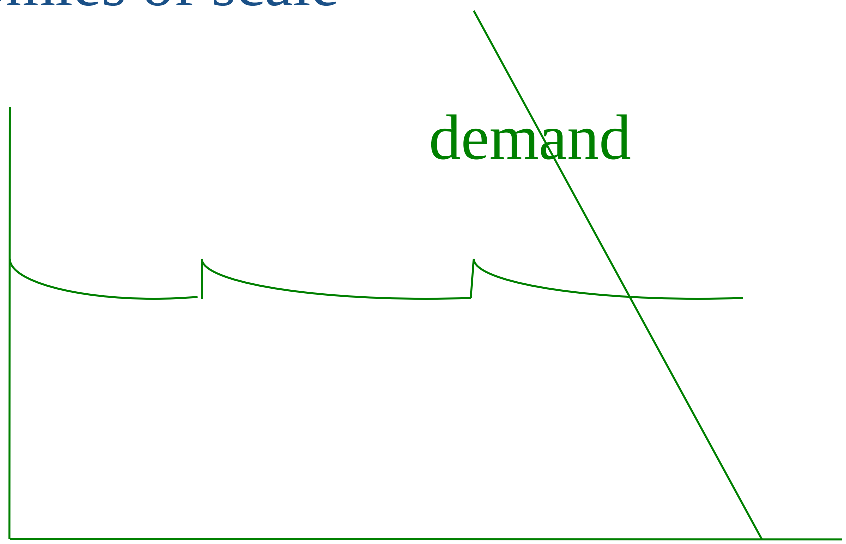
The Firm

Uncertainty, Irreversibility and Economies of Scale

Average cost: taking decisions iteratively over time trading off

- uncertainty
- economies of scale

Average
Cost



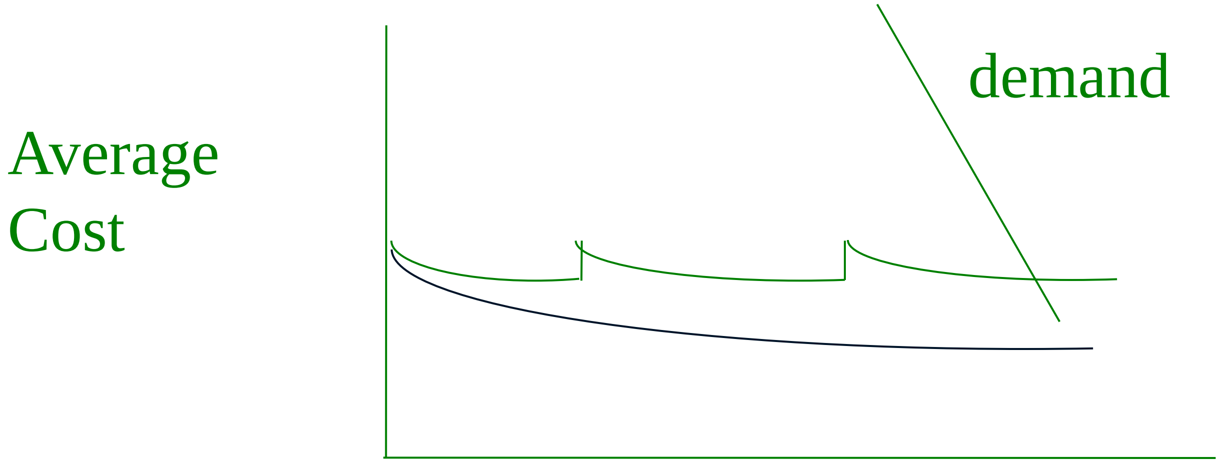
Baumol and Bradford explain this in a world of certainty

The Regulator

Uncertainty, Irreversibility and Economies of Scale Under Incentive Regulation

Makes decisions (sets prices on the basis of the efficient firm) ex post

- knowing demand
- economies of scale over *all* demand
- producing a lower average cost than the firm



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Central Regulatory Issue:

Under the “efficient” firm model of incentive regulation

- The regulator always has more information than the firm (e.g. about demand)
- It produces a conflict between firm and regulator
  - As capacity is approached average costs are lower, required capacity investment is more probable and cost of investment will not be recovered.
  - A conflict that is not in accord with incentive regulation
  - Resolved by a regulatory rate of return that is too high to be credible (at 10% economies of scale: Evans and Guthrie)
- NZ Commerce Commission
  - proposed this approach in 2001-2008 but never implemented it
  - Now (approved cost)-plus approach to price setting plus demand management

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Workably Competitive Markets

- *"….. a market framework in which the pressures of other participants (or the existence of potential new entrants) is sufficient to ensure that each participant is constrained to act efficiently and in its planning to take account of those other participants or likely entrants as unknown quantities. To that end there must be an opportunity for each participant or new entrant to achieve an equal footing with the efficient participants in the market by having equivalent access to the means of entry, sources of supply, outlets for product, information, expertise and finance."*

  Heydon (1989, p.1548) *Trade Practices Law*

- Jesse Markham *American Economic Review*: 1950*: it should enable dynamic efficiency*

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Decisions in Workably Competitive Markets I

- routinely reflect uncertainty about potential outcomes
- routinely reflect irreversibility in very many investments (e.g. advertising, contract commitment, tangible and intangible commitment),
- routinely reflect transaction cost frictions; and hence
- routinely reflect the creation and extinguishing of options

Decisions in Workably Competitive Markets II

- Workable competition does not eliminate real options and thus does not eliminate market prices exceeding operational marginal cost
  - Novy-Marx (2007): in general
  - Guthrie (2010): housing market, example

- Uncertainty, increasing marginal cost and irreversibility imply workably competitive market decisions reflect delay options

- To eliminate the observation of price > marginal cost requires investing instantaneously as soon as price exceeds marginal cost: i.e. not waiting.

Decisions in Workably Competitive Markets II

- Particularly for markets with uncertainty and irreversible investment characteristics zero “normal” profit at any time is not implied by a workably competitive market.

- There are ways to incorporate real options in analyses: some are as simple and no more data demanding than the WACC.

The Case of Electricity Markets

- Prices and fuel availability (water and gas) are uncertain over time
- Fuel can be stored
  - Without storage river flows have “no” opportunity cost
  - Gas opportunity cost depends on capacity and nature of gas market.
  - Existence of storage affects timing of use and the quantum of fuel in the case of water
- Price can exceed marginal cost for price-taking generators

Hydro Generation

- So a price-taking hydro generator may offer in at a price above operational marginal cost.
- The expected profit from stored water will depend on a wide range of factors: shape and volatility of demand, current level of stored water, prospective inflows and prices.
- Generator offers to supply electricity at or above an offer price that covers this opportunity cost – i.e. *cover the value of the option* to generate in the future
- Otherwise the value of the firm can be increased by some other generation offer

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Gas Generation

Gas available at going price

- If unlimited supplies of gas are available at a given price of gas then
  - the offer price of a gas generator will be at least the price of electricity produced by gas (the price of gas times the conversion rate to electricity plus any other operational marginal cost): call this p*

- In a competitive market
  - the offer price will equal p*
  - with base load plant (say geothermal), and sufficiently large gas generation capacity: the gas price of electricity will set the market price of electricity: hydro generators will not successfully be able to sell at a higher price

A Workably Competitive Electricity Market

NZ electricity market is an energy only market that has

- Roughly 60% hydro, 20% gas, 20% other
- Inflows to reservoirs that are volatile
- Gas capacity* that cannot supply all hydro: (would this be economic?)
- Gas contracts that are take or pay with banking*,
- Storage of gas* and water that is limited
- Thermal generation with increasing marginal cost (due to increasing fuel cost (e.g. coal fired plant) and decreasing plant efficiency, as thermal output is expanded)
- Other features: e.g. particular transmission constraints that have been important in times of fuel shortages

* These factors result in gas generation offer prices based on the same inter-temporal decision principles as for hydro.

A Workably Competitive Electricity Market

Means that

- Generation decisions of all parties are affected by short to medium term expectations of future water and gas supplies (investment is affected by expectations relating to the long term)

- Thermal (specifically gas and coal/oil) generation and hydro
  - are substitutes whose relative generation reflects the state of fuel supply
  - substitution in NZEM manages lake inflow variation
  - have the same marginal offer prices and thus offer prices that fluctuate together with hydro fuel supplies
  - when in reduced supply over periods that last a month or more; result in higher prices that reduce demand from un-hedged consumers (industry and commercial entities), and hedged consumers selling back their hedge entitlements

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Wolak's calculation of market power profit (rents) in NZEM

Wolak calculated

– variable cost of market generation

–reported the factual price level over time and

–calculated a counterfactual price based upon the marginal cost of gas supply assuming feasible expanded plant and gas supply

–reported the counterfactual price at the factual level of generation

–The margin between the two price series was deemed market power rent

Wolak’s Rents

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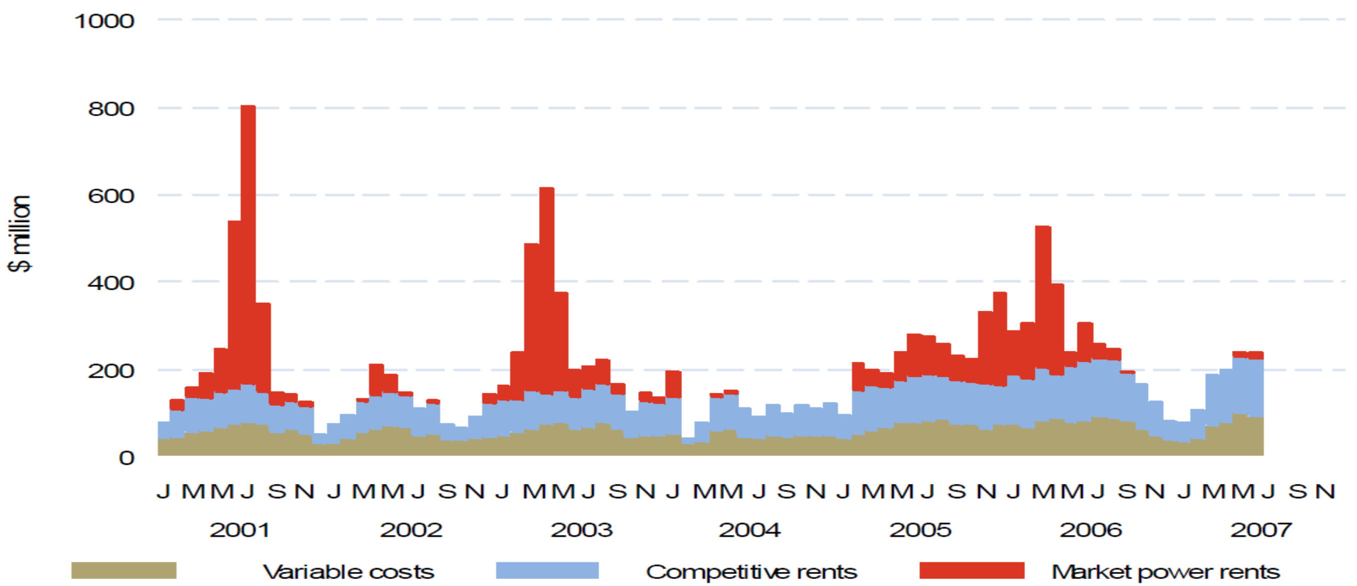
Figure 5.12: Decomposition of Wholesale Market Revenues, Counterfactual 2



Source: Calculations as described in text using offer data from Centralised Data Set and EMS, dispatch data from M-Co, and fuel price and usage data from Contact Energy, Genesis Energy and MED.

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In Sum

- Risk and irreversibility are part of commercial operation in all sorts of markets
- Its extent and importance varies across industries
- It affects behaviour, and what is observed
- It should be reflected in competition law and regulatory analyses and decisions where it is relatively important
- It is intrinsic to dynamic efficiency

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