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Economic drivers

Input and output prices
Adjustment under ITQs

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Outline

- Question being examined
  - How are fishers likely to adjust their fishing operations under ITQs?
- Methodologies to look at the issue
  - Cost functions
  - Profit functions
- Case study
  - Northern prawn fishery

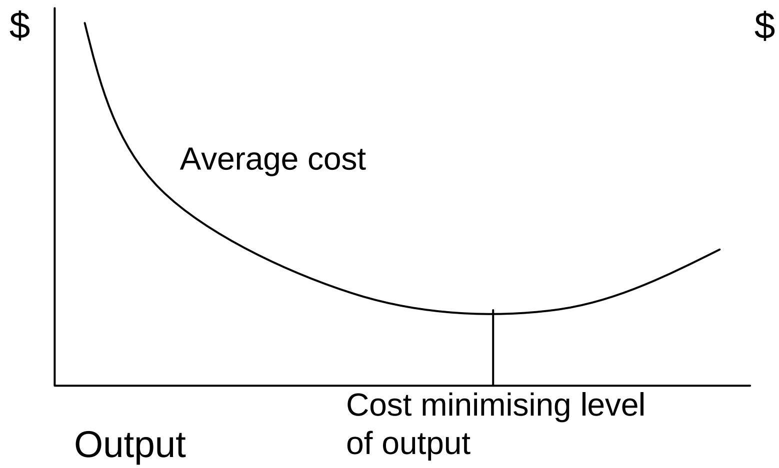
Adjustment under ITQs

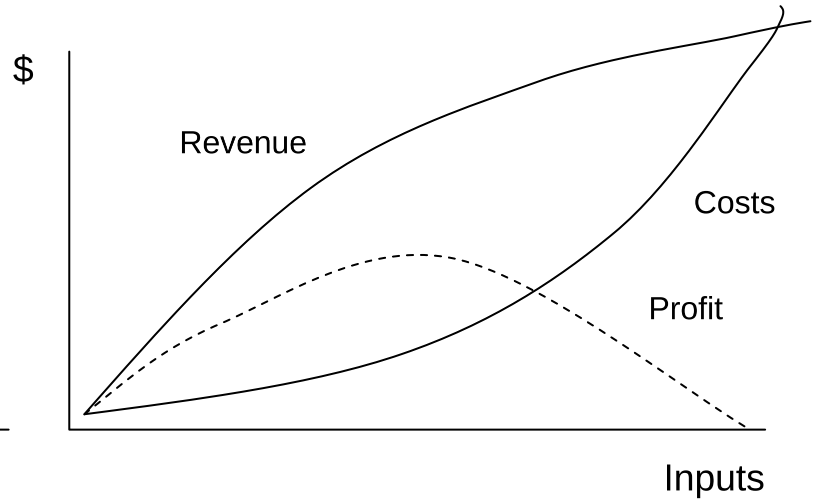
- Incentives under ITQs different to open access
  - Race to fish provides incentives for larger, more powerful vessels in order to increase share of the output
  - Removing ITQs allows fishers to
    - Adjust quota holding and effort levels to maximise profits for a given vessel in the short term, and
    - Change their vessels in order to maximise profits in the longer term

- The direction of change will depend on a number of factors
  - Output prices and expectations of output prices
  - Input prices and expectations of input prices
  - Availability of quota

Methods to look at these

- Cost functions
  - Can be used to estimate the cost minimising level of catch
  - Takes into account costs of production, but not the prices for the outputs





- Profit functions
  - Takes into account both input and output prices
  - Derive optimal input use and output levels

Cost function estimation

- Translog cost function

$$LnC = \beta_o + \sum_i^n \alpha_i \ln w_i + \frac{1}{2}\sum_i^n \sum_j^n \alpha_{ij} \ln w_i \ln w_j + \beta_y \ln y + \frac{1}{2}\beta_{yy}(\ln y)^2 + \sum_i^n \beta_{iy} \ln w_i \ln y + \varepsilon$$

- Share equations

$$S_i = \alpha_i \ln w_i + \sum_j^n \alpha_{ij} \ln w_j + \beta_{iq} \ln Q + \varepsilon$$

- Homogeneity conditions

$$\sum_i^n \alpha_i = 1, \ \sum_i^n \alpha_{ij} = 0, \text{ and } \sum_i^n \beta_{iy} = 0$$

- Solve using restricted SUR
- Minimum costs when returns to scale =1

$$RTS = 1/(\partial C / \partial Y) = 1/(\beta_y + \beta_{yy} \ln Y + \sum_i \beta_{iy} \ln w_i)$$

Profit function approach

General form

$$\ln \pi = \alpha_0 + \sum_i \alpha_i \ln P_i + \frac{1}{2}\sum_{i \neq j}\sum_{j \neq i} \alpha_{ij} \ln P_i \ln P_j + \sum_i \alpha_{ii} \ln^2 P_i +$$

$$\sum_k \beta_k \ln Z_k + \sum_{k \neq l}\sum_{l \neq k} \beta_{kl} \ln Z_k \ln Z_l + \sum_k \beta_{kk} \ln^2 Z_k + \sum_i \sum_k \beta_{ik} \ln P_i \ln Z_k$$

$$\gamma_t t + \gamma_{tt} t^2 + \sum_i \gamma_i \ln P_i t + \sum_k \gamma_k \ln Z_k t$$

- Share equations

$$S_i = \alpha_i + 2\alpha_{ii} \ln P_i + \sum_{j \neq i} \alpha_{ij} \ln P_j + \sum_k \beta_{ik} \ln Z_k + \gamma_i t$$

- Homogeneity conditions

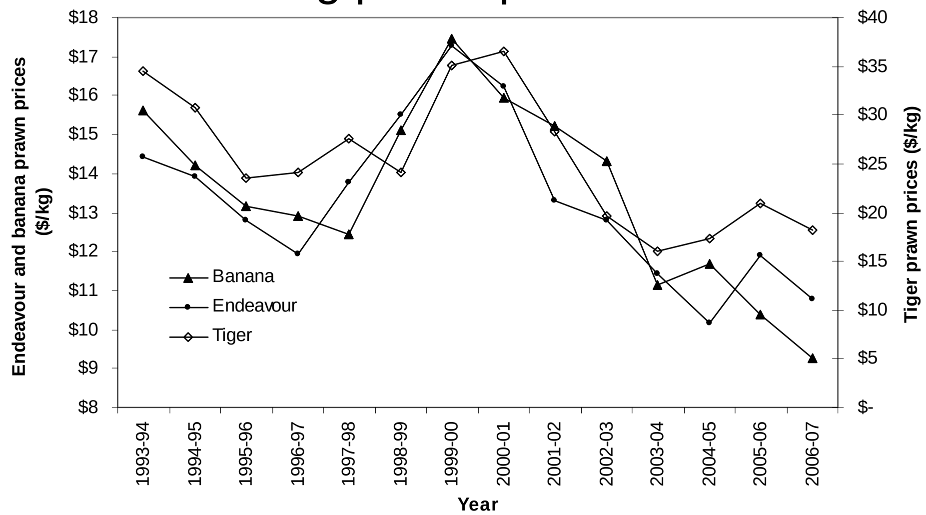
$$\sum_i \alpha_i = 1 \quad \sum_i \alpha_{ij} = 0 \quad \sum_i \beta_{ik} = 0 \quad \sum_i \gamma_i = 0$$

- Estimate using restricted SUR

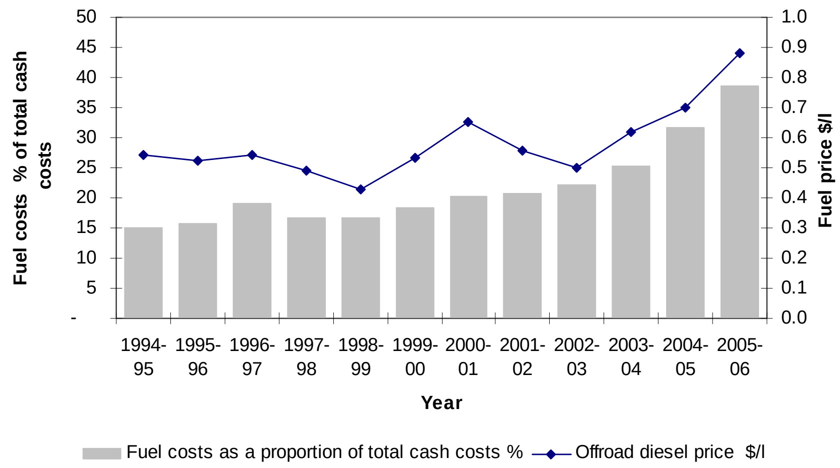
$$S_i = P_i Q_i / \pi \quad \Rightarrow Q_i = \pi S_i / P_i$$

Northern prawn fishery example

Declining prawn prices



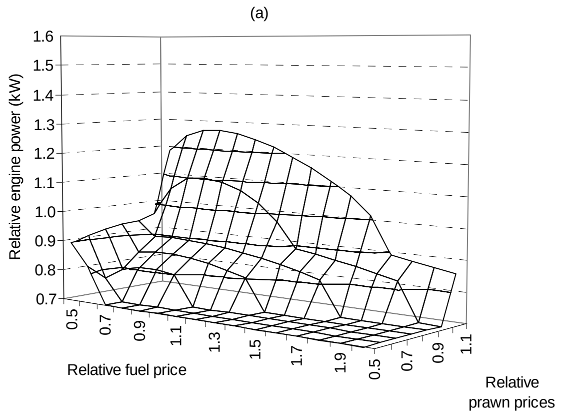
Increasing fuel prices



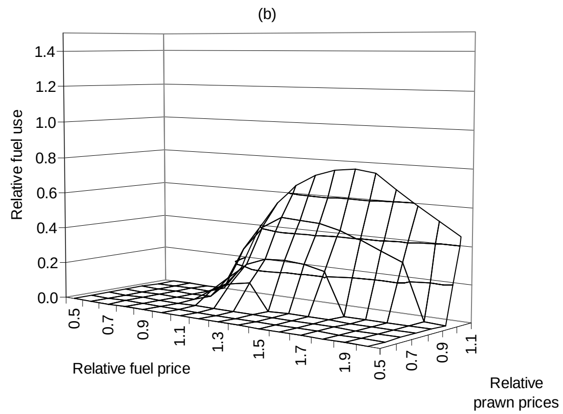
Plan to move to ITQs in 2010. Incentives to adjust catches, effort levels and vessel size to maximise profits

Optimal input use and catches

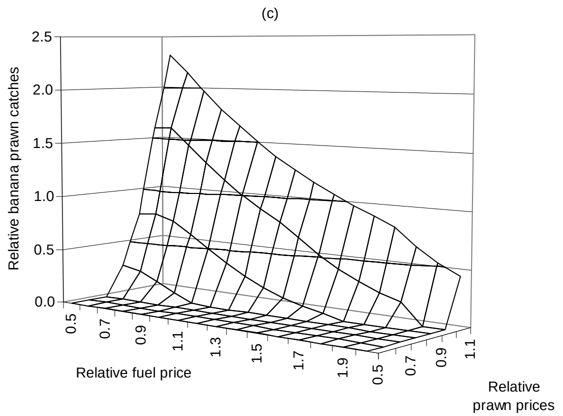
Engine power



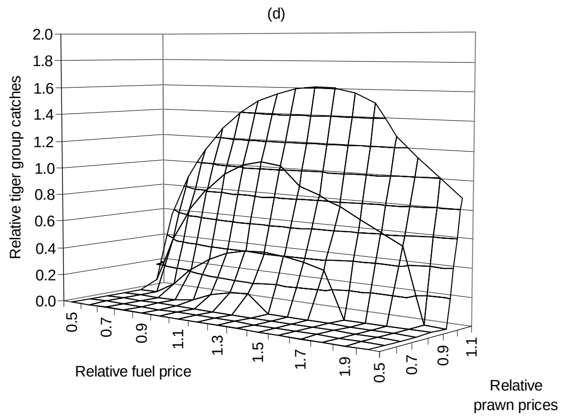
Fuel use



Banana prawn catch



Tiger prawn catch



Key assumptions and main points of results

- Key assumptions
  - Tiger prawn stocks 27% higher at MEY; banana prawn stocks average
  - Restrictions on headrope length removed (increases it only 4% above average)
- Key results
  - Larger (than current average) boats only more profitable with low fuel costs or high prawn prices
  - For all price combinations, it is worth reducing fishing effort
  - Optimal banana prawn catch is more sensitive to fuel prices than prawn prices
  - Optimal tiger prawn catch more sensitive to prawn prices
- With high fuel prices and average prawn prices …
  - A profit maximising fleet is likely to consist of smaller vessels that individually fish less, take fewer banana prawns and slightly fewer tiger prawns

Summary

- Assumptions of profit maximising behaviour allows us to predict how fishers may behave in light of changing economic conditions.
- This is only likely to be valid under conditions of ITQs
  - Under regulated open access the incentives are altered substantially
- Both profit and cost functions can be used to provide a guide as to how the fleet may look under future bioeconomic conditions