Fisheries management and fisher discount rates

Louisa Coglan and Joel Lim
School of Economics and Finance, QUT

Sean Pascoe
CSIRO Marine and Atmospheric Research

Outline

- Aims of the study
- Conceptual model and functional forms
- Data
  - Apparent relationships
- Model results
- Conclusions

Purpose of this study

- to examine the relationship between fisher discount rates and varying types of management in Australian fisheries
- test the assumption that rights based management instruments reduce uncertainty around future catches
  - lower discount rate
    - Asche 2001; Alcock 2006
  - increasing expectation of profits

Conceptual model

$$L_t = O + \frac{ExprofitFE_t - discountrate * K_t}{discountrate}$$

$$L_t = O + \frac{ExprofitFE_t}{discountrate} - K_t$$

$$L_t + K_t = O + \frac{ExprofitFE_t}{discountrate}$$

Licence value (L)

- option value (O)
- NPV of future expected full equity economic profits
  - i.e. less op cost of capital (K)

$$discountrate = fn(i_t, i_{t-n}, management_t, management_{t-n})$$

$$ExprofitFE_t = fn(profitFE_t, profitFE_{t-n}, Boats_t, Boats_{t-n}, management_t, management_{t-n})$$

Functional form

- Assume non-linear function
  - error correction form
  - assumes management affects both expectations about future profits and discount rate
  - considers both long and short term dynamics

$$(L_t + K_t) = (O?) + \frac{profitFE^{\beta_1} Boats^{\beta_2} ITE^{\beta_3} ITQ^{\beta_4}}{i^{\beta_5 + \beta_6 ITE + \beta_7 ITQ}}$$

Error correction model

$$\Delta \ln(L_t + K_t) = \beta_1 \Delta \ln(profitFE) + \beta_2 \Delta Boats + \beta_3 \Delta management$$
$$-\beta_4 \Delta i - \beta_5 \Delta i \Delta management$$
$$+\beta_{L1} \ln(L_{t-1} + K_{t-1}) + \beta_{L2} \ln(profitFE_{t-1}) + \beta_{L3} Boats_{t-1} + \beta_{L4} management_{t-1}$$
$$-\beta_{L5} i_{t-1} - \beta_{L6} i_{t-1} management$$

- Red bit is the dynamic (short run) component
- Blue bit is the long run component
  - Long run model:

$$\ln(L_{t-1} + K_{t-1}) = \frac{\beta_{L2}}{-\beta_{L1}} \ln(profitFE_{t-1}) + \frac{\beta_{L3}}{-\beta_{L1}} Boats_{t-1} + \frac{\beta_{L4}}{-\beta_{L1}} management_{t-1}$$
$$- \frac{\beta_{L5}}{-\beta_{L1}} i_{t-1} - \frac{\beta_{L6}}{-\beta_{L1}} i_{t-1} management$$

Other Functional forms considered

- Linear model

$$(L_t + K_t) = \underbrace{(\beta_1 + \beta_2 ITE + \beta_3 ITQ)}_{Option\,value} + (\beta_4 + \beta_5 ITE + \beta_6 ITQ)\left[\frac{profitFE}{i}\right]$$

- Log-linear model

$$\ln(L_t + K_t) = \underbrace{(\beta_1 + \beta_2 ITE + \beta_3 ITQ)}_{Option\,value} + (\beta_4 + \beta_5 ITE + \beta_6 ITQ)\ln\left[\frac{profitFE}{i}\right]$$

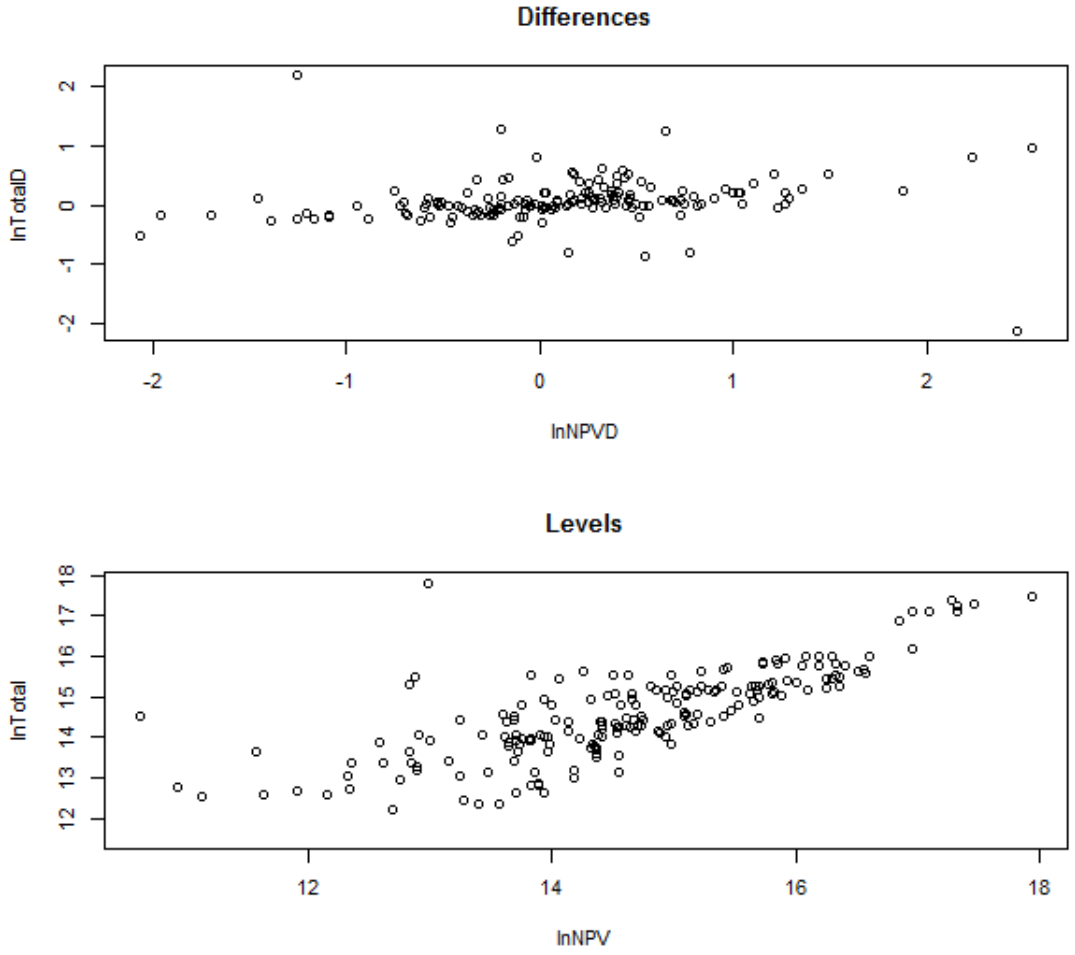
Data

- Economic survey data
  - Fishery level (averages) – avoids issues relating to heterogeneity between vessels
  - Commonwealth fisheries data from ABARES annual reports
  - SA fisheries data from Econsearch annual reports
  - 1991/92 to 2010/11
    - Not all fisheries in earlier years
    - 233 observations
- 15 fisheries
  - 5 Input control
  - 2 ITE only
  - 7 ITQ only
  - 1 transition from input to ITE
  - 1 transition from input to ITE to ITQ

Data

Fishery	Input controls	ITE	ITQ
Commonwealth trawl sector			20
Eastern tuna and billfish fishery	16	4	
Gillnet (shark boats)	3		15
Hook and trap (non trawl)			15
Northern Prawn Fishery		17	
Torres Strait Prawn Fisheries		17	
SA Abalone fishery			15
SA Blue Crab fishery			15
SA Gulf St Vincent Prawn Fishery	15		
SA Lakes and Coorong Fishery	10		
SA Northern Zone Rock lobster	1	5	9
SA Sardine fishery			11
SA Scalefish fishery	15		
SA Southern Zone Rock lobster			15
SA Spencer Gulf and West Coast Prawn Fishery	15		
Total	75	43	115

Apparent relationship

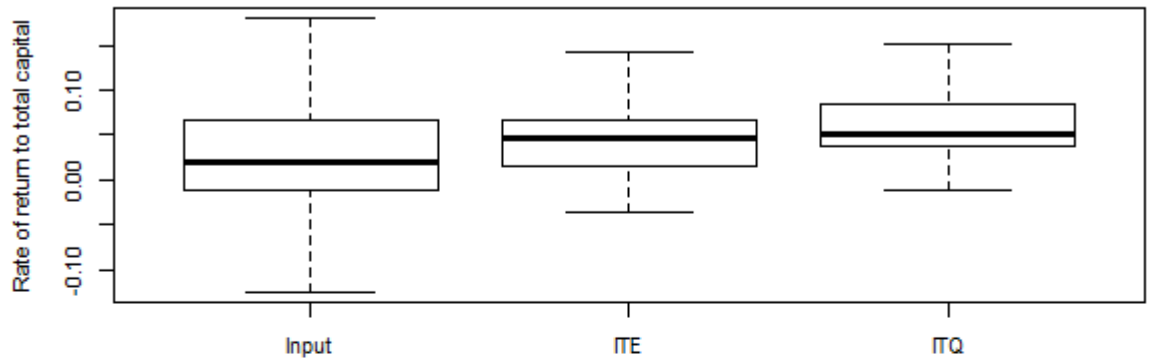


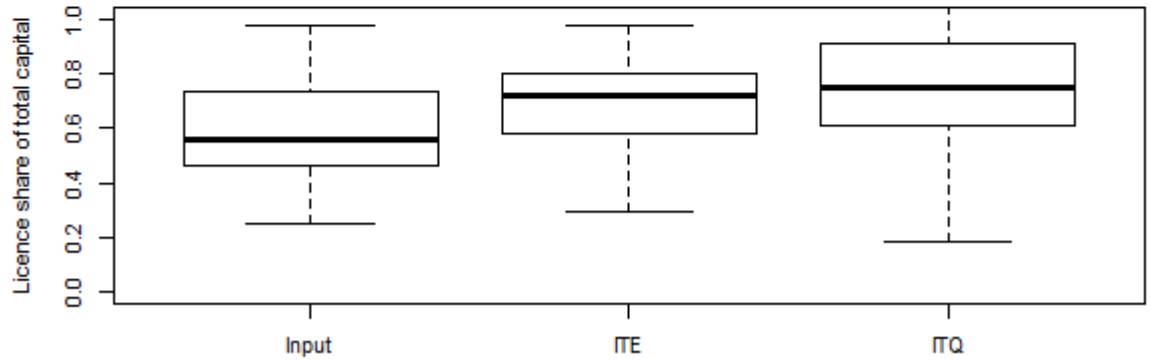
Results

- Non-linear model
  - dummy variables for each fishery (mostly significant not displayed)

	coeff	SE	t	Prob	sig	LR coeffici
lnprofitD	0.096	0.046	2.072	0.040	*	
lnInterestD	-0.362	0.246	-1.468	0.144		
lnBoatNoD	-0.065	0.325	-0.199	0.842		
lnTotalL	-0.538	0.072	-7.479	0.000	***	
lnprofitL	0.105	0.053	1.981	0.050	*	0.196
lnInterestL	-0.331	0.542	-0.612	0.542		-0.617
lnBoatNoL	-0.241	0.117	-2.054	0.042	*	-0.448
ITE	0.894	1.722	0.519	0.604		1.663
ITQ	1.014	1.527	0.664	0.508		1.887
ITEI	0.070	0.652	0.107	0.915		0.130
ITQI	0.157	0.594	0.264	0.792		0.292
Adjusted R-squared: 0.2307						
F-statistic: 2.938 on 26 and 142 DF, p-value: 2.47e-05						
AIC	138.1524					

Returns by management type





Conclusions

- Higher profits lead to higher licence values
- Boat numbers also linked to higher licence values
  - expectations of higher profits
- ITQs and ITEs appear to be associated with higher rates of return
  - not fully capitalised into the licence value
  - taken as higher “incomes”
- Unlikely that ITQs and ITEs affect discount rate
  - but higher profits under ITQs lead to higher licence values