Discrete Choice Modeling of Fishermen's Landing Locations

Photo: Wikipedia

Anna M. Birkenbach[1], Martin D. Smith[1], Frank Asche[2]

[1] Duke University, [2] University of Stavanger

Quotas: Efficiency & Equity Goals

- Economic efficiency
  - In place of “race to fish,” fishermen can target and sell catch when/where value is highest
- Non-efficiency goals imposed on quota policies
  - E.g., processor quota, CDQs, quota transfer restrictions
- More community-focused measures likely

Research Questions & Motivation

How will geographically targeted, equity-focused policies affect fishermen, seafood processing, and fishing communities?

Do fishermen make profit-maximizing decisions that are responsive to changing economic opportunities across space?

Photo: Mihael Blikshteyn

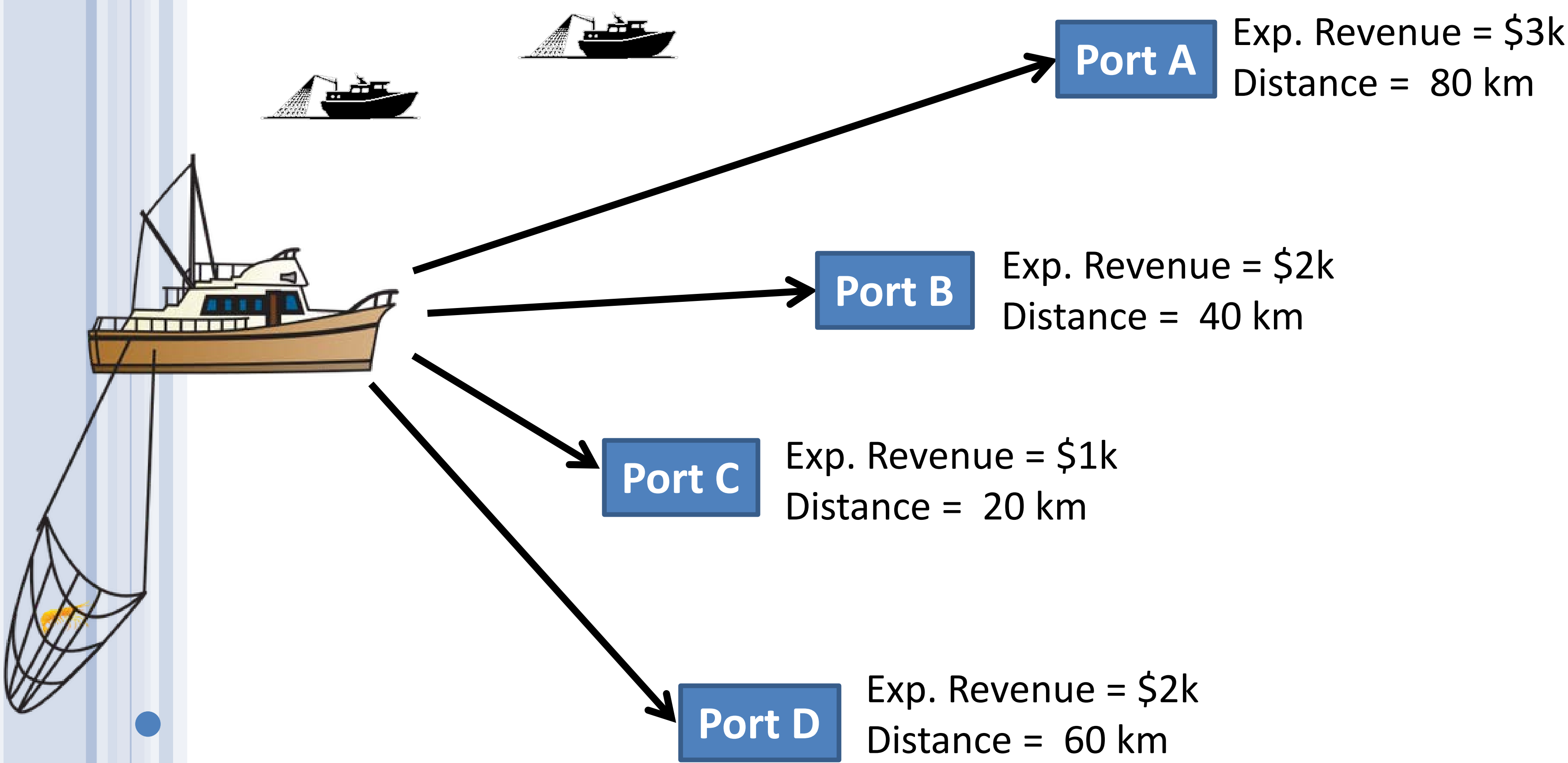
Fishing Location Choice Literature

- Many discrete choice models include **expected revenue** across locations/time and **travel distance** [Eales and Wilen 1986; Smith 2002; Haynie, Hicks, and Schnier 2008; Haynie and Layton 2010; Zhang and Smith 2011]

- Some incorporate past behavior (**state dependence**) and/or unobserved heterogeneity (**random coefficients**) [Holland and Sutinen 1999; Mistiaen and Strand 2000; Smith 2005]

...But do findings translate to **landing** location choices?

Discrete Choice Model of Landing Locations



Discrete Choice Model of Landing Locations

- RUM framework
- Choice probabilities:

$$P_{ni} = \frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}}$$

- Maximum Likelihood Estimation
- **Conditional Logit Model 1:**

$$U_{nj} = \beta_j + \beta_{ER} EXP\ REV_j + \beta_{DIST} DISTANCE_{nj} + \varepsilon_{nj}$$

- **Conditional Logit Model 2:**

$$U_{njt} = \beta_j + \beta_{ER} EXP\ REV_{jt} + \beta_{DIST} DISTANCE_{njt} + \beta_{SD} \boldsymbol{CHOICE_{n,t-1}} + \varepsilon_{njt}$$

Empirical Application: Finnmark, Norway

- Daily microdata for groundfish fishermen
- ~ 500 vessels, 14 ports
- Single year (2010)
- Distances from chosen fishing spot to every port
- Expected revenues by port
- Multiple trips per vessel

Empirical Results: All Vessels

	Model 1(a)	Model 1(b)	Model 1(c)	Model 2(a)	Model 2(b)	Model 2(c)
Moving Avg. Revenue, Past 30 Days ($1000s)	0.0014***			-0.0001		
Moving Avg. Revenue, Past 45 Days ($1000s)		0.0014***			-0.0005	
Moving Avg. Revenue, Past 60 Days ($1000s)			0.0018***			0.0003
Distance Between Fishing Area and Community (in miles)	-0.0887***	-0.0888***	-0.0890***	-0.0413***	-0.0408***	-0.0406***
Landing Community Chosen in Previous Period				5.0572***	5.0735***	5.0799***
Number of cases	9,347	9,350	9,352	8,882	8,885	8,887

+ $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Site-specific constants and standard errors not shown.

Port-Switchers vs. Non-Port Switchers

- ~ **75%** of vessels **never** change where they land
- How are port-switching vessels different from those that always land in the same port?

Measure	Port-Switchers	Non-Port Switchers	t	P
Avg. vessel length (meters)	13.75	12.25	2.04	0.0428
Avg. travel distance (miles)	32.3	22.8	2.67	0.0085
Avg. # of fishing spots visited	2.7	1.6	6.90	0.0000
% of fishing trips in top-ranked fishing spot (by weight)	76%	92%	-8.23	0.0000

- ER still non-significant for port-switcher subgroup

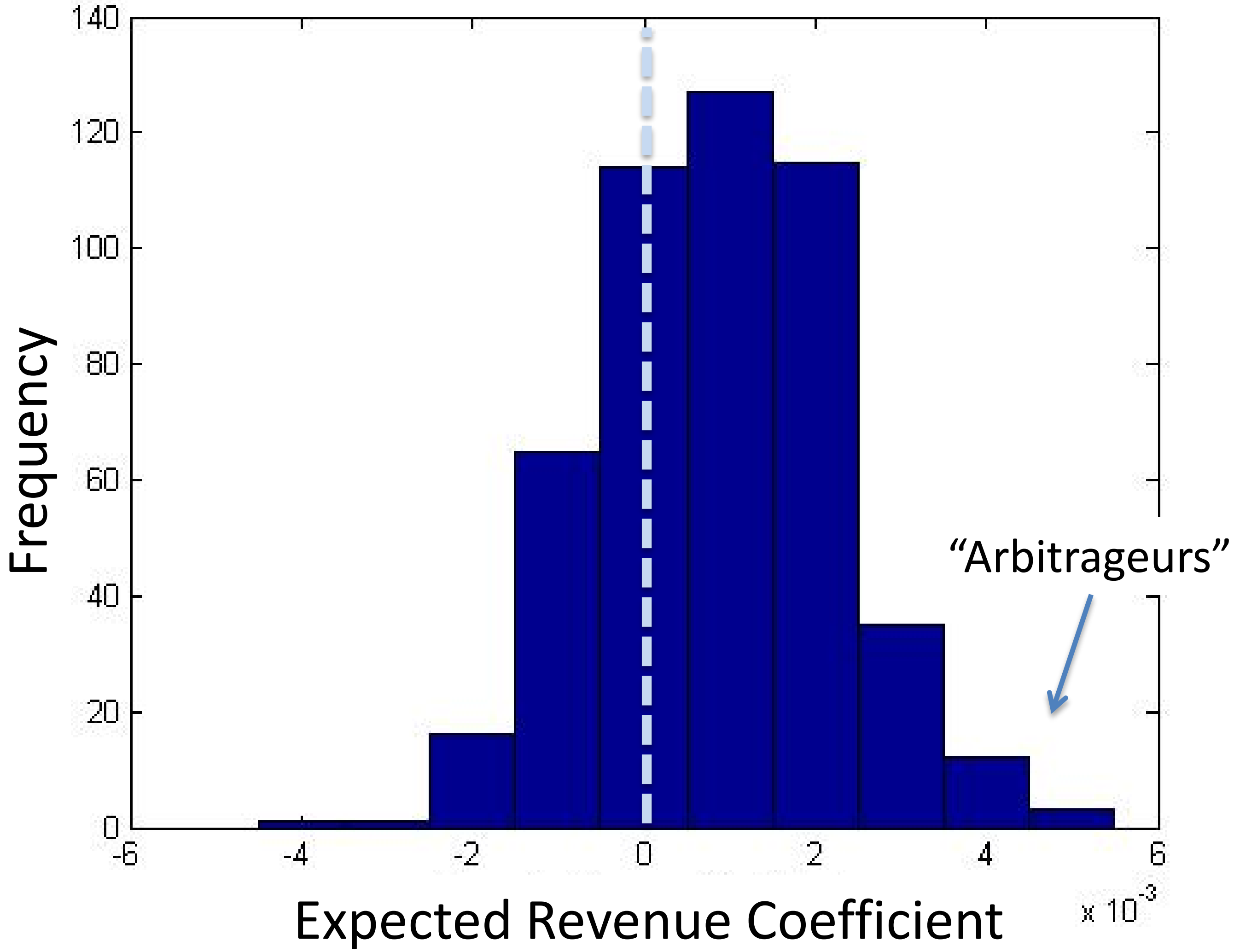
Empirical Results: Random Coefficients

	Model 2(c)
Mean β	
Moving Avg. Revenue, Past 60 Days ($1000s)	0.0010***
Distance Between Fishing Area and Community (in miles)	-0.0410***
Landing Community Chosen in Previous Period	5.6025***
Standard Deviation of β	
Moving Avg. Revenue, Past 60 Days ($1000s)	0.0014+
Distance Between Fishing Area and Community (in miles)	0.0314***

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Note: Site-specific constants not included in these models.

Empirical Results: Random Coefficients



Conclusions

- Insights from the fishing location choice literature do not translate perfectly to landing location choices.
- Results are similar when models run naïvely, but when state dependence is accounted for, significance on expected revenue goes away, even for port-switchers.
- Allowing for random parameters shows that portions of the fleet respond to revenues.
- Results imply that restricting landing locations may be much more costly than policymakers realize.
  - Compensating variation 37x higher for Model 2 than Model 1

Next Steps: Policy Simulations

- How long does it take for behavior to re-equilibrate following a revenue shock at one landing site?
- If fleet were required to land X% in a particular port, what would the welfare implications be?

Photo: Arctic RC

Thank you

Funding for this research provided by the Norwegian Research Council.

Photo: Karim Sahai