Science, Service, Stewardship

Technical Efficiency & Capacity Reduction

A case study of vessel buyouts in California

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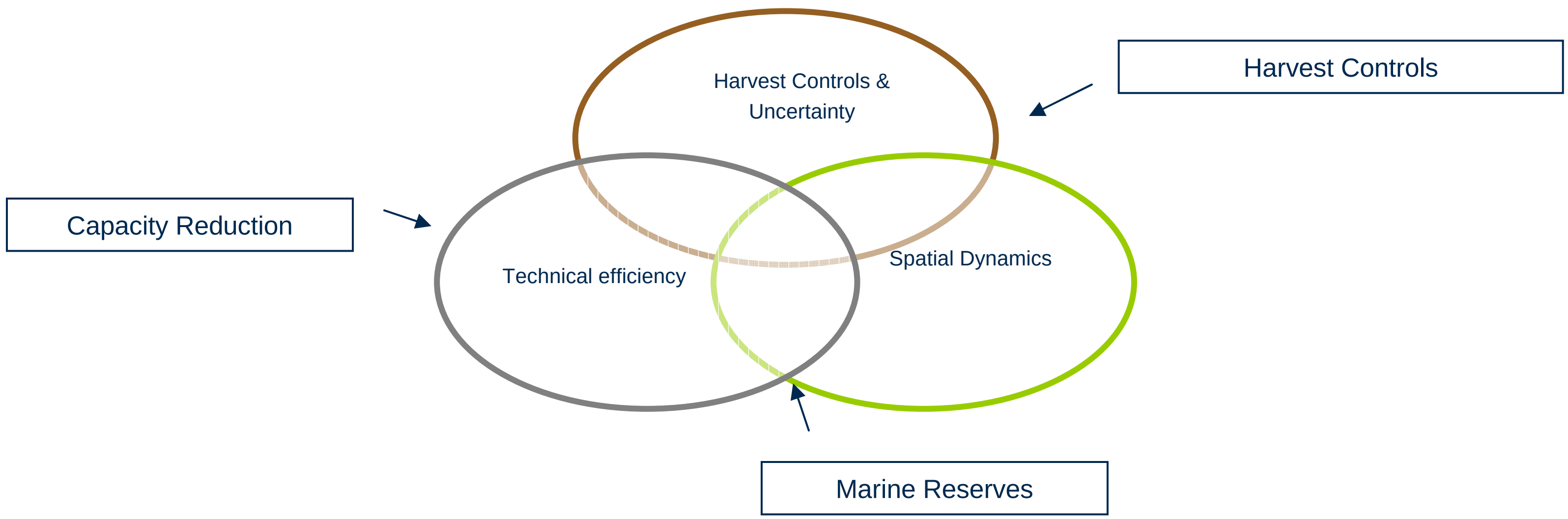
Motivations

Determine how policy instruments impact decisions of *individual* fishers

— how does policy impact efficiency of the individual?

The Big Groundfish Picture



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Fishery Background

- 3rd largest commercial fishery (by value) in California
- 12% of statewide commercial fishing revenues
- Managed to provide year round landings through:
  - Trip Limits (Catch limits)
  - Gear Restrictions
  - Area Closures (RCAs)

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Current Study

Goal: to assess the efficiency implications of the groundfish trawl buyback at the vessel level.

Motivation:

Efficiency & Capacity Utilization have been estimated for almost all major fisheries in the U.S. (*National Assessment of Excess Harvesting Capacity in Federally Managed Commercial Fisheries)*…examining how technical efficiency changes as the individual's choice set changes seems a less popular pursuit.

Notable Exceptions:

Fisheries

- *Felthoven, 2002*
- *Pascoe, Andersen & de Wilde, 2004*

Econ

- *Millimet and Collier, 2008*

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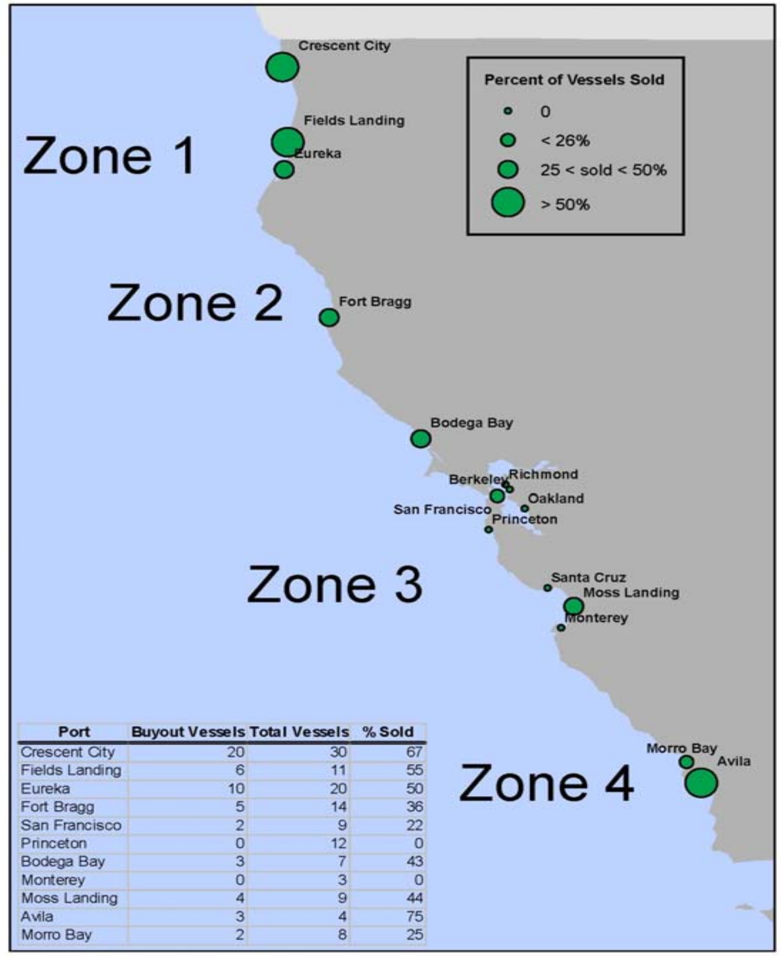
Capacity Reduction & Efficiency

- How might a vessel buyout impact efficiency?
  - Crowding effects (+)
  - Competition effects (+, -)
  - Stock effects (+)

Buyback Basics

- ❑ Fishery declared a federal disaster in 2000
- ❑ Pacific Groundfish Limited Entry Trawl Buyback Program instituted in 2003
- ❑ 91 limited entry groundfish trawl vessels retired coastwide
- ❑ 43 from California
- ❑ Bids scored according to landings
- ❑ Mostly industry funded –
  - Feds put up initial $43 million
  - $36 million to be paid back



Port	Buyout Vessels	Total Vessels	% Sold
Crescent City	20	30	67
Fields Landing	6	11	55
Eureka	10	20	50
Fort Bragg	5	14	36
San Francisco	2	9	22
Princeton	0	12	0
Bodega Bay	3	7	43
Monterey	0	3	0
Moss Landing	4	9	44
Avila	3	4	75
Morro Bay	2	8	25

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Data

- Tow-level logbook data provided by PacFIN
  - California only
  - Limited entry vessels only
  - Data on: tow location, depth, lbs, value, self-reported target
- Vessel characteristics data provided by NMFS NWR
  - Vessel length, weight and horsepower
- Buyback Info taken from Federal Registrar
  - Sellers versus non-sellers

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Model

- Schmidt & Sickles (1984) model w/time invariant efficiency:

$$y_{it} = \alpha + x_{it}\beta - u_i + \varepsilon_{it}$$

- Alternative:
  - Green (2004): time variant efficiency

Although Green's model allows time variant inefficiency, it requires inefficiency to be independent across cross-sectional units…ignoring competition effects.

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Practical Issues

Multi-species Fishery:

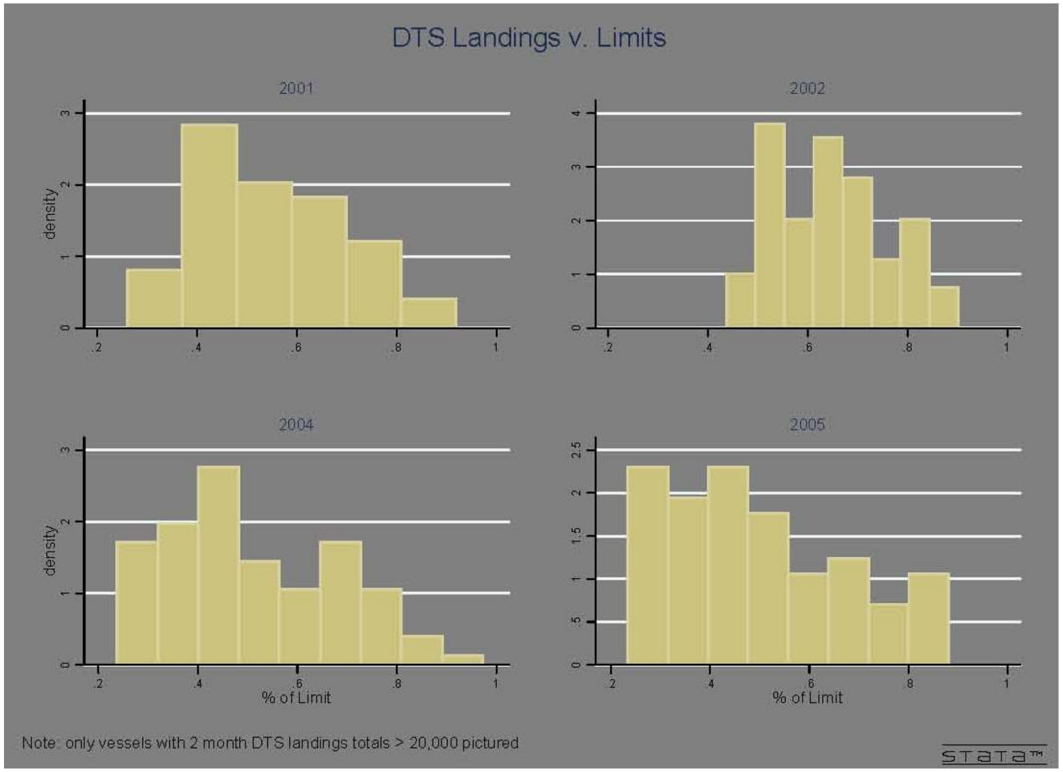
- o Use a subsample of data:
  - o DTS vessels only (annual DTS revenue > 60% of total vessel revenue)

- ❑ DTS is the largest segment of the fishery
  - o by volume (roughly 60% of total landings)
  - o by effort (70% of total effort)
- ❑ DTS landings make up 85% of total landings on DTS tows

Practical Issues

Trip Limits:

- Define dependent variable as DTS catch-limit fulfillment $y_{it} = \frac{lbs_{it}}{L}$



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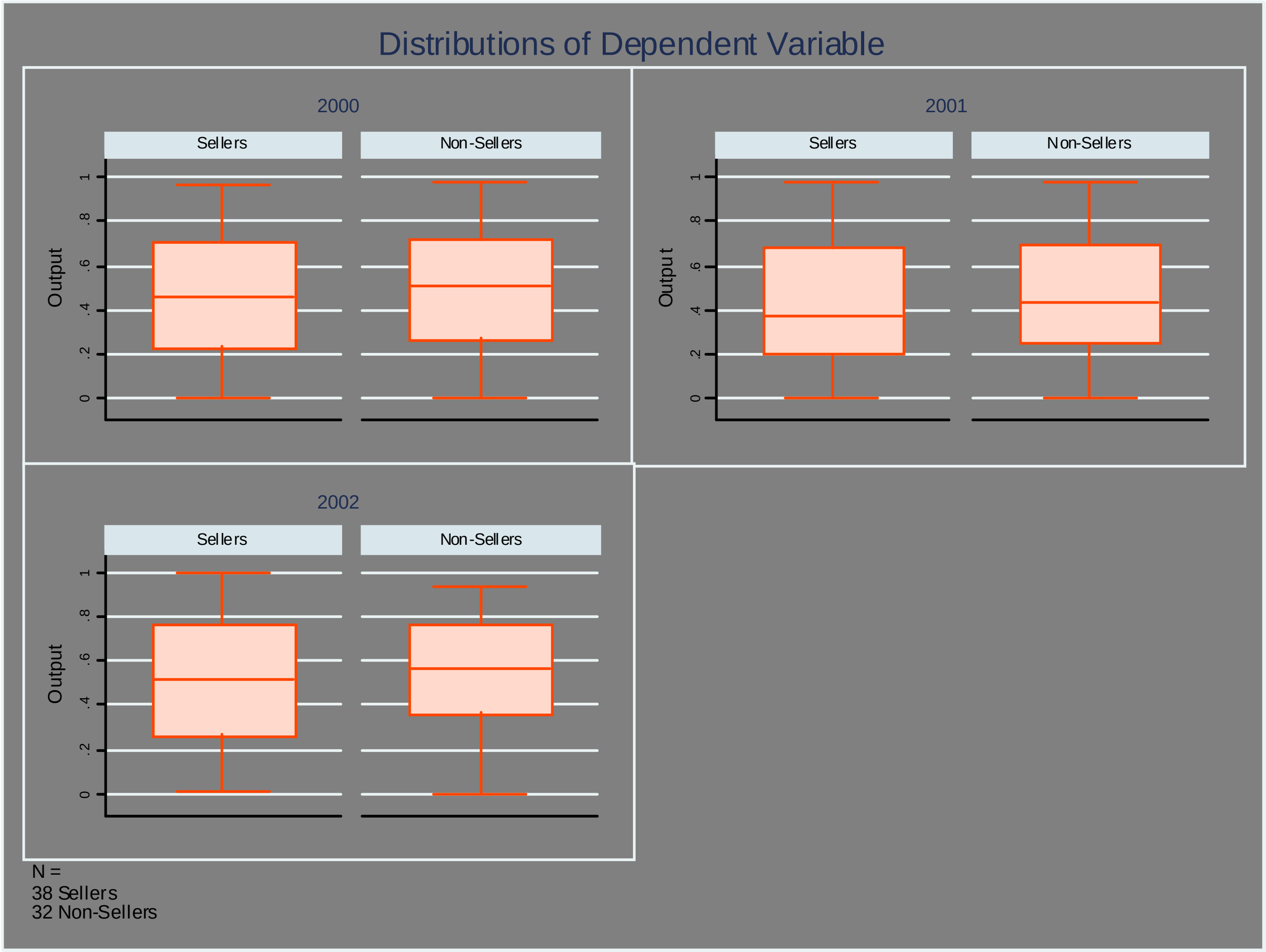
Data Summary



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Capital Inputs

Two sample KS test for equality of distribution functions

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HORSEPOWER

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Smaller Group	D	p
Sellers	0.184	0.317
~Sellers	-0.111	0.658
Comb	0.18	0.615

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VESSEL LENGTH

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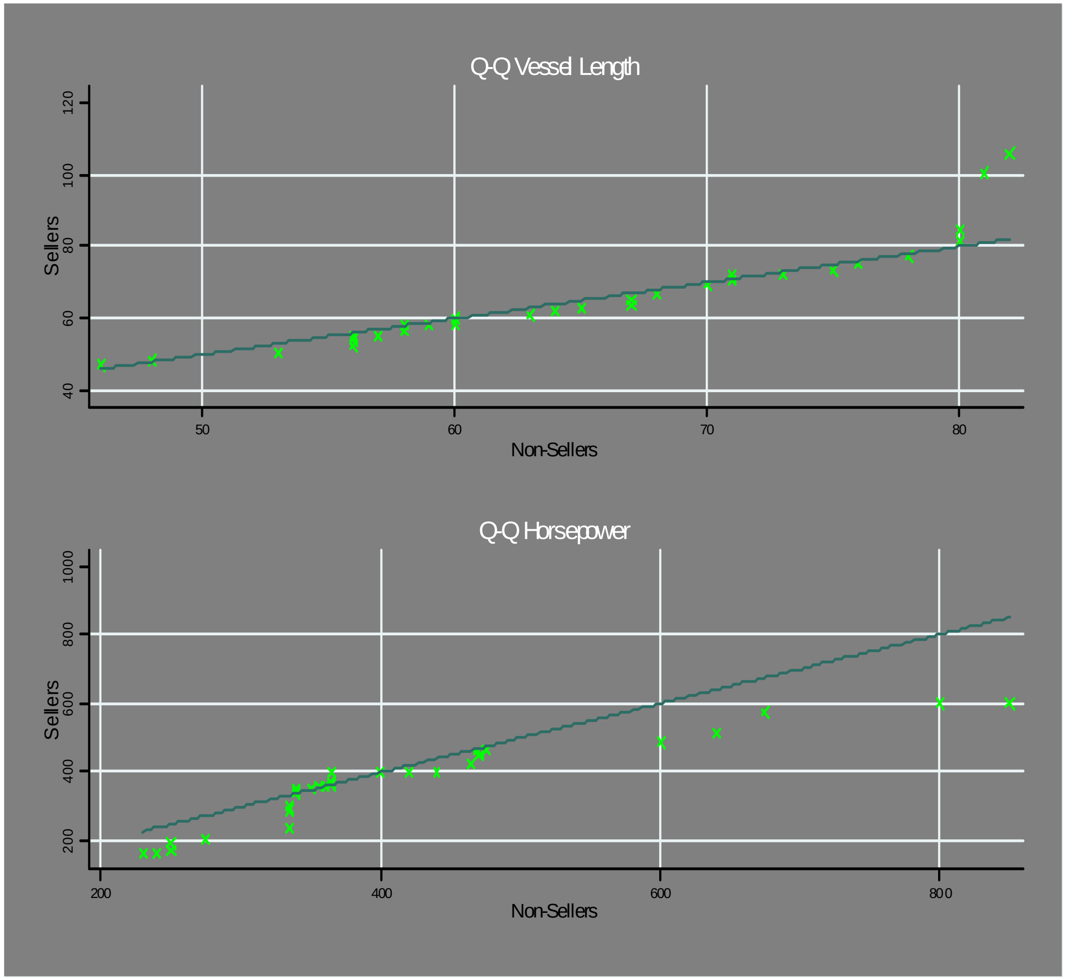
Smaller Group	D	p
Sellers	0.166	0.390
~Sellers	-0.045	0.933
Comb	0.166	0.734



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Variable Inputs

Two sample KS test for equality of distribution functions

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DAS

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Smaller Group	D	p
Sellers	0.131	0.533
~Sellers	-0.068	0.842
Comb	0.131	0.912

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Tow Hours

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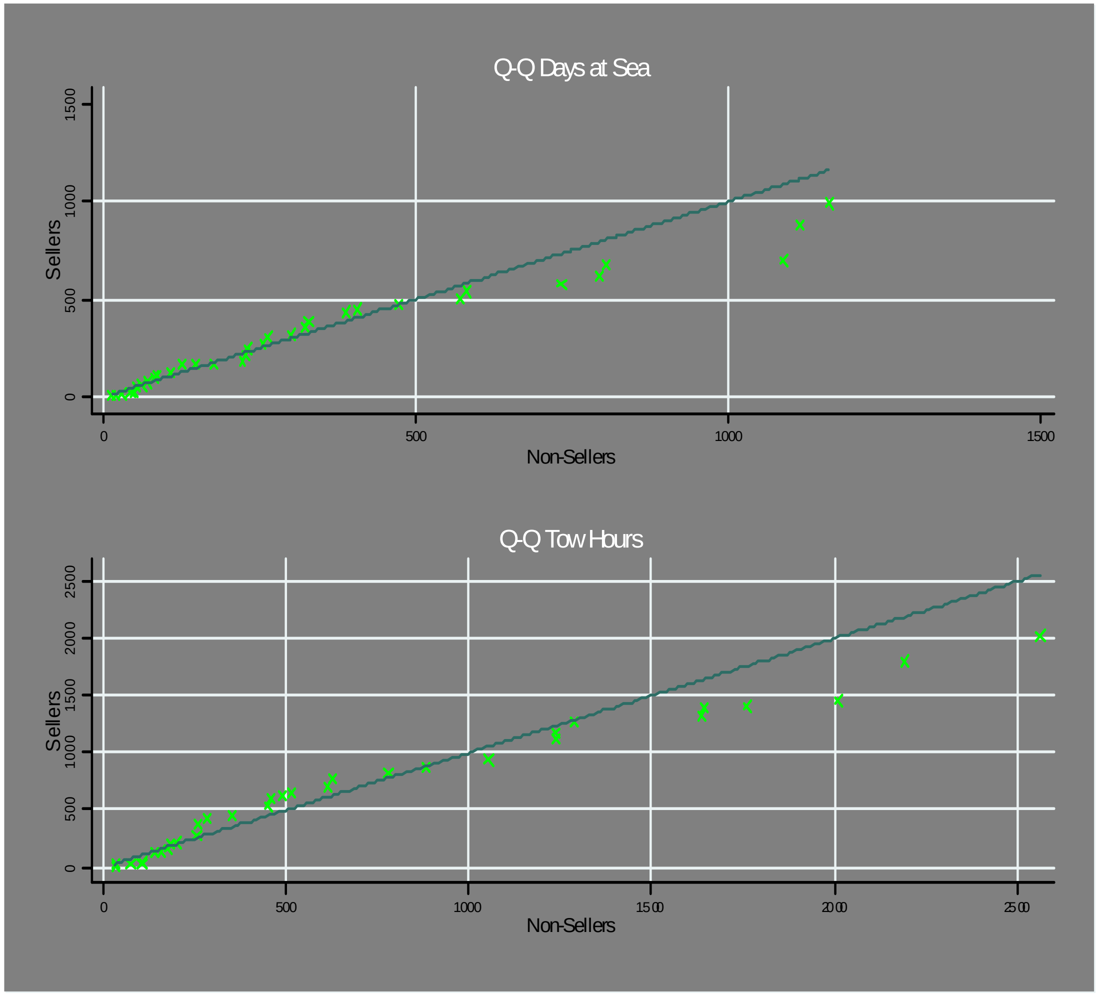
Smaller Group	D	p
Sellers	0.131	0.533
~Sellers	-0.125	0.564
Comb	0.131	0.912



Estimation

$$\ln y_{it} = \alpha + \ln x_{it}\beta + \_M\gamma + \_P\phi + \_T\omega - u_i + \varepsilon_i$$

Where:

X = (days at sea, tow hours)

_P = dummy variables indicating primary port

_M = month group dummy variables

_T = yearly dummy variables

				R-sq		
Model	*N*	*Groups*	*F-test: Joint significance of vessel-level fixed effects (p-value)*	*Within*	*Between*	*Overall*
Pre-buyback	573	70	2.27 (0.000)	0.524	0.452	0.421
Post-buyback	191	29	3.378 (0.000)	0.596	0.460	0.541

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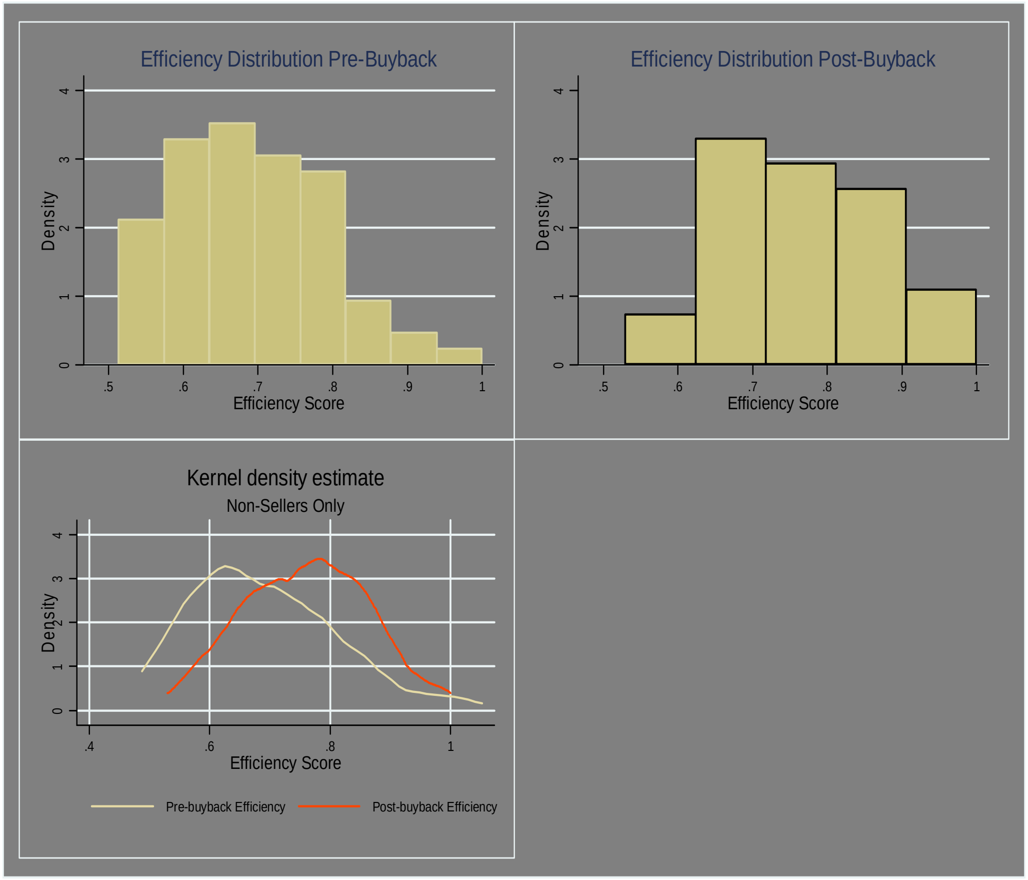
Results

- ❑ Mean efficiency increases from 69% to 76%
- ❑ Mass of efficiency distribution shifts
- ❑ Efficiency distribution *among non-sellers* shifts
- ❑ KS-test confirms difference in efficiency among non-sellers significant w/ p = 0.051



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Summary

- Did capacity reduction have a measurable impact on output efficiency of the fleet?
  - our results suggest this was the case…however,
  - confounding management actions make it difficult to establish causality

- Can we determine whether vessel reduction had implications for efficiency at the vessel level?
  - again our results suggest yes…however,
  - time invariant specification for efficiency makes it difficult to prove this:
    - If the hyper efficient vessel actually became less efficient the rest of the fleet could be no more efficient yet appear to be.

Extensions

- Apply Collier, Johnson & Ruggiero (2009) to deal with multi-species issue.