Profit Effects in a Rights Based Management Regime

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Introduction

- Norwegian Purse Seine fishery evolved from an open access fishery to a Rights Based Management system
- Individual vessel licenses and Individual vessel catch quotas assigned to all major fish species
- Changes in 1996 with the establishment of Unit quotas and again in 2006 with the introduction of Structural quotas
- The current Norwegian regulatory system allows, with some restrictions, transferability of quota

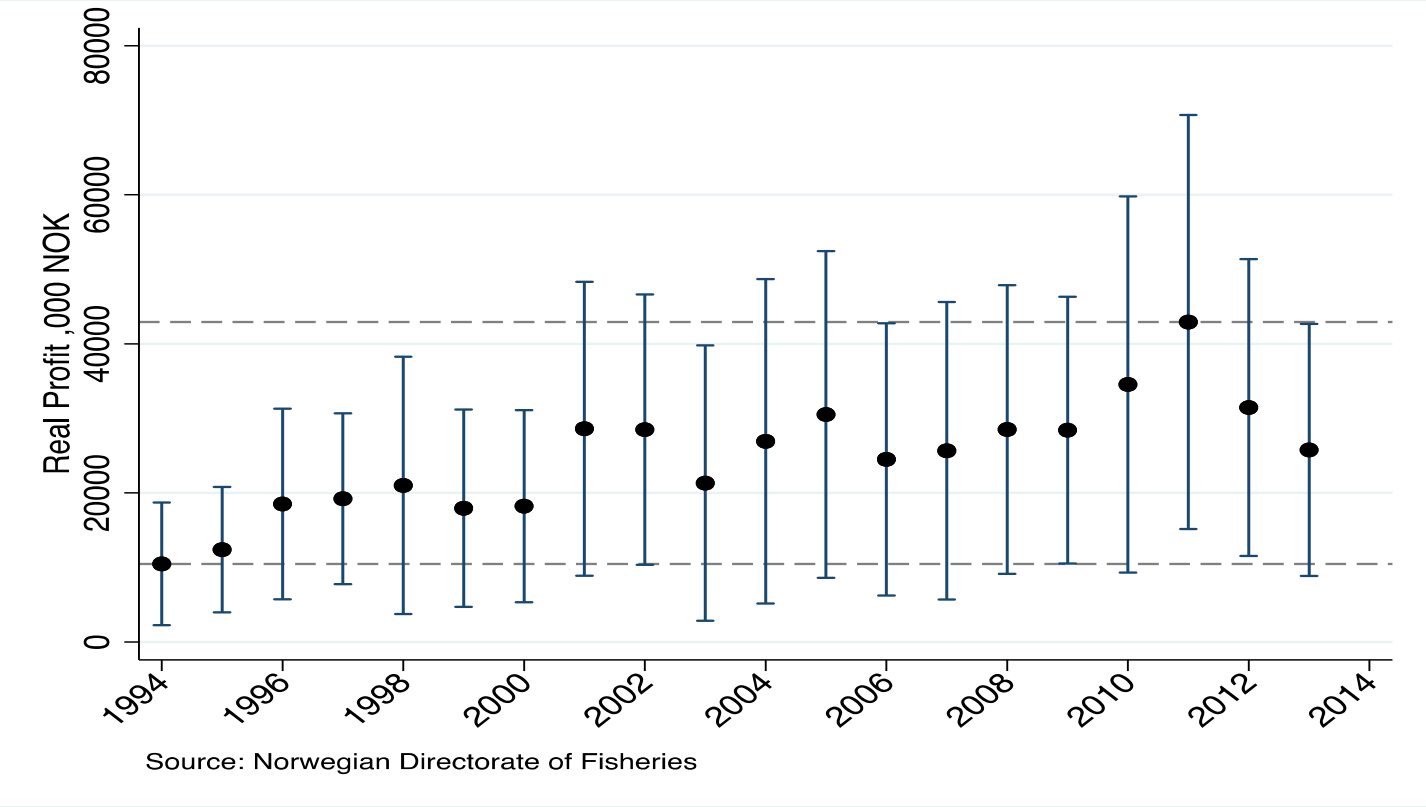
Introduction

- What is the impact of rights based management for the Norwegian Purse Seine fleet
- Interested in looking at the changes in profits, prices, capital
- Associate these changes with changes in regulatory policy
- Economic theory, providing profit incentives removes a competitive race to collect fish, efficient combination of inputs, capital and harvest
- Short term, should see prices increase, profits increase
- Long term, should see changes in capital structure

Introduction

- Interest: Practical: not much empirical work on the Purse seine fishery, Economic: this fishery has for a long time regulated the output side of the fishery
- Allowing the market to regulate the fishery provides incentives for better prices, profits, rent and (perhaps) optimal capital structure.
- Substantial Resource rent realized (Steinshamn 2005).
- Nøstbakken (2006) looks at investment in this fishery

Conditional Expectation Function: Real Profit Purse Seine



- Profit from 10.4m NOK to 42.9m NOK
- Positive shock in 1996, Negative shock in 2006
- Notice fall in profits after 2011

Causal Effects

- A serious issue to disentangle the true effects of rights based impacts from stock or environmental changes
- The problem is that there is a serious identification problem
- Our hope is to examine this issue but for now just trying to understand the data and correlation of results
- A very nice paper on this problem by Dickert and Schweder (2015)
- We start by trying to measure the effects of prices, capital and biomass on individual profits

Tools

- Technique to decompose the separate effects of prices, vessel capital stock, productivity and fish biomass on profits
- Measure separate effects of the various input and output factors on changes in vessel level profitability
- Use index profit decomposition method (Fox et al. 2003)
- Application of the Törnqvist (1936) index
- Törnqvist index has multiplicative property to combine each factor impacting profits

Profit Decomposition

- Profit decomposition method requires only observed data and relies upon intra-vessel comparisons to measure performance.
- All measures relative to a base or numeraire firm, most profitable (a)
- So define profit $\Gamma^{a,b} = \frac{\pi^b}{\pi^a}$
- Define similar type relative measures for prices (output/input) and capital stock
- $P^{a,b} = \frac{P^b}{P^a}, \qquad K^{a,b} = \frac{K^b}{K^a}$

- Build an aggregate output index
- $O^{a,b} = \frac{\Gamma^{a,b}}{P^{a,b}}$
- Output changes that can't be accounted for by capital stock is residual
- Define this residual as a productivity index
- Outputs divided by inputs
- $R^{a,b} = O^{a,b} / K^{a,b}$
- We can further augment the index using fish biomass.
- $R^{a,b} = O^{a,b} / (K^{a,b} \cdot F^{a,b})$

- Given that we are particularly interested in Profits write
- $\Gamma^{a,b} = R^{a,b} \cdot P^{a,b} \cdot K^{a,b} \cdot F^{a,b}$
- The ratio of profits between the two vessels can be decomposed into the relative differences between productivity, prices and quasi-fixed capital utilisation. (can adjust for biomass levels)
- The Törnqvist Index is just a share weighting index that has nice properties, say for prices
- $P^{a,b} = \exp\left[\sum_{n=1}^{N} \frac{1}{2}\left(s_n^b + s_n^a\right) ln\left(\frac{P_n^b}{P_n^a}\right)\right]$

Data

- A large multi-sector data set from the Directorate of Fisheries' profitability surveys of the Norwegian licensed purse seiner fleet over the period 1994-2013 is available.
- The data provides information on vessel ownership, license holdings and quota size
- Good information on revenue and harvest level, labour share, fuel expenditure, capital statistics

Data

- Spring spawning herring, North Sea herring, mackerel and capelin
- Blue whiting and sandeel plus ‘other’ category
- Some purse seiners are equipped with additional gear (trawl), holding supplementary licenses
- This allows us to divide the fleet of purse seiners into three subgroups: purse seiners, blue whiting trawlers, and pelagic trawlers

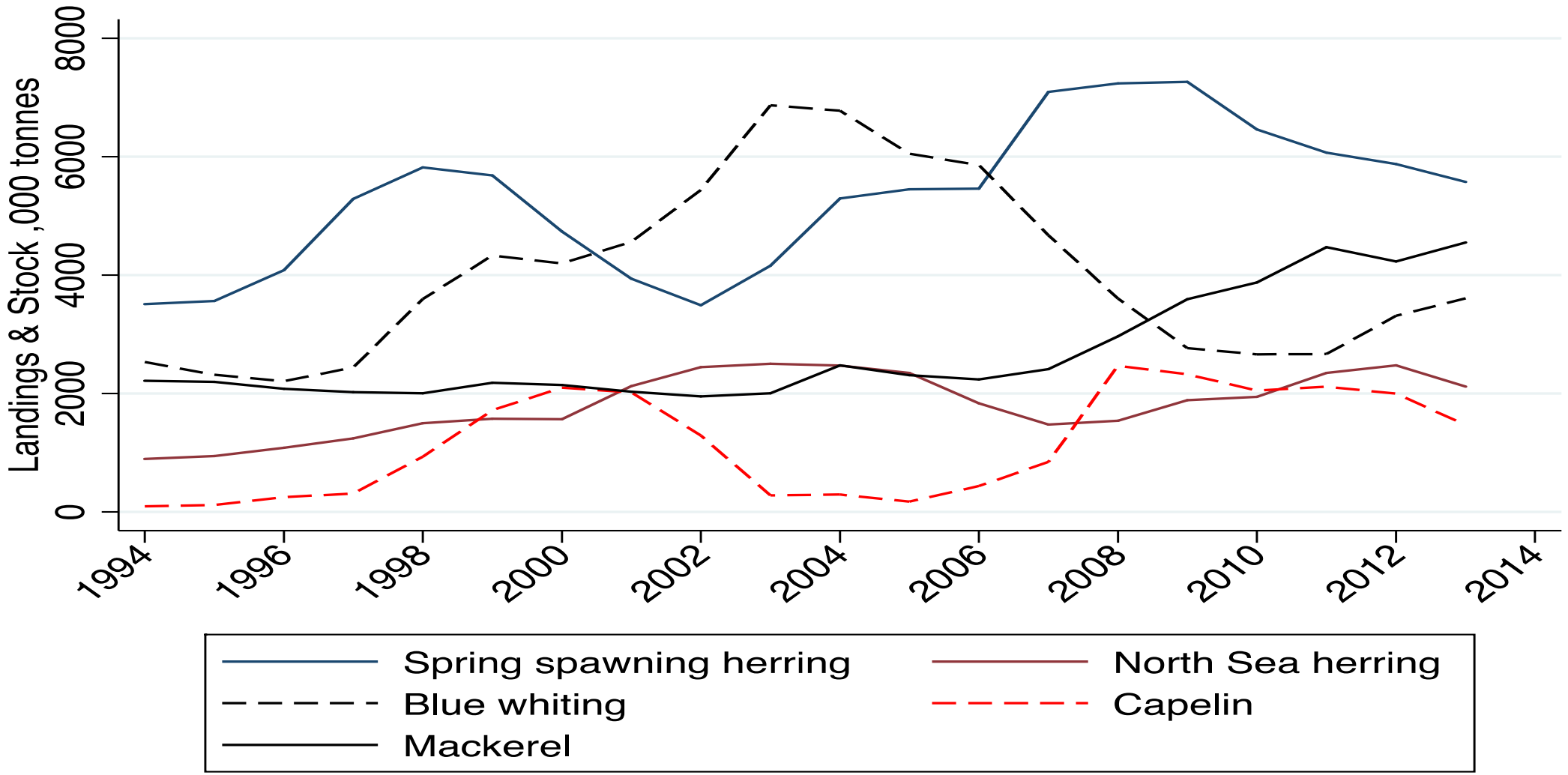
Regulatory Structure of Purse Seine Fleet

Consolidation schemes in the Norwegian purse seine and industrial trawl fleets 1994-2013						
	1994	1996	2002	2005	2005	2007
Purse Seine		Unit quota		Structural quota	Postponed	Structural quota
	Consolidation of licenses					
Industrial trawl			Unit quota	Structural quota	Postponed	Structural quota

Purse Seine: Average Summary Statistics Inputs (real values), Various Years				
	1994-2000	2001-2006	2007-13	1994-2013
Profit[a]	19,000	27,900	31,300	26,900
Revenue[b]	31,000	44,900	50,400	43,400
Operating Days	280.6	252.1	187.7	233.9
Fuel Exp[a]	2,599	4,732	5,262	4,381
Crew Share[c]	9,367	12,300	13,900	12,100
Gross Tonnage	1067.9	1502.9	1610.3	1431.1
Obs.	292	374	442	1108

Purse Seine: Average Summary Statistics Outputs[a] (real values), Various Years				
	1994-2000	2001-2006	2007-13	1994-2013
Revenue SSH	10,200	14,100	20,000	15,400
Price SSH	2.57	4.70	4.54	4.07
Quantity SSH	3,909.5	2,978.2	4,830.7	3,962.6
Revenue NSH	2,335	3,736	3,667	3,341
Price NSH	2.94	3.34	4.54	3.72
Quantity NSH	844.1	1,145.3	808.0	931.9
Revenue Mackerel	10,200	13,400	15,300	13,300
Price Mackerel	8.37	11.02	10.3	10.0
Quantity Mackerel	1,325.8	1,245.3	1,497.9	1,366.8
Rev Blue Whiting	10,3	12,000	6,577	9,321
Price Blue Whiting	0.92	0.98	1.79	1.32
Quat Blue Whiting	11,200.0	11,300.0	3,753.8	7,985.6

Stock



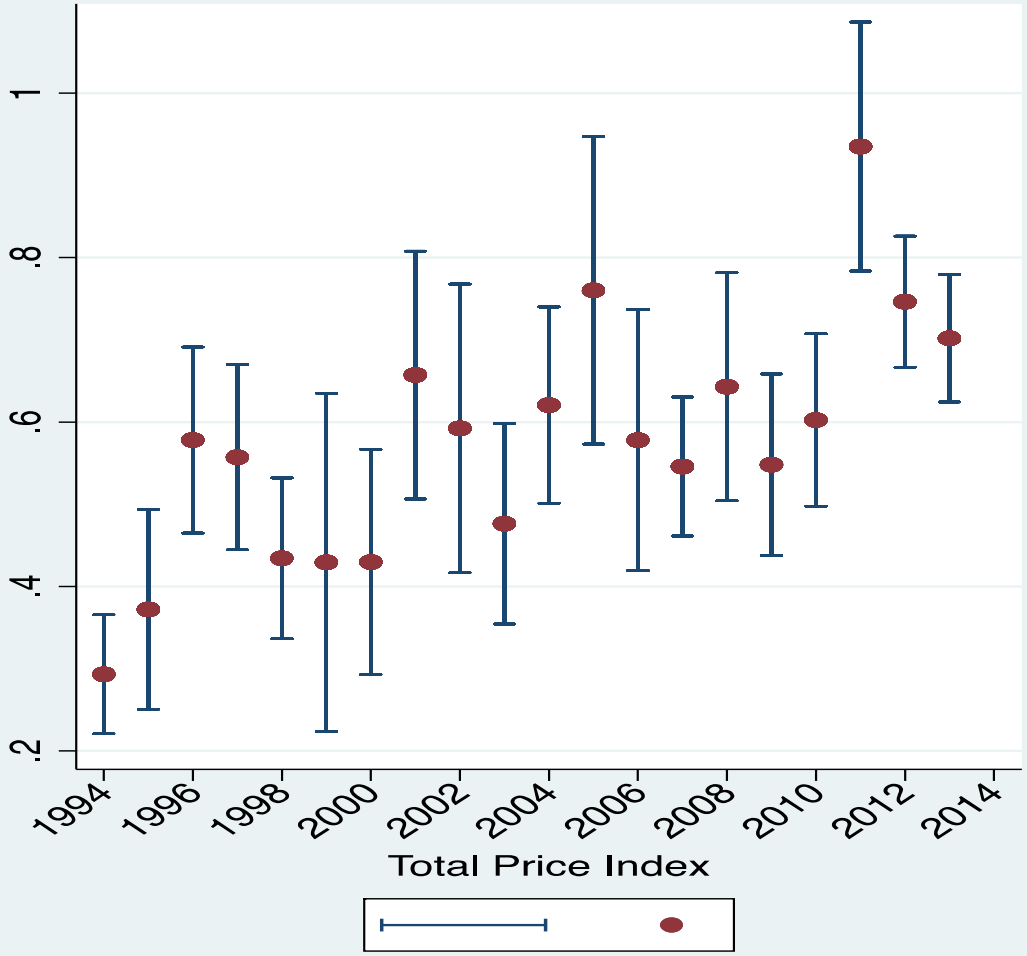
Source: International Council for the Exploration of the Seas (ICES)

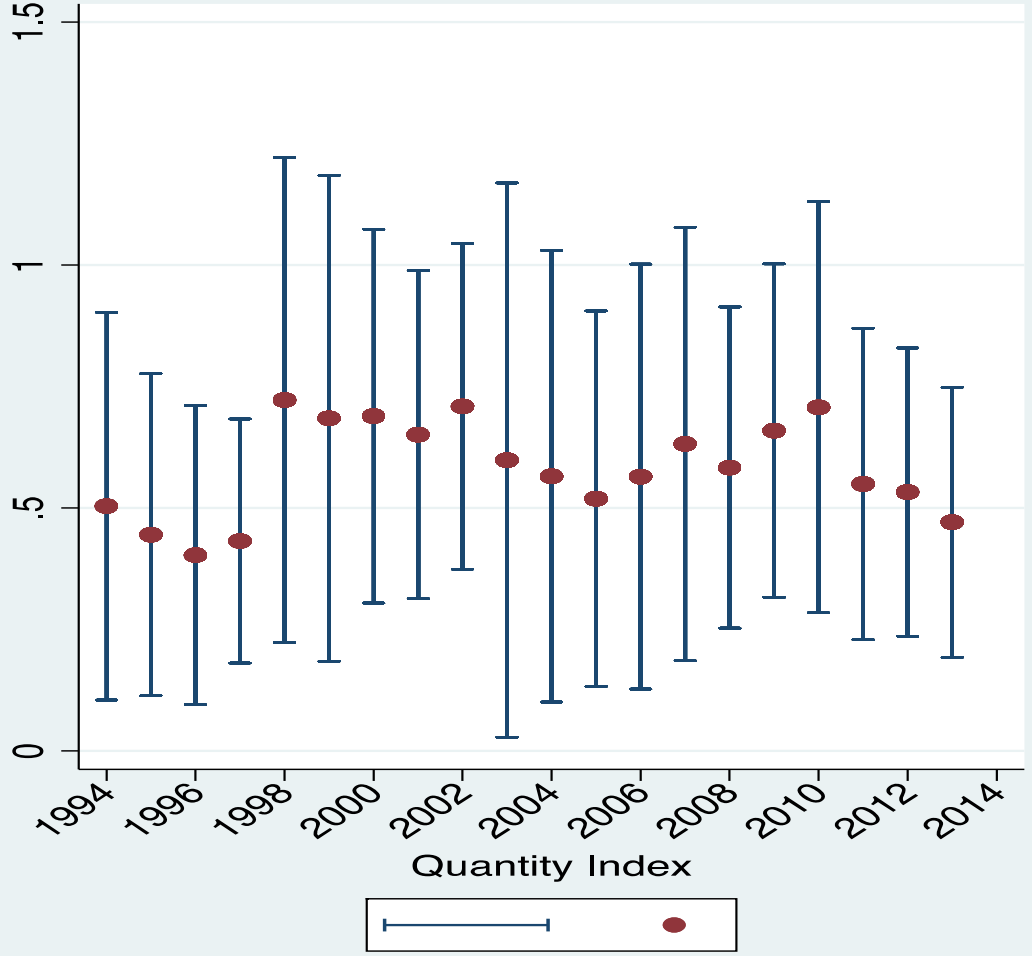
Profit Decomposition

- The price index
- $P^{a,b} = \prod_{n=1}^{N} P_n^{a,b}$
- Includes both output and input prices
- But can easily break down the index for output, input or individual
- Output price divided over, spring spawning herring, north sea herring, mackerel, capelin, sandeel and other.
- Input price over fuel, labour and gear
- Individual indices on capital and biomass

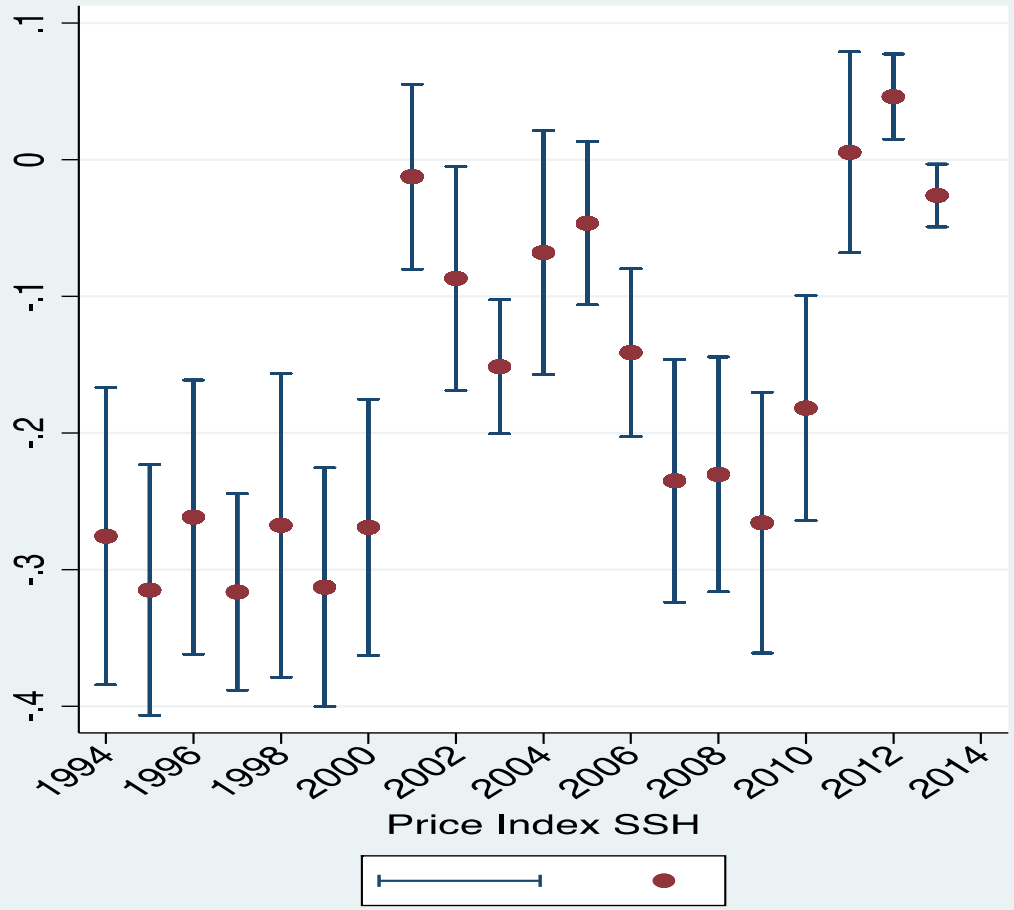
Defining Indices

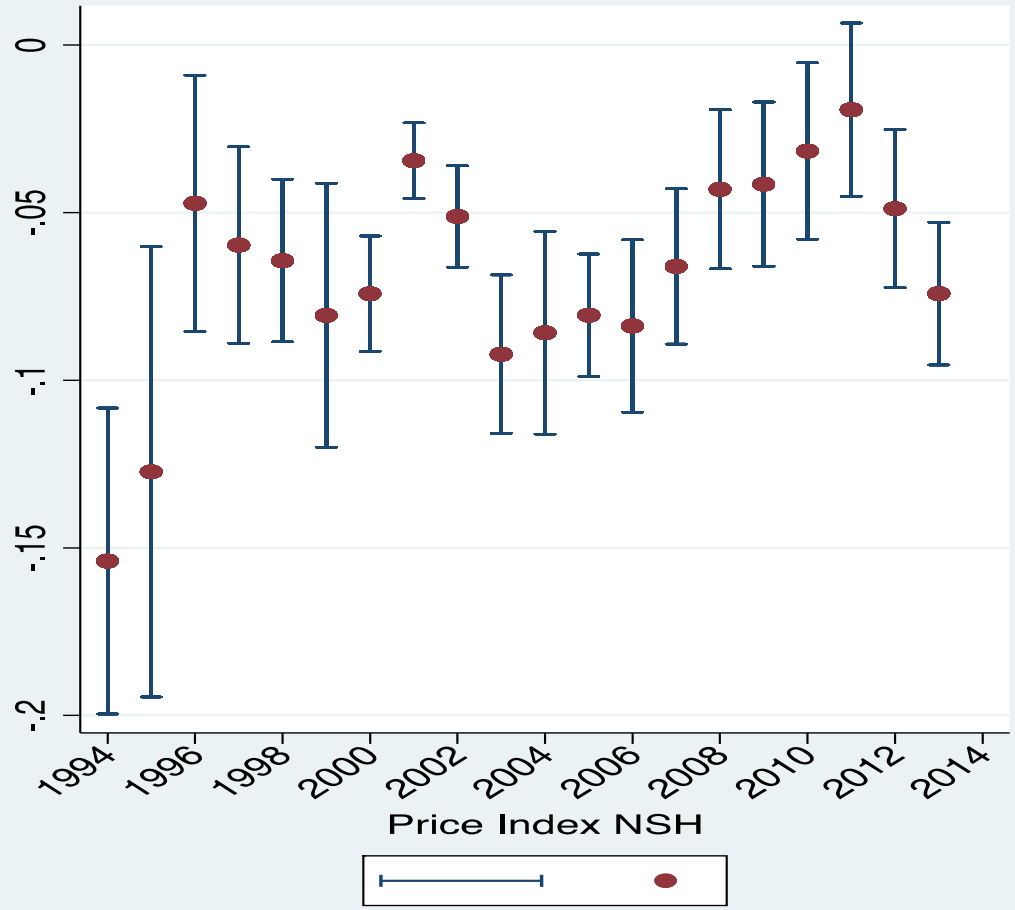
- The individual indices represent the relative contribution of these variables to profits of vessel *b* relative to the numeraire vessel.
- If $P_n^{a,b}$ exceeds unity, then this implies that price makes a greater contribution to the profits of vessel *b* than it does to the profits of the numeraire.
- Given that higher variable costs reduce profits and that in put shares are negative, an input price index that is greater than unity implies lower factor input costs for vessel *b* relative to the numeraire and higher profits.
- Numeraire vessel, 2034 tonne vessel in 2011, profits 90.7 million Nkr, with 12 workers earing each 2.4 million





Source: Norwegian Directorate of Fisheries





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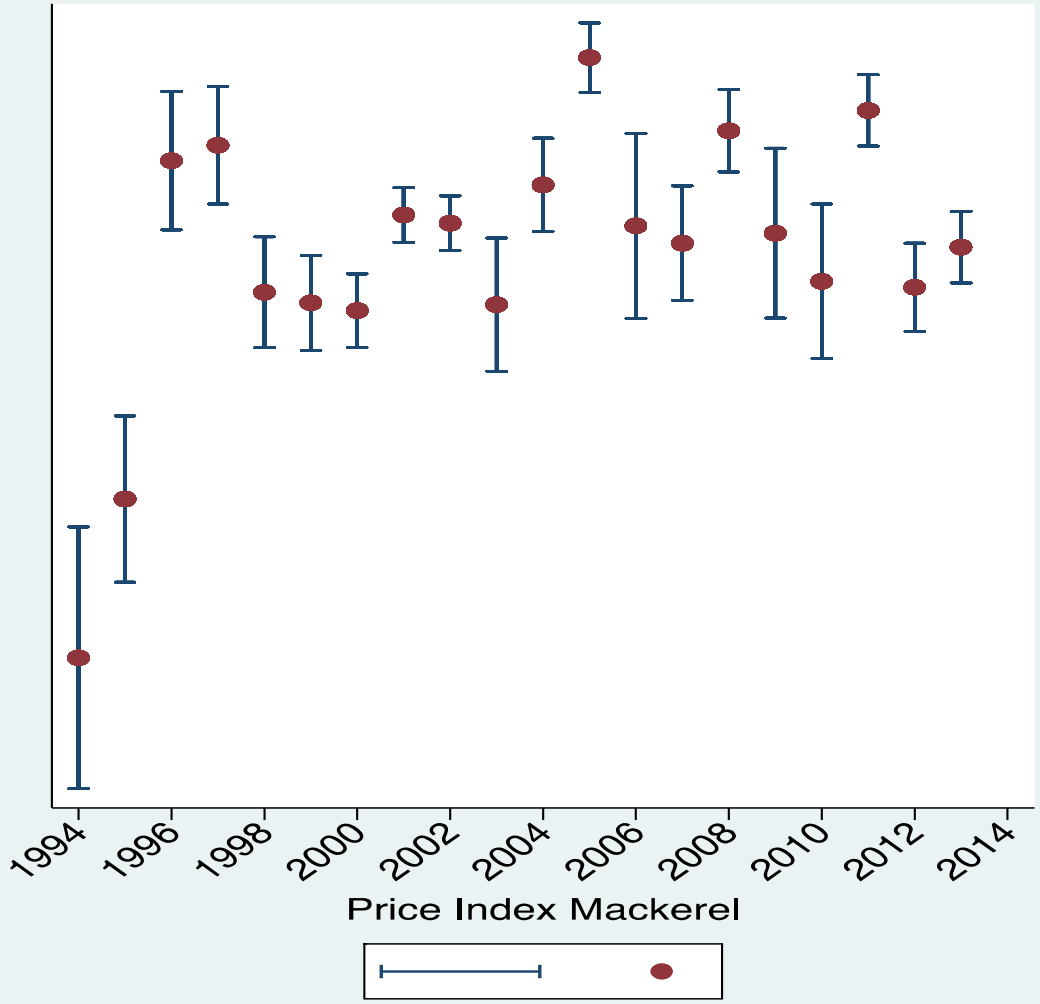

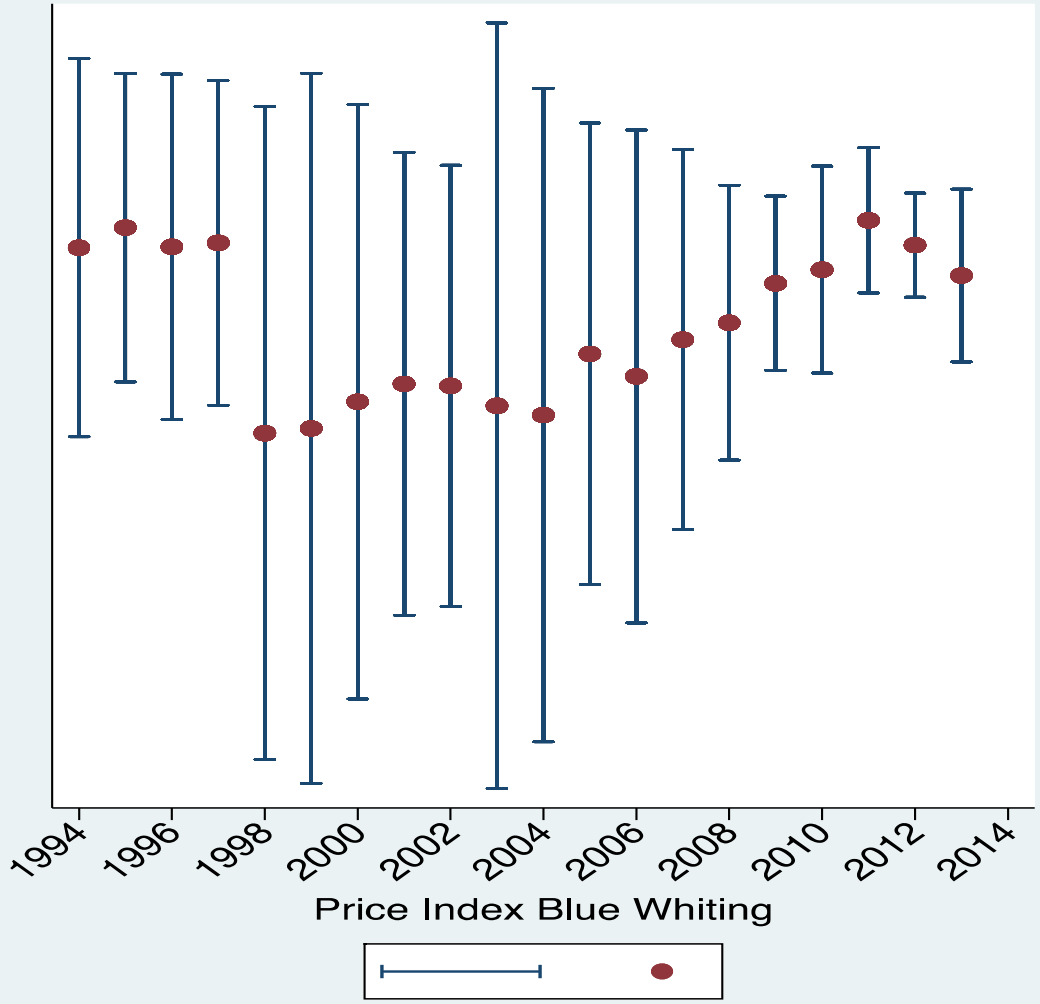

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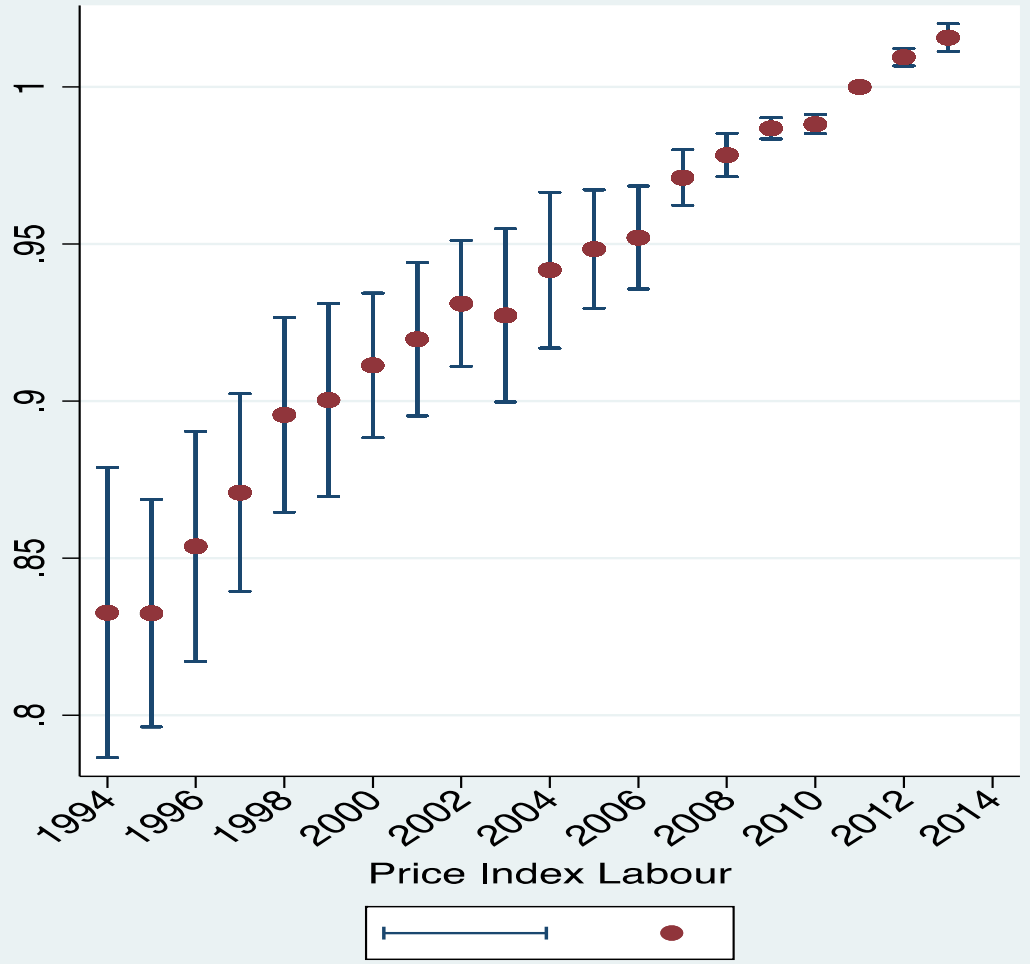

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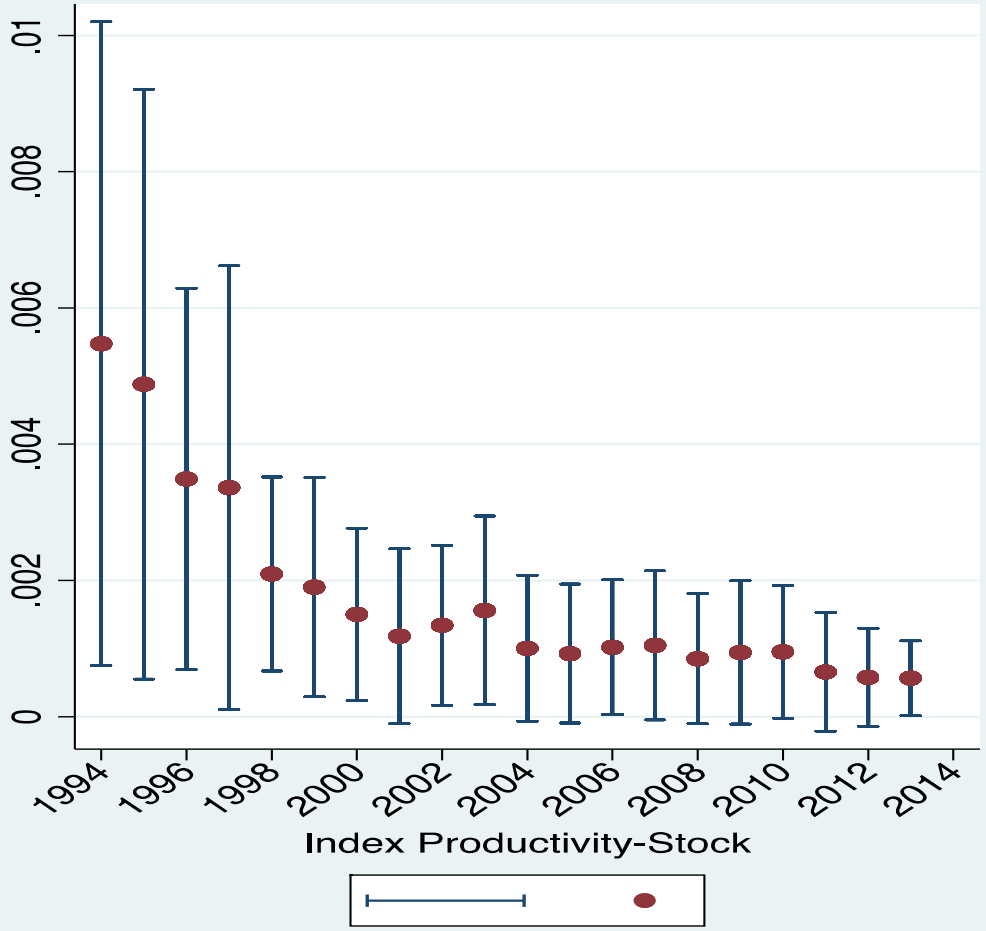
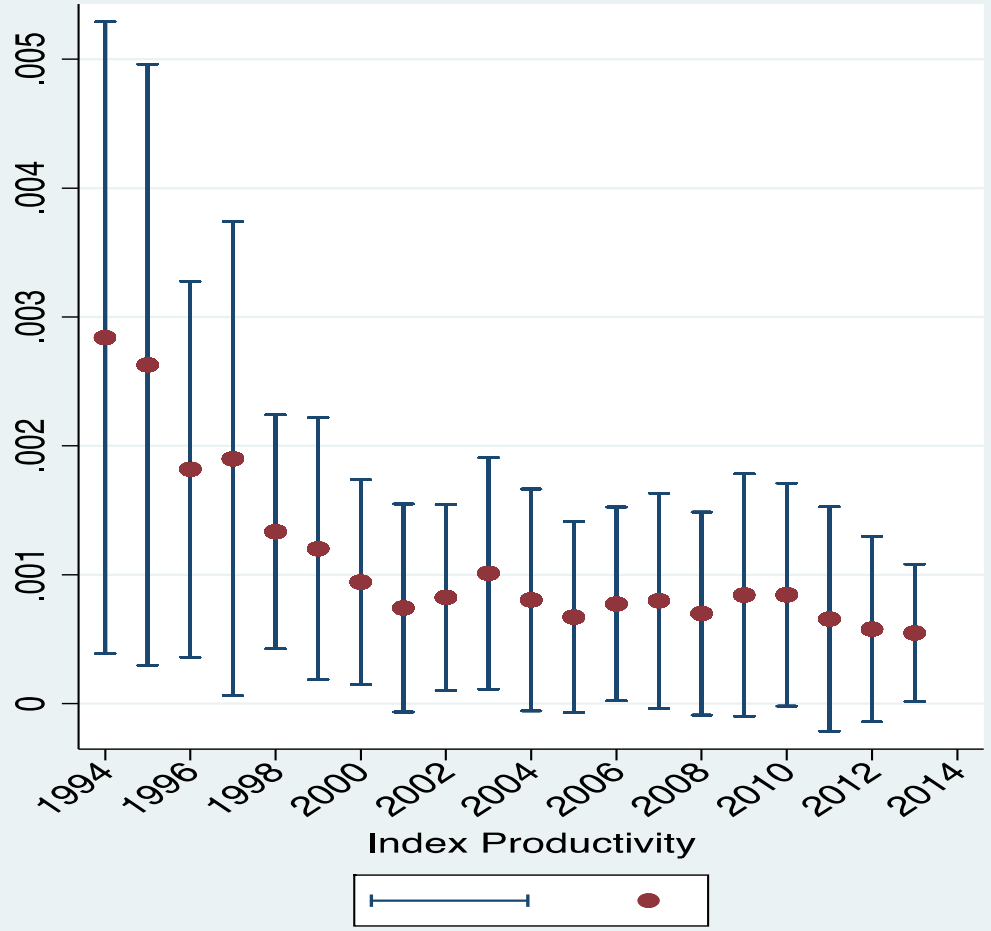
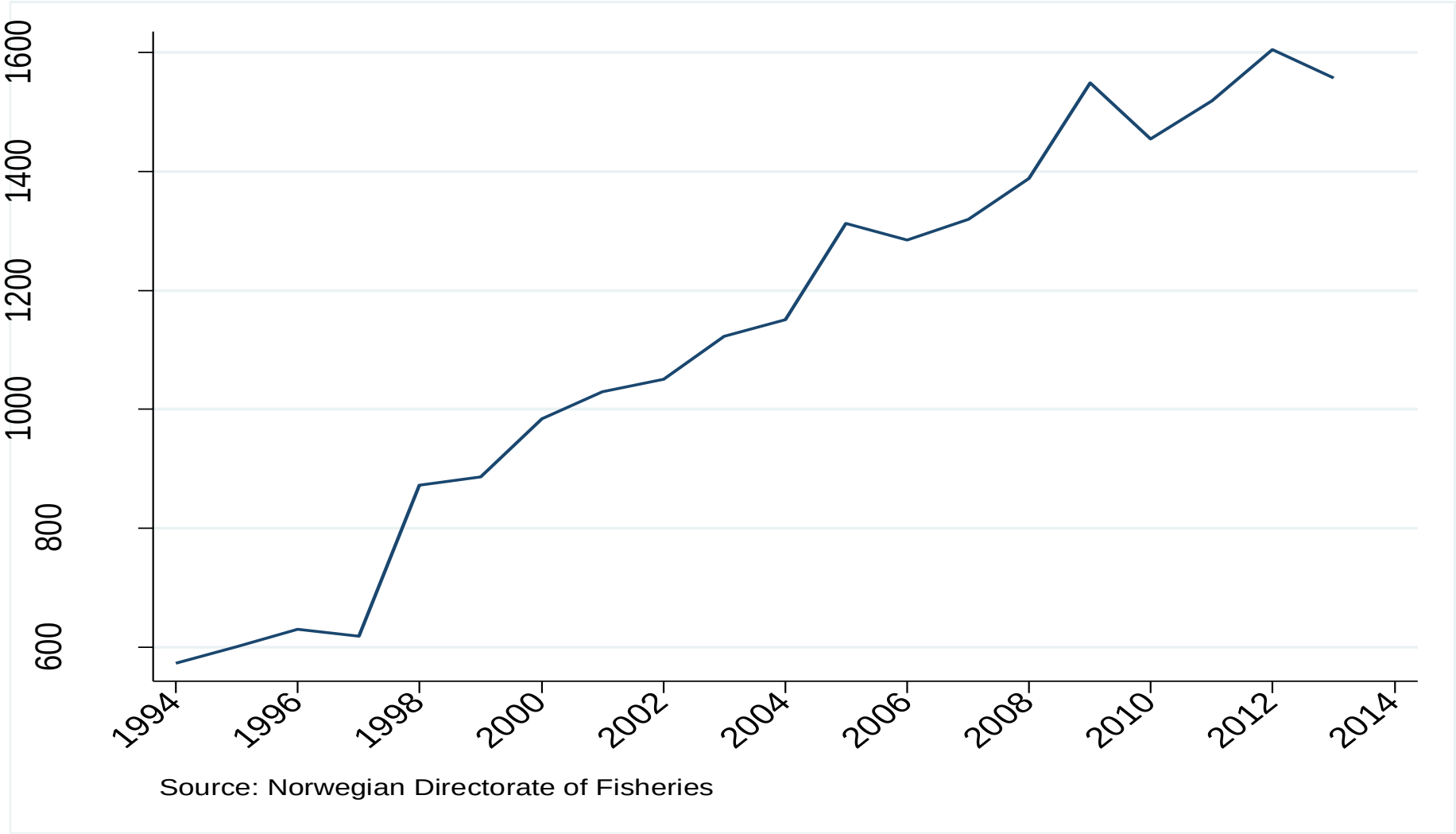


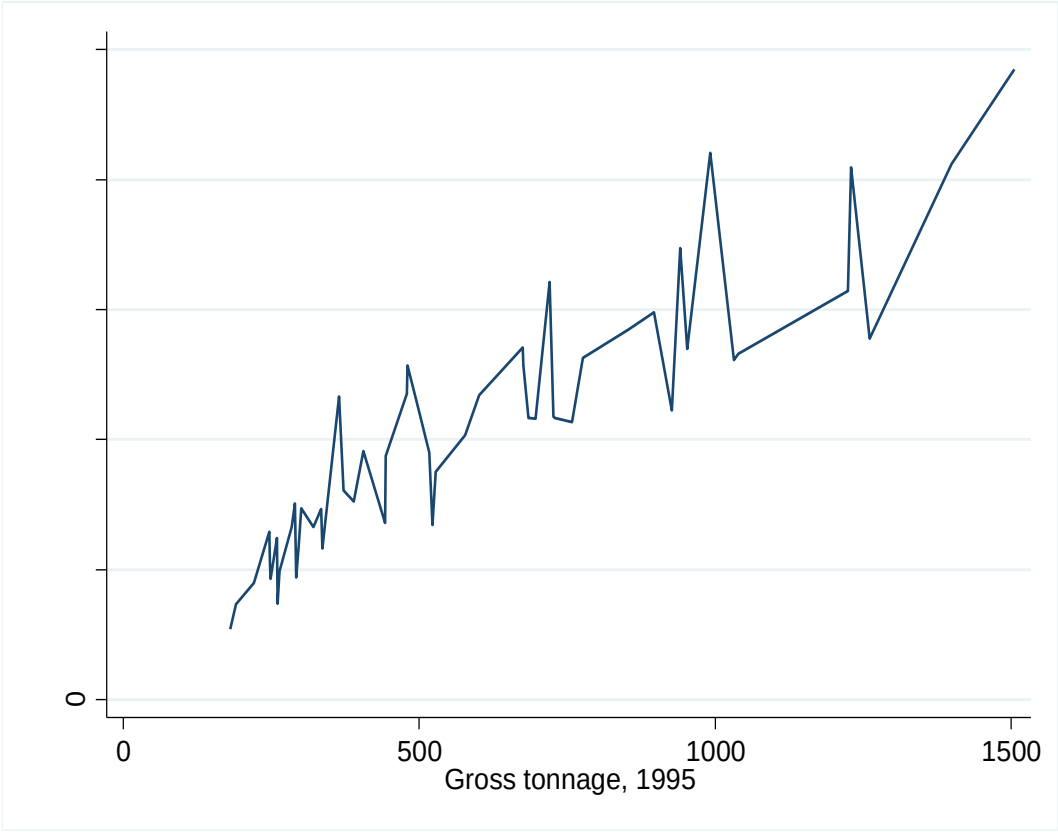


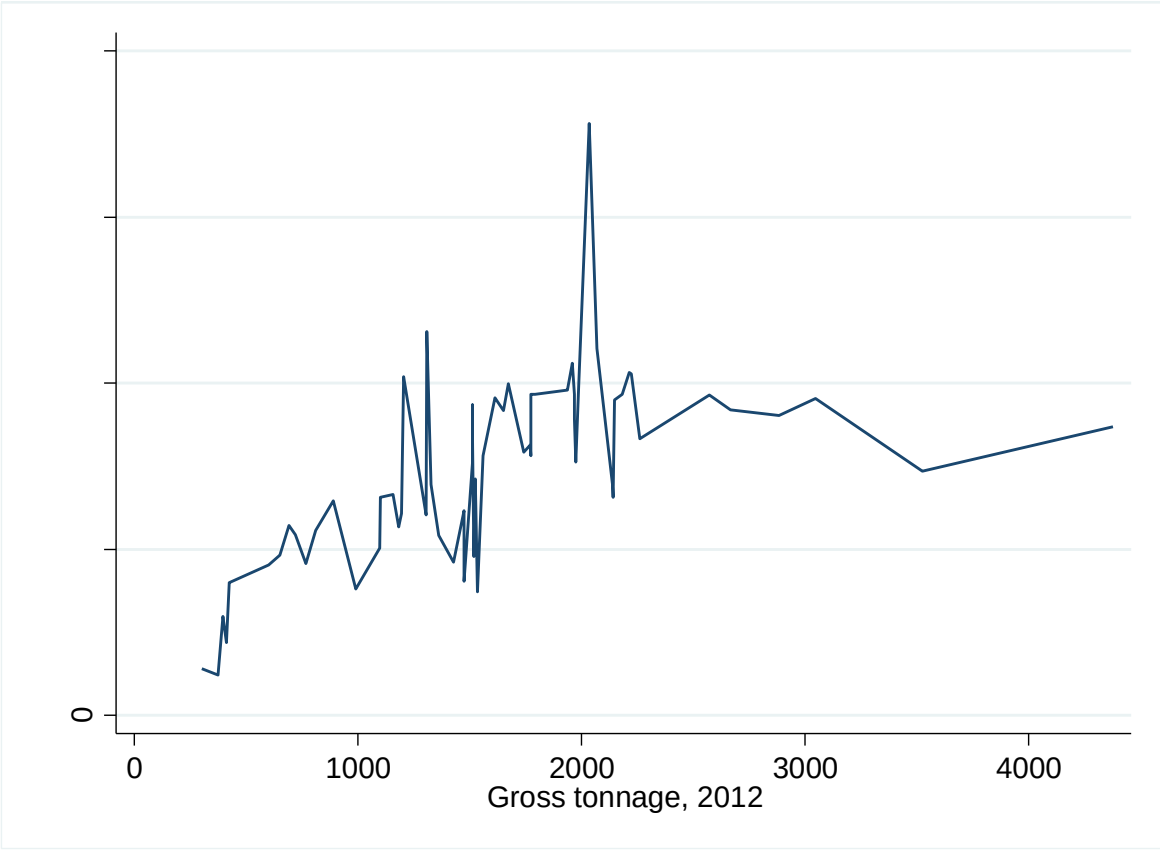
Source: Norwegian Directorate of Fisheries

Gross tonnage, sample annual average



Real Profits vs Gross Tonnage





Comments

- First attempt to measure importance of different factors on Profits Purse Seine Fleet
- Very nice and complete data set
- Prices still play the key role in increasing profits
- Productivity falls in early years and flat over most periods
- Why are vessels so Big?