Measuring Productivity Change in the Northeast Multispecies Fishery

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• Original idea was to create an “Economic Health Index” (EHI) for regional fisheries.
• Past studies have used index numbers to look at vessel performance (Norton et al. 1985, Squires 1987)
  \[ \pi_{it} = \frac{P_{it}}{W_{it}} \times \text{TFP}_{it} \] (O’Donnell, 2008)
• \[ \text{TFP}_{it} = \frac{Q_{it}}{X_{it}} \] (i.e output index/input index)
• The Fisher Index was used to measure TFP.
• Goal was to combine private and public data to create the EHI.
The Multispecies fishery

- Species – cod, haddock, yellowtail flounder, pollock, American plaice, witch flounder, white hake, windowpane flounder, Atlantic halibut, winter flounder, Acadian redfish, wolfish, ocean pout, red hake, silver hake.
- Vessels also capture a variety of other species during fishing operations.
- Vessel types – Trawl, gillnet and longline gear.
- Vast Majority is landed by trawl gear.
Fisher Indices

Fisher Index is the Geometric Mean of the Laspeyres and Paasche Indices.

\[ Q^L = \frac{p_0' * q_1}{p_0 * q_0} \]
\[ Q^P = \frac{p_1' * q_1}{p_1 * q_0} \]

\[ Q^F = (Q^L * Q^P)^{1/2} \]
Data used for TFP Index.

- Output Quantity Index: Included all species caught by vessels using trawl gear on trips where one pound of groundfish was caught.
- Output Prices in each period are converted to 2005 levels using the GDP implicit price deflator.
- Inputs used in Input Quantity Index include fuel, labor and capital services.
- Problem with calculating input quantities is that the data are not available for every vessel, particularly fuel use.
Fuel Use

Fuel – Estimated on a trip level basis using regression results based on sea sampling data.

\[ \ln(\text{fuel used}) = \ln(\text{horsepower}) + \ln(\text{days at sea}). \]

Price for fuel was the average price paid by sea sampled vessels in constant 2005 dollars.
Labor use

• Labor Use was taken directly from vessel logbooks and is equal to crew size times days at sea.
• For the opportunity cost of labor, the average hourly earnings for construction workers multiplied by eight was used.
• Food cost was also included since crew spends money on food for each trip.
• Average cost for food per crew day at sea was calculated, and then used to calculate food trip costs.
Capital Services.

• Fishing vessel provides crew amenities, as well as fishing power so an appropriate measure of capital services is difficult to construct.

• Used the engine horsepower times days at sea as measure of capital services.

• Price of capital services is the yield for BAA rated bonds (Squires, 1987)
Fisher Input and Output Quantity Index


Index

Output
Input
Productivity
Components of Economic Health Index

The graph shows the Price Component, Productivity Component, and Economic Health Index from 1996 to 2010. The Economic Health Index has a slight upward trend from 2007 to 2010. The Price Component and Productivity Component show fluctuations over the years, with the Price Component remaining relatively stable and the Productivity Component showing periods of increase and decrease.
Conclusions

• Both publicly available data, and confidential vessel data can be used to construct the Fisher Productivity Index.

• Lack of input prices and quantities was the most difficult part of index construction to overcome.

• This index measured productivity for one component of the fishery. Need to include other sectors to complete productivity index.

• Fisher Index holds promise for fisheries with small number of vessels, as well as those with large fleets.