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## Some distributional consequences of collective rights in artisanal fisheries

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# MOTIVATION

- In 2004 the Chilean fisheries administration launched a collective catch quota system called “Régimen Artesanal de Extracción” (RAE) for artisanal organizations (vessel owners)
- Collective quota assignment has generated distributional concerns (“unfair” distribution)
  - Assignment based on vessel’s historical landings (2001 -2003)
  - Incomplete information about actual landings records
- The fishery administration and the federations of fisher organizations have agreed on a redistribution of quotas from large to small vessel (quota) owners.



## Collective Fishing Rights: RAE (Régimen Artesanal de Extracción)

- Assignment of quotas:
  - To organization and not to individual boats or fishers
  - Based on historical landings data
  - Each organization implements its own mechanisms for individual quota assignment within the organization, without guidelines from the authorities.
- Some caveats:
  - No public information about annual quota exchanges or quota prices within organizations is available.
  - No information of exchange prices between organizations.
  - Strategic associations between processing plants and artisanal fishers interfere with an efficient assignment of quotas.
  - Some organizations/ vessel owners are dissatisfied with the initial assigned quotas



## Aim

- We want to measure the impact of quota re-distribution on income distribution and discuss the potential for direct redistribute policies.

**Consequences of quota re-distribution** will depend on:

1. How effort is collectively organized (efficiency).
2. How net income is distributed (distribution)
3. How quota is re-distributed between fishermen (policy)



## What do we do?

- We model different effort assignment forms (centralized, decentralized), distributional forms (egalitarian, proportional), and policy measures (schemes). No uncertainty and perfect compliance are assumed.
- Optimize different assignment models with parameters from the sardine and anchovies artisanal fisheries in Central-Southern Chile.
- Calculate net income per vessel and the Theil index under different distributional assumptions. Unit of analysis: Vessel owner and organization
- Calculate the impact of quota redistribution under different assumptions on the net income Theil index and discuss the results .



# Example: Centralized quota assignment

- Problem:

$$\underset{(\varepsilon_i)}{\text{Max}} \sum_{i=1}^I \left[ p^q q_i(\varepsilon_i) - c_i \varepsilon_i \right]$$

s.t.

$$\sum_{i=1}^I q_i(\varepsilon_i) \leq \bar{Q}$$

$$0 \leq \varepsilon_i \leq \varepsilon_{MAX}$$

$p^q$  product price,  $q$  landings,  $\varepsilon$  effort,  $c$  unit cost,  $\bar{Q}$  organization quota,  
 $i$  vessel owner

- Optimal rule for interior solution:

$$p^q - \left( \frac{c_i}{\partial q_i / \partial \varepsilon_i} \right) = \lambda \geq 0$$

The difference between marginal revenue and marginal cost should be equal for all fishers to the shadow price of the quota restriction.

- To this assignment rule a distributional assumption is added: egalitarian or proportional (to initial endowments)
- Distribution will vary depending on assignment and distributional rules assumed.

## Assignment and Income distributions schemes

Model Nr.	Effort assignment form	Distribution form
Model-I	Collective decentralized without trade	initial endowment
Model-II	Collective centralized without trade	egalitarian
Model-III	Collective centralized without trade	proportional
Model-IV	Collective decentralized with trade	Collective with trade
Model-V	Individual decentralized with trade	Individual



# Application

- We used information for the common sardine and anchovies artisanal fisheries in Central Southern Chile.
- To parametrize the model we
  - estimated coefficients of a Cobb Douglas production function (landings – effort relationship) by non-linear minimum squares, for each type of vessel (boats, small vessels, medium vessels and large vessels).
  - used information on average product prices, unitary fishing costs per vessel type, max vessel operation days per year, vessel and organization quotas, and max tons landings per vessel type.
  - optimized each model and obtained effort (and in some cases) quota exchange per vessel and shadow price of quota exchange.

## Application, cont.

- We calculated the net income per vessel, using different distributional assumptions.
- With this information we were able to calculate the Theil index for a base situation (0% redistribution) and a redistribution in initial quota assignments (1% of total artisanal quota) from large vessels to small vessels. Two forms of redistribution were used (proportional and egalitarian)
- These indexes were calculated at the vessel owner and organizational level

Reference  
distribution

# Results

Most “even”  
distribution

Theil index for net income with no redistribution (0%)

	Theil index (net income)		Total variation (base Model-I)	
	Vessels	Organizations	Net income	Landings
Model-I	0.0693	0.1131	1.0000	1.0000
Model-II	0.0306	0.1130	1.0354	1.0194
Model-III	0.0624	0.1130	1.0348	1.0207
Model-IV	0.0576	0.1132	1.0350	1.0194
Model-V	0.0523	0.1073	1.0462	1.0221

## Results, cont.

### Their index without (0%) and with (1%) redistribution

	No redistribution of quota	Egalitarian redistribution of 1% of quota	Proportional redistribution of 1% of quota
Model-I	0.0693	0.0692	0.0688
Model-II	0.0306	0.0296	0.0299
Model-III	0.0624	0.0588	0.0598
Model-IV	0.0576	0.0545	0.0551
Model-V	0.0523	0.0485	0.0495

# Some conclusions

- The effect of assignment, distribution and redistribution form is important on net income at the vessel level and not so much at the organizational level. This should be a consequence of heterogenous composition of the organizations (include large and small vessels).
- Decentralized assignment with trade approaches more than other forms the most equal distribution (centralized egalitarian)
- The effect of quota redistribution has a very small impact on the “evenness” of the distribution as compared with the effect of assignment form. Trade and transparency in the information should be promoted for distributive concerns.

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# Thank you for your attention

