Fuel fisheries subsidies in Mexico

Gaines Lab

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Back in the day, during fieldwork

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Some stats

In the world

- $\sim$ US$35 billion per year to the fishing industry
- Fuel subsidies account for ~22% of total

In Mexico

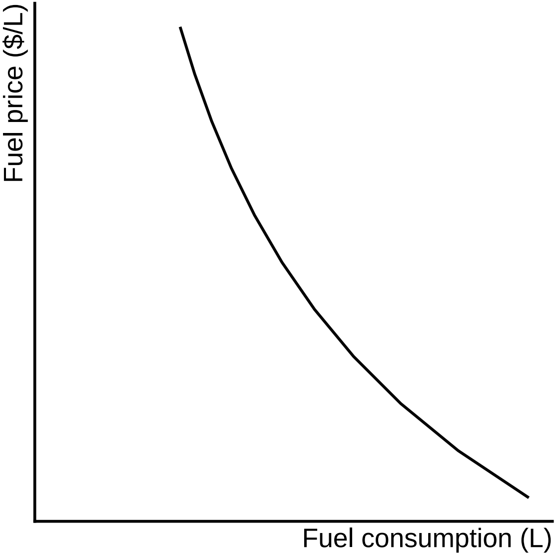
- US$200 million per year subsidies
- US$30 million per year on fuel

Subsidy reforms

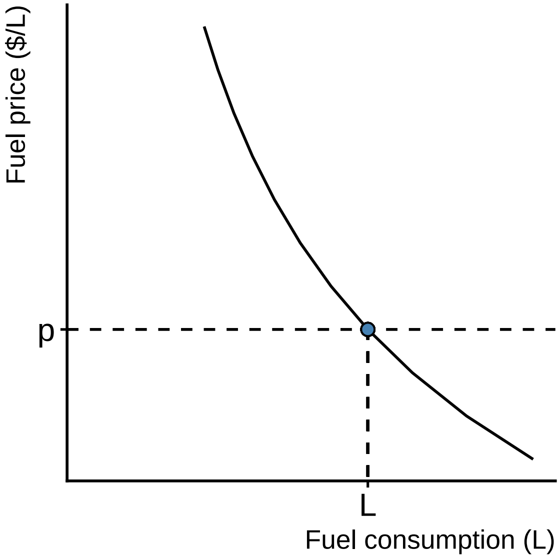
- WTO has debated subsidy reforms for almost 20 years now
- SDG 14.6 Seeks to reduce “harmful subsidies”
- Large uncertainty on how big the upsides would be
- High political cost on backtracking them

Fuel subsidies in fisheries

Demand curve for the average boat



Fuel subsidies in fisheries



Fuel subsidies in fisheries

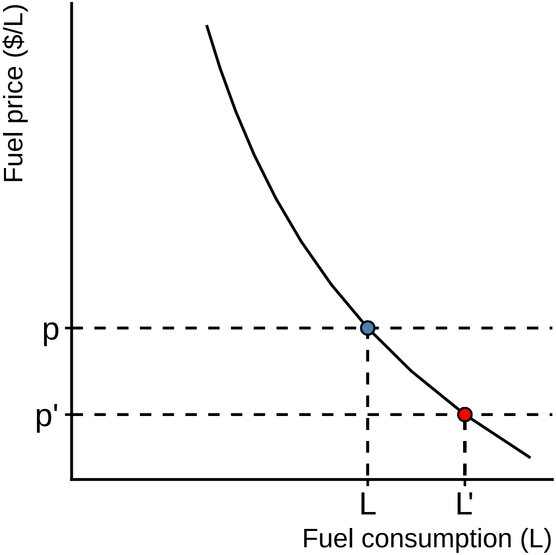


Figure 1: A fuel subsidy induces overfishing

Fuel subsidies in Mexico

$$I_i = (MDL_i \times DPC_i) \times AF$$

Where:

- I_i is the "Incentive for the acquisition of fuel" for fisher i: The amount of fuel (L) that will be subsidized at $p - 2$
- MDL_i is the "Maximum daily liters"
- DPC_i is the "Days per cycle"
- AF is the "Adjustment factor"

With $AF = 1$, $I_i = \mathrm{E}[L]$

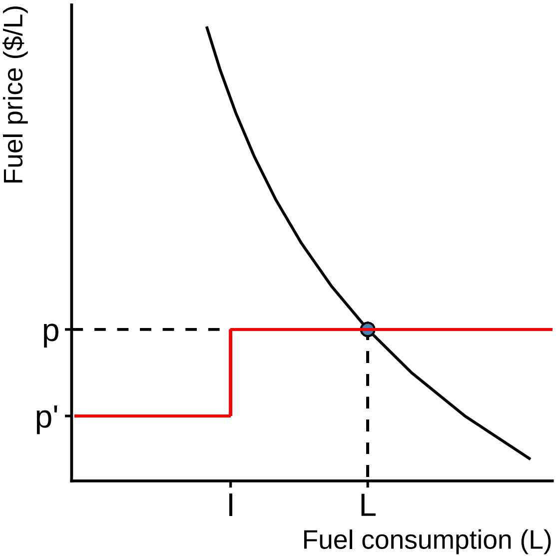
An example

Figure 2: Azteca 1 is a tuna purse seiner with a 3,600 HP Diesel engine

$$I_i = (15455\ [l/day] \times 220\ [days]) \times 0.4$$
$$I_i = (3.4 \times 10^6\ [liters]) \times 0.4$$
$$I_i = 1.36 \times 10^6$$

- On any given year, Azteca I is expected tro consume 3.4 M liters
- The subsidy makes it such that 1.36 M of that come at a price $p - 2$

Updating the set up



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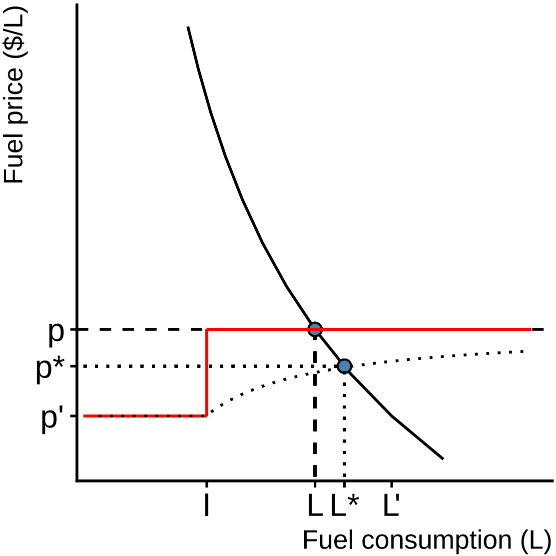

The questions

How do fisher's fuel consumption respond to block pricing caused by fuel subsidies?

Exciting because we can estimate something useful:

- Do fishers respond to marginal or average prices? - Interesting insight with implications for micro and fisheries mngmt

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  - If fishers respond to average prices, then:
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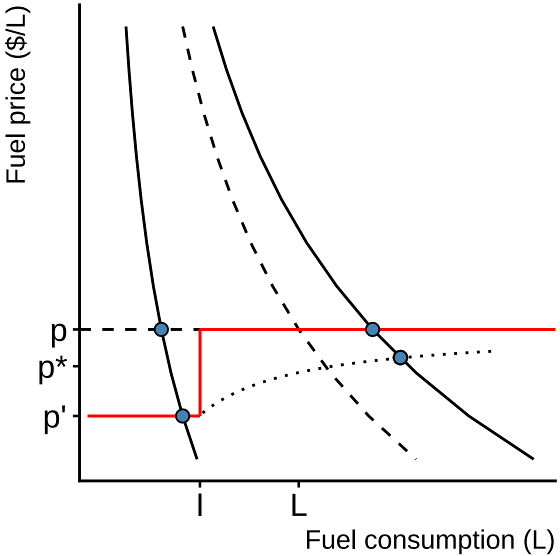
    - We would have an estimate the effect of fuel subsidies on fishing effort

There is room for both

Two types of vessels



Empirics

Focus only on "bad" fishers

- Consider a dummy variable $D_i = \{0, 1\}$ denoting treatment status of vessel i, with 0 indicating no subsidy received and 1 receiving subsidy.
  - So $Y_i(0)$: fuel consumption if the vessel is unsubsidized
  - $Y_i(1)$ if subsidized
  - and we expect $Y_i(1) - Y_i(0) > 0$
- "Bad" fishers are defined based on $Y_i(0)|D_i = 0$ relative to I_i

$$Y_i = D_i Yi(I) + (1 - D_i) Y_i(0)$$
$$Y_i = \alpha + \beta_1 D_i + \epsilon_i$$

Empirics

Now consider the "good" fishers

Under the same specification:

$$Y_i = \alpha + \beta_1 D_i + \epsilon_i$$

- $\beta_1 > 0$ would indicate that fishers respond to average prices
- $\beta_1 = 0$ would indicate that fishers respond to marginal prices

Emprics: All together

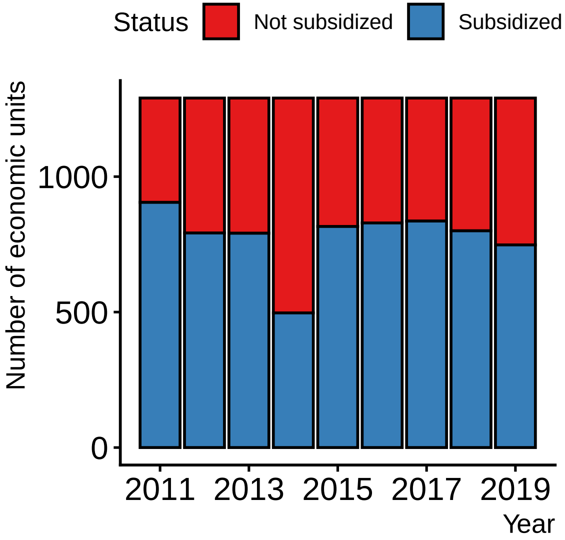
- Consider another dummy, $R_i = \{0, 1\}$, that denotes if a vessel is to the left or right of the kink

$$\begin{aligned}
Y_i(0,0) &: \text{Unsubsidized vessels to the left} \\
Y_i(1,0) &: \text{Subsidized vessels to the left} \\
Y_i(0,1) &: \text{Unsubsidized vessels to the right} \\
Y_i(1,1) &: \text{Subsidized vessels to the right}
\end{aligned}$$

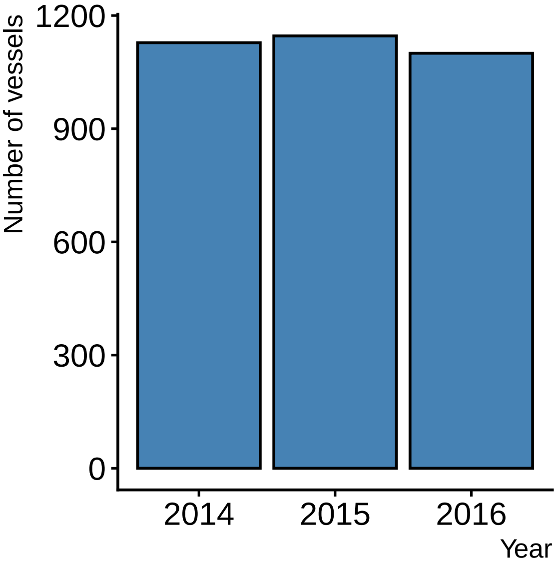
$$Y_i = \alpha + \beta_1 R_i + \beta_2 D_i + \beta_3 R_i \times D_i + \epsilon_i$$

- β_1 is the causal effect of subsidies on fuel consumption
- β_3 is the causal effect of a "block pricing" fuel subsidy on consumption

Figures: Subsidized economic units



Effort



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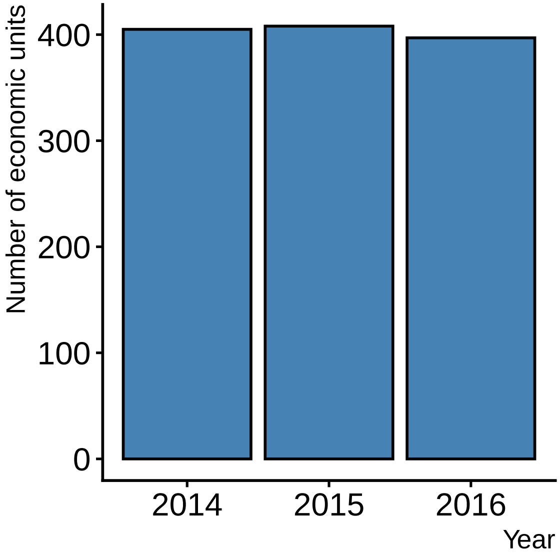


Number of economic units
400
300
200
100
0
2014
2015
2016
Year

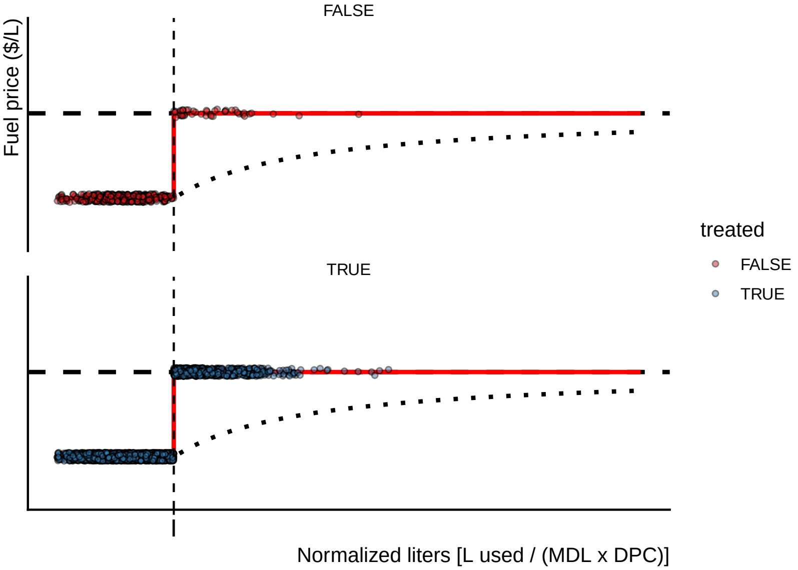
Calculating fuel consumption

$$C_i = P_i \times SFC_i \times \left(L_{max} \times \frac{\frac{v_i}{d_i} + \frac{L_{min}}{L_{max} - L_{min}}}{1 + \frac{L_{min}}{L_{max} - L_{min}}} \right)$$

Where:

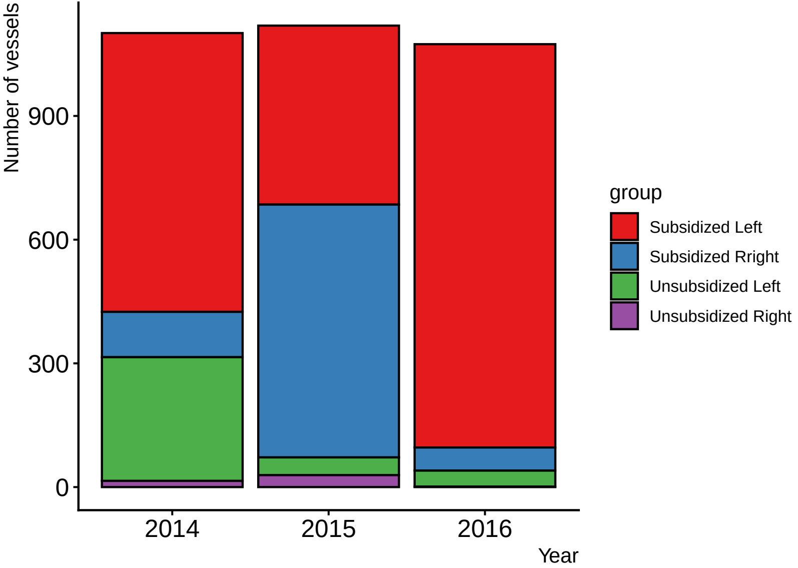
- P_i: Engine power
- SFC_i: Specific Fuel Consumption
- v_i: Observed speed
- v_i: Design speed
- $L_{...}$ Loading factor

Jackpot?



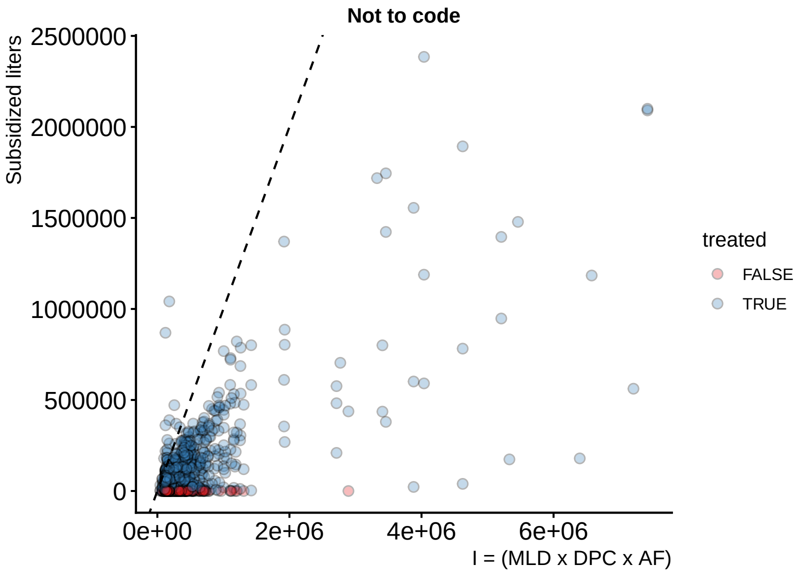
FALSE
TRUE
Fuel price ($/L)
Normalized liters [L used / (MDL x DPC)]
treated
FALSE
TRUE

Jackpot?



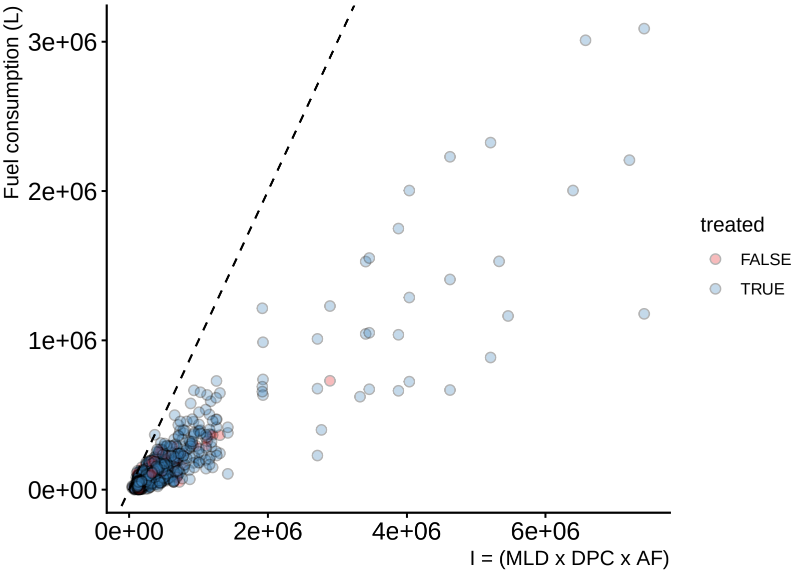
Number of vessels
900
600
300
0
2014
2015
2016
Year
group
Subsidized Left
Subsidized Rright
Unsubsidized Left
Unsubsidized Right

Not so fast



Not to code
Subsidized liters
2500000
2000000
1500000
1000000
500000
0
0e+00
2e+06
4e+06
6e+06
I = (MLD x DPC x AF)
treated
FALSE
TRUE

Looking closer



Still, some discontinuities