SUBSIDIES TO GROUNDWATER PUMPING IN MEXICO: PERVERSE EFFECTS & OPTIONS FOR DECOUPLING

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Mexico has a severe crisis of aquifer overexploitation

- 100 of the 188 most important aquifers are overexploited

- Present and future generations of farmers will face higher costs for pumping water
- Scarcity hinders urban economic growth and supply to households.
- Threshold crisis: saline intrusion, heavy metals
Aquifers in red, yellow and green are overexploited
Agriculture uses 77% of all underground water.
Concessions are poorly enforced
Excess demand is encouraged by the subsidy to electricity used for groundwater pumping

Farmers pay less than 1/5 of the cost of generating and distributing electricity.
The subsidy given to farmers through the electricity fees for pumping water is more than US$ 670 million per year.

Only 30% of all farmers in Mexico have any type of irrigation system which implies that more than 70% of all campesinos (peasants) receive none of this subsidy.

Just a few farmers receive most of the subsidy. We estimate a Gini coefficient of 0.91 (1.00 would be total inequality).
A SUBSIDY CAPTURED BY THE RICHEST FARMERS

<table>
<thead>
<tr>
<th>DECILES</th>
<th>PERCENTAGE OF THE SUBSIDY THAT EACH DECILE RECEIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.00%</td>
</tr>
<tr>
<td>II</td>
<td>0.02%</td>
</tr>
<tr>
<td>III</td>
<td>0.15%</td>
</tr>
<tr>
<td>IV</td>
<td>0.47%</td>
</tr>
<tr>
<td>V</td>
<td>1.3%</td>
</tr>
<tr>
<td>VI</td>
<td>3.3%</td>
</tr>
<tr>
<td>VII</td>
<td>6.8%</td>
</tr>
<tr>
<td>VIII</td>
<td>12.5%</td>
</tr>
<tr>
<td>IX</td>
<td>21.8%</td>
</tr>
<tr>
<td>X</td>
<td>53.7%</td>
</tr>
</tbody>
</table>

LORENZ CURVE OF THE DISTRIBUTION OF THE SUBSIDY
**COSTS OF THE SUBSIDY**

Average cost of:

- generating 1 kwh → 0.63
- transmitting 1 kwh → 0.81

Average total cost of 1 kwh → 1.44

670 million US dollars per year

**Costs of:**
- Diminished water quality
- Harm inflicted upon aquatic ecosystems
- Saline intrusion in aquifers
- Lower volume for industry and households
Decoupling means increasing the price of electricity while giving the farmers the same amount of money through a direct transfer (i.e. in cash or debit card).

The new price gives incentives to save: change crop patterns, reduce area, adopt water-saving technologies.

The transfer keeps farmer’s welfare the same, plus some liquidity to undertake the necessary changes.
RESULTS FROM DECOUPLING

RESULT 1: INCENTIVES TO USE MORE EFFICIENT TECHNOLOGIES

<table>
<thead>
<tr>
<th>Price change (%)</th>
<th>Drip</th>
<th>Sprinkler</th>
<th>Canal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>47.9%</td>
<td>46.2%</td>
<td>5.9%</td>
</tr>
<tr>
<td>75%</td>
<td>69.3%</td>
<td>24.5%</td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>74.8%</td>
<td></td>
<td>8.2%</td>
</tr>
</tbody>
</table>

Price change (%)
RESULTS FROM DECOUPLING

RESULT 2: AQUIFERS WOULD BE RESCUED

<table>
<thead>
<tr>
<th>Decoupled subsidy</th>
<th>Current subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>413</td>
<td>355</td>
</tr>
<tr>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td>66</td>
<td>81</td>
</tr>
<tr>
<td>1412</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

- Blue: with margin of extraction
- Light blue: in equilibrium
- Yellow: over-extraction (extraction is 10-50% more than recharge)
- Orange: severe extraction (extraction is 50-100% more than recharge)
- Red: extreme extraction (extraction is 100-800% more than recharge)
POLICY OPTIONS FOR DECOUPLING

WHERE
is the measure undertaken

TO WHOM
is the subsidy given to

HOW MUCH
is transferred to each farmer
1. In all aquifers
2. Only in overexploited aquifers
3. Only in the extremely overexploited aquifers

Each 10% increase in price reduces water extraction by 1.5%

Differentiating sends the correct political signal

Slight reaction but no other way to curb demand
1. All irrigation farmers (1/5 are “irregular”)
2. Only to those with concessions

- Discourage illegal extraction
- Political opposition by illegal users, some sort of compensation needed
- Illegal ones are gradually receiving less subsidy (shh! don’t tell)
1. Average transfer per m$^3$ of concession (better/worse off)

2. Historical transfer to each farmer (makes inequality evident)

Where the water table is lowest farmers loose and vice versa

Transparency makes rain-fed farmers aware of the inequality

Actually, enough data to calculate both
THANK YOU!

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