Using tariff structures as demand management instruments: Case Studies from Zaragoza & Kampala

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Scope of presentation

- Overview of Water Demand Management
- Water Tariffs as WDM instruments
- Case Study 1: Zaragoza, Spain
- Case Study 2: Kampala, Uganda
- Conclusion
Water Demand Management (WDM)

- WDM is the promotion of policies & measures to control/restrict demand for, use or waste of water
- Need to tap conservation potential of behavioural & technological changes
- Need to use a combination of measures & instruments, such as:
  - Technological interventions
  - Economic interventions
  - Social/educational/legislative interventions

Water Tariffs as a WDM instrument

- Multiple objectives for setting water tariffs, e.g.
  - Revenue collection for financial sustainability
  - Equitable distribution of benefits according to ATP
  - As an economic instrument for WDM
- Different pricing models used for tariff setting, e.g.
  - Historical cost pricing (HCP)
  - Average cost pricing (ACP)
  - Marginal cost pricing (MCP)
- MCP provides better price signals for efficient water use, & more appropriate for applying the tariff for WDM
Case Study 1: Zaragoza, Spain

- Capital of Aragon Region
- 5th largest Spanish city, 0.615M (2001) pop.
- Mean annual rainfall – 314mm
- Evapotranspiration - 795mm


Towards Economic Water Pricing - Zaragoza

- Pre-1995 period tariff structure based on criteria such as
  - Presence of commercial activities on the street
  - Length/breadth of street
  - Political considerations
- Reform of tariff from 1995 to make it more
  - Economically efficient
  - Horizontally & vertically equitable
  - Transparent
  - More causative to universal accessibility
Evolving tariff levels in Zaragoza (1990-2002)

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<tbody>
<tr>
<td></td>
<td>Spanish Pesetas (ESP)</td>
<td>Euros</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0- 6</td>
<td>19</td>
<td>20</td>
<td>29</td>
<td>29</td>
<td>30</td>
<td>0.19</td>
<td>0.21</td>
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<tr>
<td>6-13</td>
<td>36</td>
<td>41</td>
<td>70</td>
<td>69.9</td>
<td>70.9</td>
<td>0.44</td>
<td>0.45</td>
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<td>13-35</td>
<td>50</td>
<td>58</td>
<td>172</td>
<td>156</td>
<td>158.6</td>
<td>0.99</td>
<td>1.06</td>
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<tr>
<td>35- 40.5</td>
<td>69</td>
<td>78</td>
<td>255</td>
<td>234</td>
<td>239</td>
<td>1.50</td>
<td>1.58</td>
</tr>
<tr>
<td>&gt;40.50</td>
<td>69</td>
<td>78</td>
<td>255</td>
<td>233</td>
<td>238</td>
<td>1.49</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Source: Zaragoza City Council (AYTO), 2008
Currency Units before 1999 are in Spanish Pesetas (ESP).
1 Euro = 166.4 ESP, at the time of Currency Exchange in 1999.

Zaragoza’s Rationalised tariff, 2007

Source: Shirley-Smith, Cheeseman & Butler (2008)

- Fixed charge depending on pipe diameter; e.g. 3.8 €/month for 20mm pipe
- Plus variable charge based on household consumption

<table>
<thead>
<tr>
<th>Price €/m³</th>
<th>Consumption m³/hh/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.333</td>
<td>6</td>
</tr>
<tr>
<td>0.799</td>
<td>18.5</td>
</tr>
<tr>
<td>1.6</td>
<td></td>
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</table>
Zaragoza water consumption and population growth, 1980 - 2008

Between 1996 - 2008, city population increased by 13.3%; water demand reduced by 25.4%

Tariff reform + other interventions led changes in h/h consumption
e.g. Average pc h/h consumption reduced 109 -> 99 l/day (1996 – 1999)

Between 1996 - 2008, city population increased by 13.3%; water demand reduced by 25.4%

Case Study 2: Kampala, Uganda

Kampala is capital city
Pop ~ 1.5m, 45% living in informal settlements
Lake Victoria, the water source facing declining levels and worsening water quality
NWSC regularly updating treatment processes

Objective of study is to demonstrate how demand-responsive tariffs could be used as economic instruments to trigger water conservation
Methodology for CS 2

- Development of an excel-based model, with these main inputs:
  - > 5% random sample (n=2701) of monthly household billings for July 2006 to June 2007
  - Household sizes – Uganda HH survey (UBS, 2006)
  - Estimated income levels - a study by Kayaga & Franceys (2007)
  - Per capita consumption estimates for various income levels (Study conducted by Beller Consult in 2004)
  - Price Elasticity of Demand for 3 income levels (parallel surveying) – Cape Town study conducted by Jansen og & Shulz (2006)

- Main Assumptions
  - Rule of World Bank-based thumb for ATP of 3% of HH income
  - Minimal sharing between households
- The function for Price Elasticity of Demand used for processing

Kampala CS: Key Results

<table>
<thead>
<tr>
<th>Outputs of the Tariff Model</th>
<th>Block 1 (Low)</th>
<th>Block 2 (Middle)</th>
<th>Block 3 (High)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Price (Ug-Shs/m³)</td>
<td>1,190</td>
<td>1,372</td>
<td>1,914</td>
<td>1,314</td>
</tr>
<tr>
<td>Consumption (m³/HH-M)</td>
<td>0-11</td>
<td>11-20</td>
<td>&gt;20</td>
<td></td>
</tr>
<tr>
<td>% change in tariff</td>
<td>-2%</td>
<td>13%</td>
<td>58%</td>
<td>8%</td>
</tr>
<tr>
<td>% Δ in consumption p.c.d</td>
<td>0</td>
<td>+4%</td>
<td>-53%</td>
<td>-20%</td>
</tr>
<tr>
<td>Δ consumption (m³/year)</td>
<td>-15,812</td>
<td>1,246,152</td>
<td>-3,765,414</td>
<td></td>
</tr>
<tr>
<td>Proportion of households</td>
<td>29%</td>
<td>49%</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Water allocation</td>
<td>14%</td>
<td>48%</td>
<td>38%</td>
<td></td>
</tr>
</tbody>
</table>
### Other implications for Kampala CS

- Minimal change in proportion of households in Block 1
- Number of households in Block 3 decreased from 29% to 22%
- Number of households in Block 2 increased from 41% to 49%
- Water savings of about 2.535 Mm$^3$ per year
- Revenue for the utility increases by ~1.7b Uganda Shs (up by 8%)
- Extra revenue could be used by the utility to expand the reticulation network to distribute saved water and serve an extra 19,205 households in informal settlements

### Conclusion

- WDM is necessary for both Zaragoza & Kampala:
  - In Zaragoza – to plug the gap in water resources
  - In Kampala – to plug the gap in organisational resources
- Tariffs have an important role to play in WDM for cities of high- and low-income countries.
- In both Kampala & Zaragoza, well designed tariffs can reduce the supply-demand gap in the shorter term
- In Kampala, such tariffs could also
  - Increase revenue for the utility
  - Increase allocative efficiency of social benefits
Thank you for listening

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