

# Continuous Piped Water or Improved Intermittency?

*Willingness to Pay for Piped Water Services  
in Hubli-Dharwad, India*

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# Research Questions

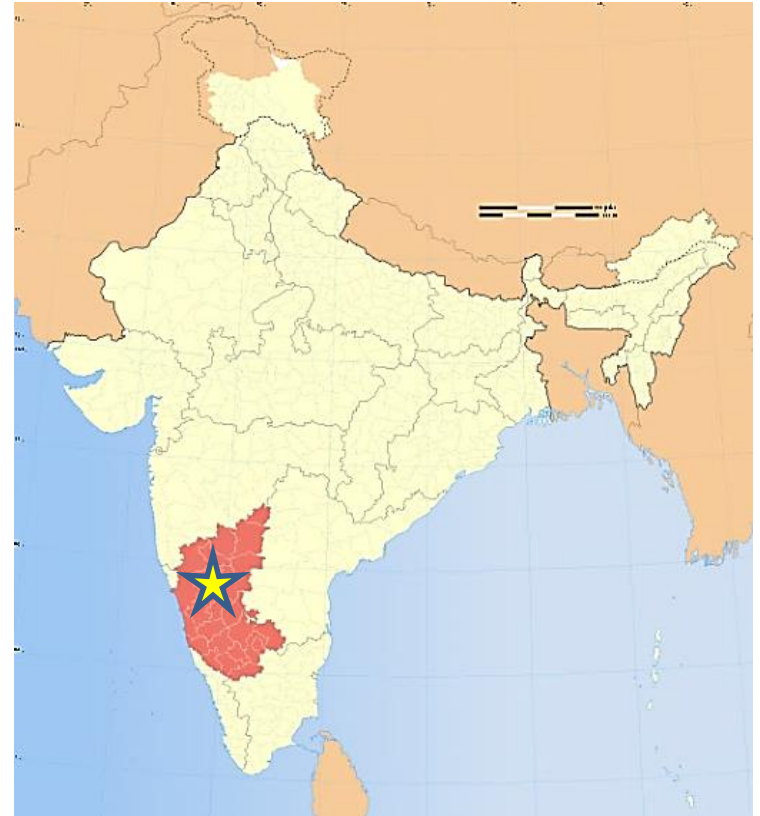
- 1. Are water users willing to pay for incremental improvement in water services?**
  - If so, how much?
  
- 2. Does experience with service improvements change WTP?**
  - If so, by how much?

# Study Location

## Hubli-Dharwad

- Mid-size city
- Increasing urbanization

<i>Population:</i>	943,185 <sup>1</sup>
<i>Annual GNI per cap:</i>	US\$ 776 <sup>2</sup>
<i>Piped water access (2006):</i>	once in 3-4 days <sup>3</sup>



1 Gov of India Census

2 Gov of Karnataka

3 (CMDR 2006)

# Pilot Project: Continuous Piped Water

## Pilot Project Zones

8 Wards (10% of all residents)

Mix of low, middle, high income

## Service Changes

Continuous piped water

Full metering

Higher tariff

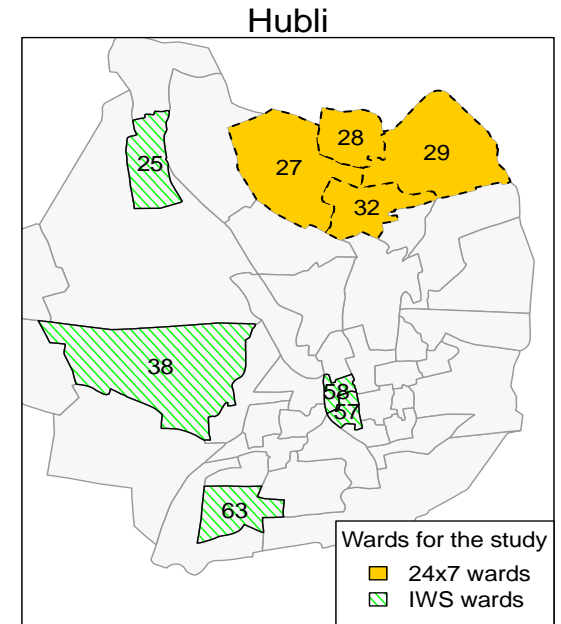
Removal of public borewells

=> Planned full scale-up in near future



# Sampling Method

- Genetic matching of wards<sup>1</sup>
- Household survey data (2006) used for matching<sup>2</sup>
- Cases had continuous piped water for 3 years at time of survey



## Continuous Water Service (CWS)

## Intermittent Water Service (IWS)

Households

1418

1525

Sample Size

4571

4253

<sup>1</sup> (2009) Sekhon

<sup>2</sup> (2006) Center for Multi-Disciplinary Research, Dharwad

# Survey Instrument

Stated Preference  
Discrete Choice  
Unlabeled Alternatives

## Attributes and Levels

Prices (₹ per 1000 liters):

₹ 0.01, ₹ 0.10, ₹ 0.15, ₹ 0.25, ₹ 0.50, ₹ 0.99

Frequency + Duration:

24hrs / 7days

5hrs / 2days

2hrs / 2days

5hrs / 5days

2hrs / 5days

Punctuality of Delivery

(Yes = 1, No = 0)

Borewell Access

(Yes = 1, No = 0)

Water Quality

(Good = 1, Bad = 0)



# Model Estimation

- Mixed Logit Discrete Choice (Randomized Utility Model)
- Estimated coefficients for all five attributes (Punctuality, Water Quality, Borewell Access, Frequency of Delivery, Tariff)
- Differentiated by household characteristics:
  - Above or Below Median Wealth (AMW or BMW)
  - Currently receiving CWS or IWS
  - Estimated Usage per month

# Supplemental Borewell Access

	Value	p-value
BMW	-0.0755	0.27
sigma (BMW)	1.08	<0.01
AMW	-0.00777	0.87

- AMW households don't seem to value borewell access
- BMW households spread around zero
  - ⇒ some BMW households value having access and others value taking it out
  - ⇒ WTP for borewell access was not calculated



# Willingness To Pay (WTP)

	WTP (Rs. Per Month)	
	BMW	AMW
Median Monthly Usage (Kiloliters)	5	9.5
Water delivered exactly on time	22	122
Improved Water Quality (IWS)	30	93
Maintaining Water Quality (CWS)	-36	-114
Continuous Water Access (IWS)	28	89
Continuous Water Access (CWS)	141	442
5 hours delivered once every 5 days	45	142
2 hours delivered once every 2 days	48	151
5 hours delivered once every 2 days	79	247

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# Phrasing of Water Quality Attributes

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CWS

Your water quality is the same as it was before CWS water began

Your water quality is the same as you are currently receiving

IWS

Your water quality is the same as you are currently receiving

Your water quality is better than the water you are currently receiving

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In CWS areas how do they judge what is improved water quality?

⇒ By appearance, taste and smell

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# Under-Valuing Convenience

WTP for continuous water:

- Increased access
- Increased convenience
- Decrease of other 'coping costs'

⇒ Represents a trade-off between time (convenience) and money (tariffs)

WTP for continuous water in CWS >> than in IWS

⇒ convenience is undervalued when not experienced

# Conclusions

Water users have a positive WTP for:

- Incremental improvements in frequency, duration and punctuality of deliveries
- Water quality improvements might be complicated by taste preferences
- Experience has a large, positive effect on WTP for continuous water service

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# Thank You

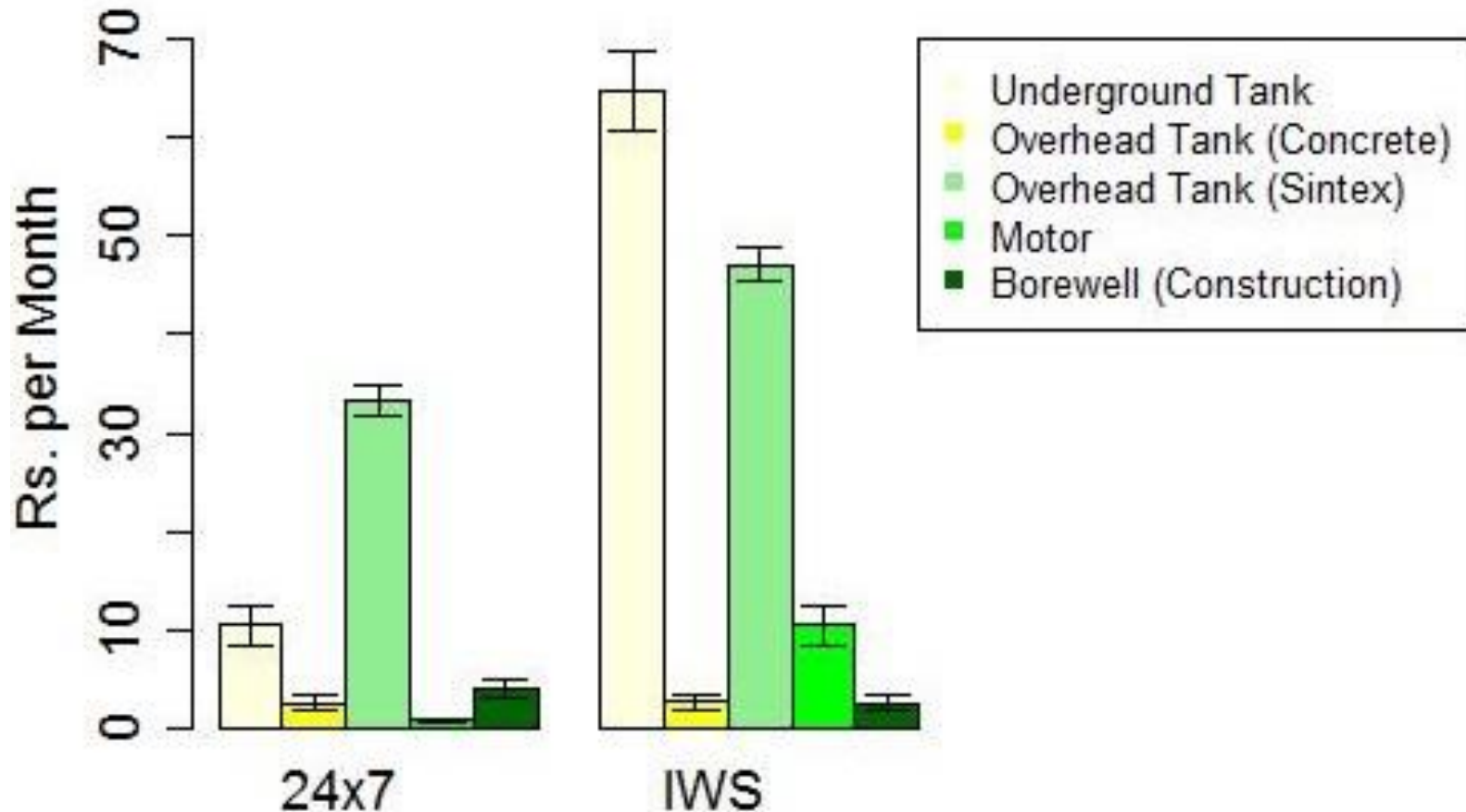




# Study Balance

Average Characteristics	24x7	IWS
Persons per household	6.5	6.5
Children <5 yrs per household	1.4	1.4
Age of primary caregiver	27	27
Rooms in household	2	2
% with pakka roof	44%	45%
% with illiterate mother	9%	10%
% of Hindu households	73%	66%

# Savings from Reduced Investment



In 24x7, amortized average investment in equipment is ₹ 97 / month less than in IWS

# Estimated Model

$$\begin{aligned} V_{ij} = & \textit{Punctuality} * (\beta_1 * \textit{BMW} + \beta_2 * \textit{AMW}) + \\ & \textit{WaterQuality} * (\beta_3 * \textit{IWS} + \beta_4 * \textit{CWS}) + \\ & \textit{ContinuousWater} * (\beta_5 * \textit{IWS} + \beta_6 * \textit{CWS}) + \\ & \beta_7 * \textit{FREQ5\_DUR5} + \\ & \beta_8 * \textit{FREQ2\_DUR2} + \\ & \beta_9 * \textit{FREQ2\_DUR5} + \\ & \textit{Borewell} * (\beta_{10} * \textit{AMW} + (\beta_{11} + \sigma_1 * \mu) * \textit{BMW}) + \\ & \textit{Tariff} * (\beta_{12} * \textit{BMW} + \beta_{13} * \textit{AMW} + \beta_{12} * \textit{USE100}) \end{aligned}$$

Name	Value	p-value
<b>Punctual (BMW)</b>	<b>0.087</b>	<b>0.13</b>
Punctual (AMW)	0.151	<0.01
Improved Water quality (IWS)	0.115	0.01
Maintain water quality (CWS)	-0.141	<0.01
24hrs/7days (IWS)	0.11	<0.01
<b>24 hrs/7days (CWS)</b>	<b>0.545</b>	<b>0.17</b>
5 hrs / 5 days	0.175	<0.01
2 hrs / 2 days	0.186	<0.01
5 hrs / 2 days	0.304	<0.01
<b>Supplemental Borewell (BMW)</b>	<b>-0.0755</b>	<b>0.27</b>
sigma (BMW)	1.08	<0.01
<b>Supplemental Borewell (AMW)</b>	<b>-0.00777</b>	<b>0.87</b>
Tariff (BMW)	-0.0177	<0.01
Tariff (AMW)	-0.00859	<0.01
Tariff (Usage per month)	-0.0329	<0.01

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## Summary Statistics

Sample size:	8824
Final log-likelihood:	-5672.521
Rho bar:	0.07