Dynamic pricing of residential water : opportunities and obstacles

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Smart metering: research context

the smartH2O project
A European project on water sustainability

SEVENTH FRAMEWORK PROGRAMME

EU project SmartH20 :
Maximising water-saving potential of smart metering

MANCHESTER 1824
The University of Manchester

Work on potential for dynamic pricing
(with Prof. Julien Harou)

Presentation from paper:
Rougé et al. (2018). Assessment of Smart-Meter-Enabled Dynamic Pricing at Utility and River Basin Scale. *Journal of Water Resources Planning and Management.*
(topped Most Read from that journal in April 2018)

Contents

1) Smart metering and dynamic pricing contexts

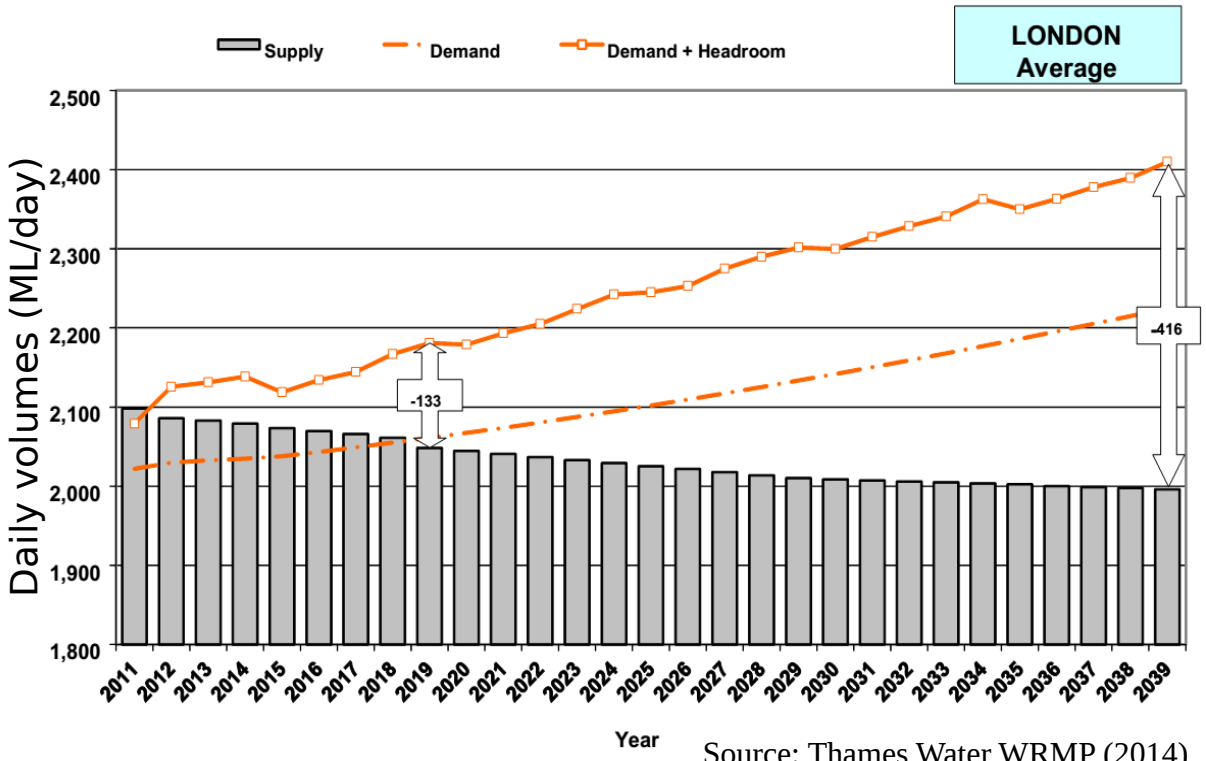
2) Scarcity pricing: theory and results

3) Challenges, obstacles… and opportunities

1) Smart metering and dynamic pricing context

Context: rising water stress

Projected supply-demand imbalance, London, UK



Source: Thames Water WRMP (2014)

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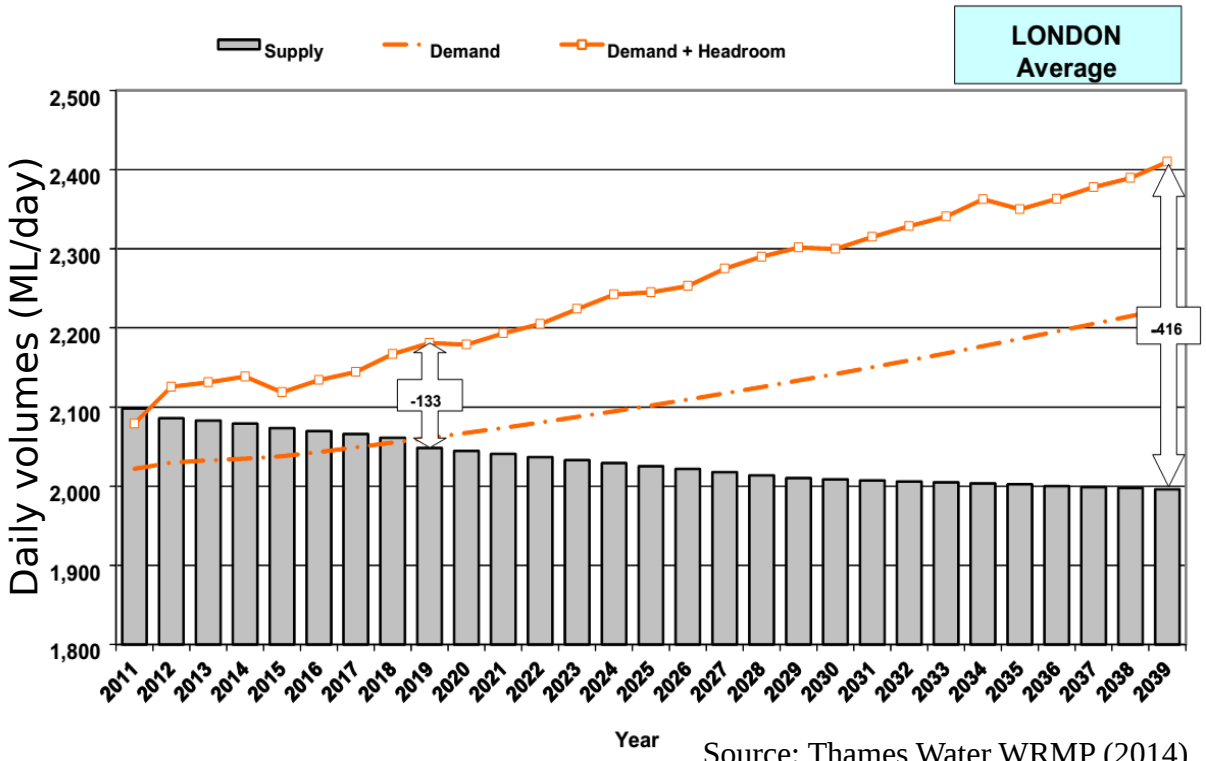

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The challenge

- **Bridge the gap** between supply and demand
- Find **cost-effective** solutions
- Water supply options:
  - reservoir, desalination, etc.
  - Effective
  - **Costly**

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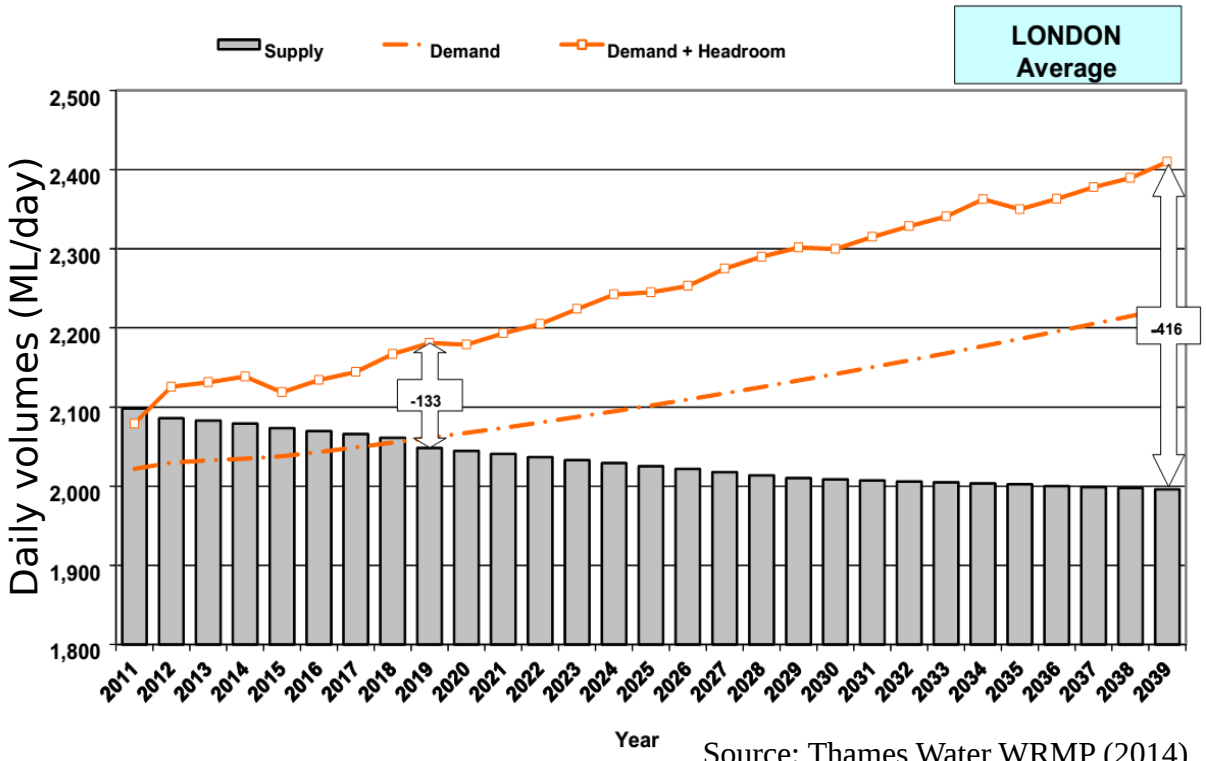

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Smart water metering : a cost-effective way of managing demand

⇒ Technology (apps, gamification) and insights into customer's behavior

⇒ A revolution in the utility-customer interaction, which may include **pricing**.

Dynamic water pricing

- Smart metering introduces new possibilities for pricing:
  - Frequent measurements of consumption
  - Making customers aware of the cost of their actions in real time

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Investigation of easy-to-understand schemes

1) Scarcity pricing

❖ Drought-time demand reduction

❖ Weekly to seasonal timescale

2) Peak pricing

❖ Demand shifting

❖ Sub-daily to weekly timescale

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Investigation of easy-to-understand schemes

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❖ Drought-time demand reduction

❖ Weekly to seasonal timescale

❖ Aims at overall economic efficiency

2) Peak pricing

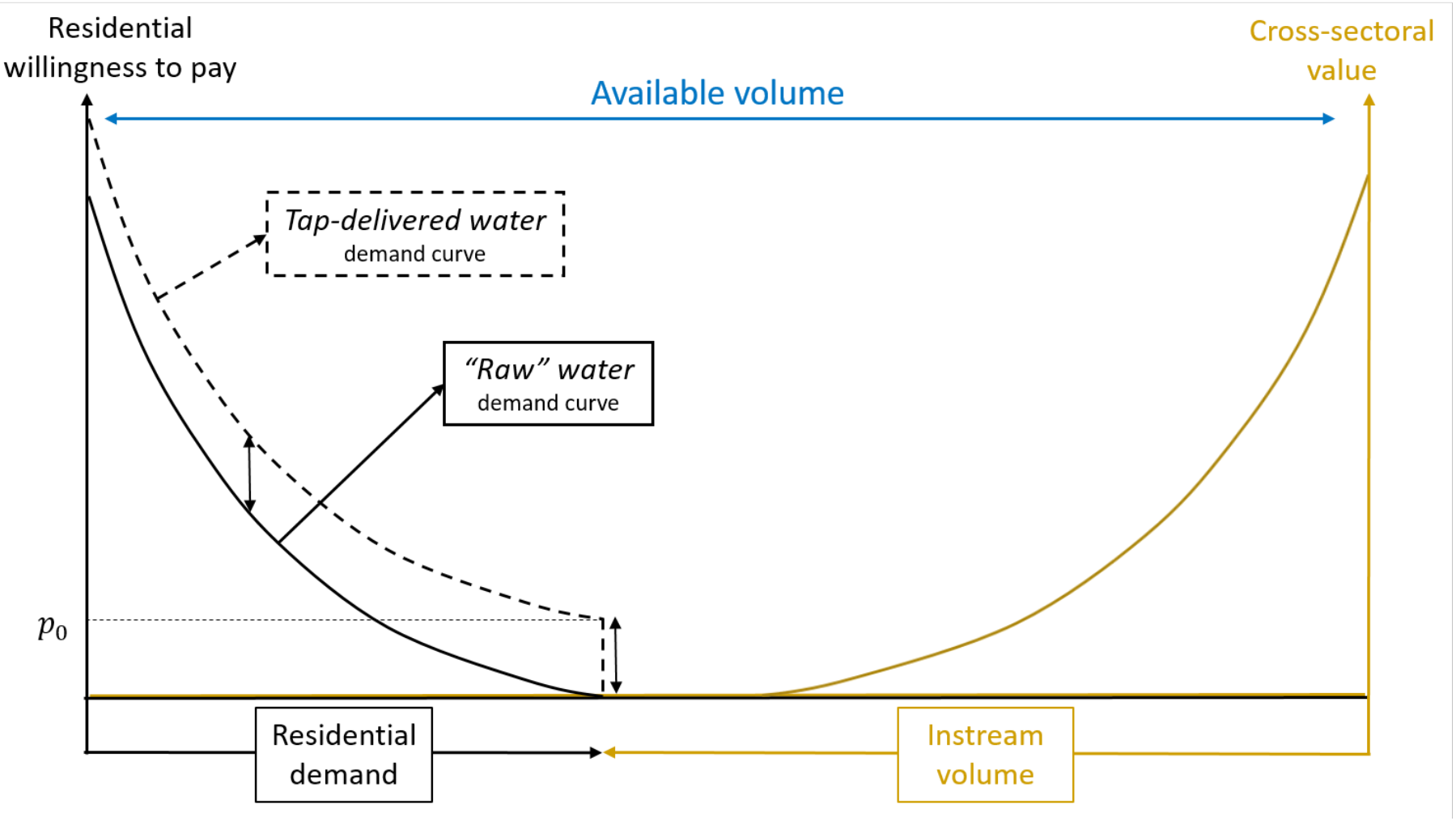
❖ Demand shifting

❖ Sub-daily to weekly timescale

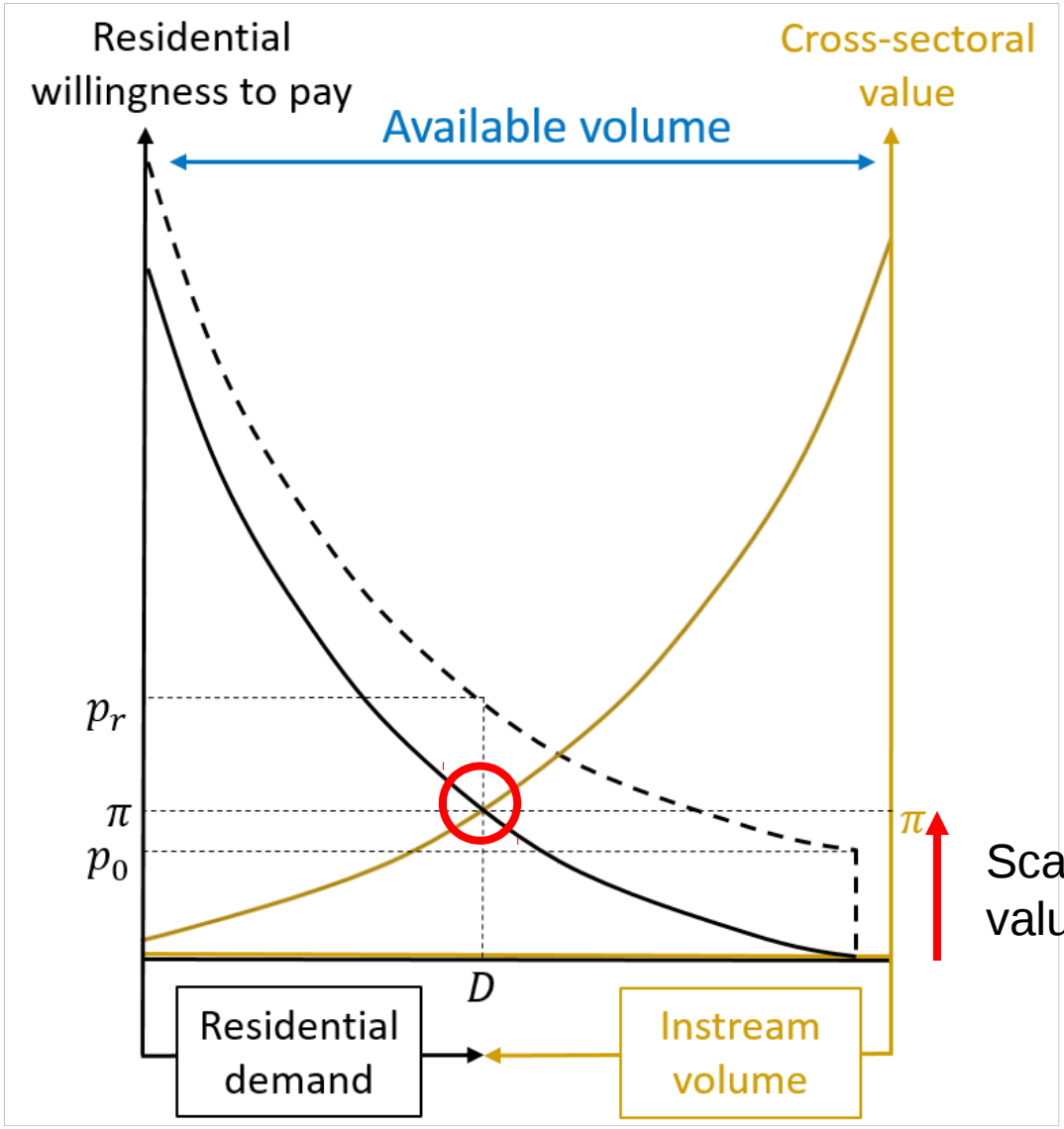
❖ Savings for the pipe systems (for London, £ hundreds of millions NPV).

2) Scarcity pricing : theory and results

Efficient water pricing (1/2)



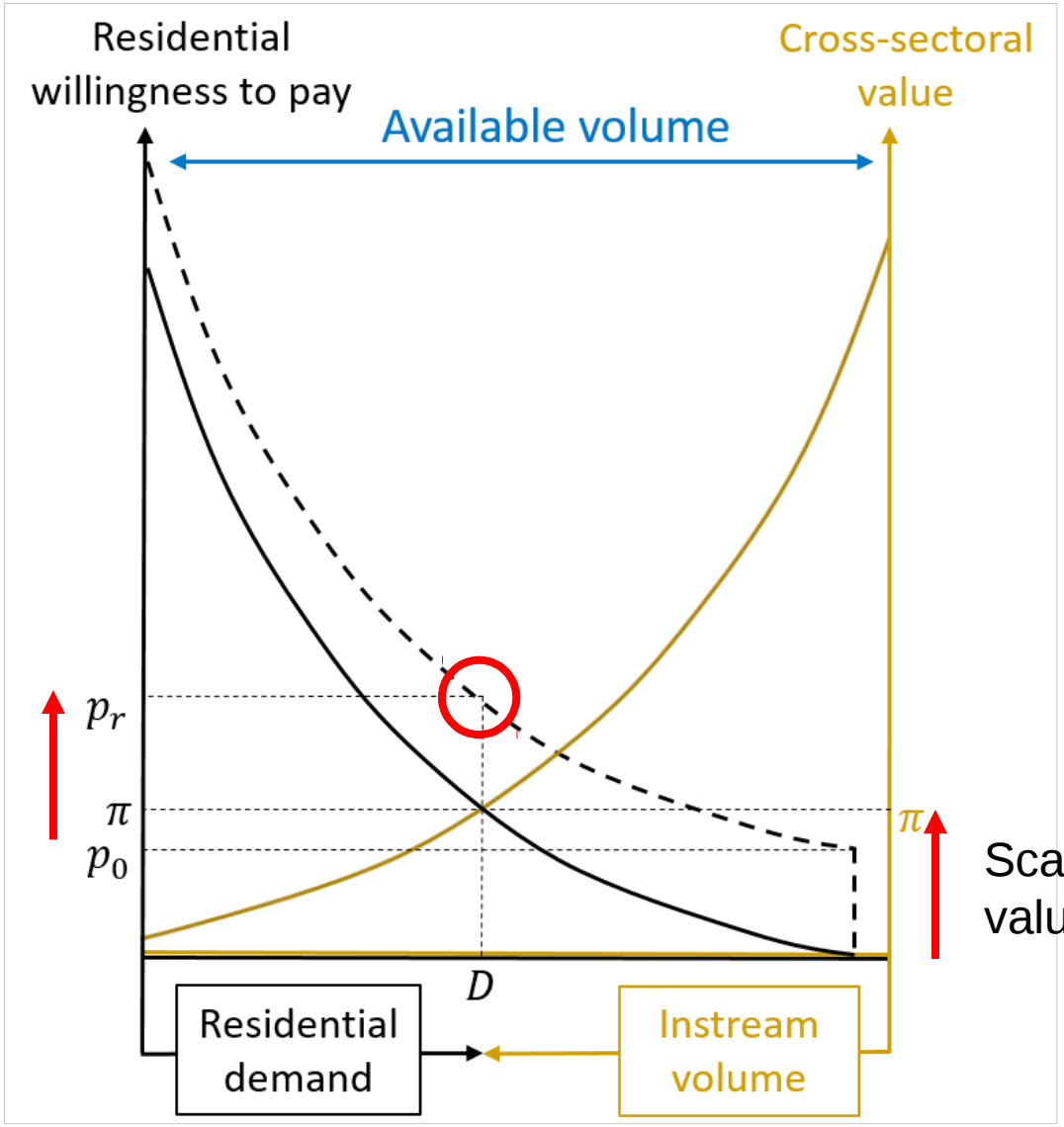
Efficient water pricing (2/2)



Scarcity raises the value of water

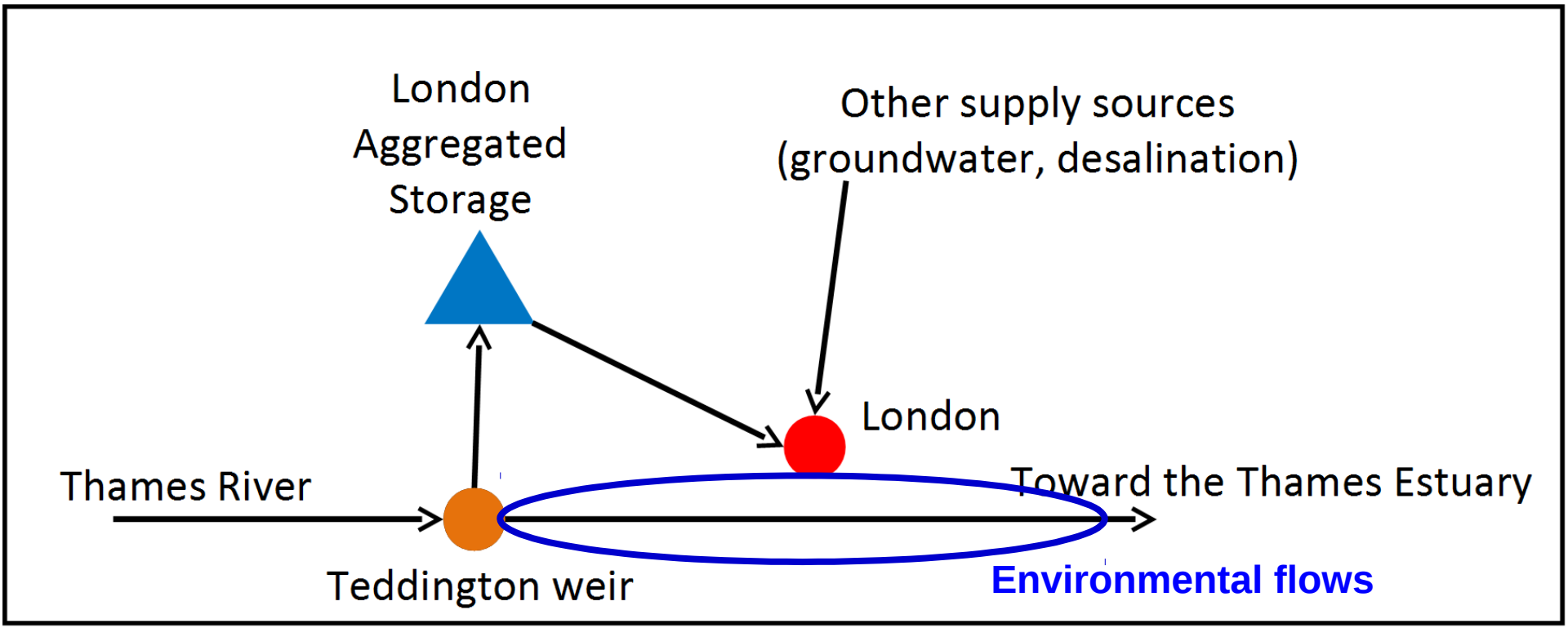
Efficient water pricing (2/2)

Prices at the tap increase by the same amount



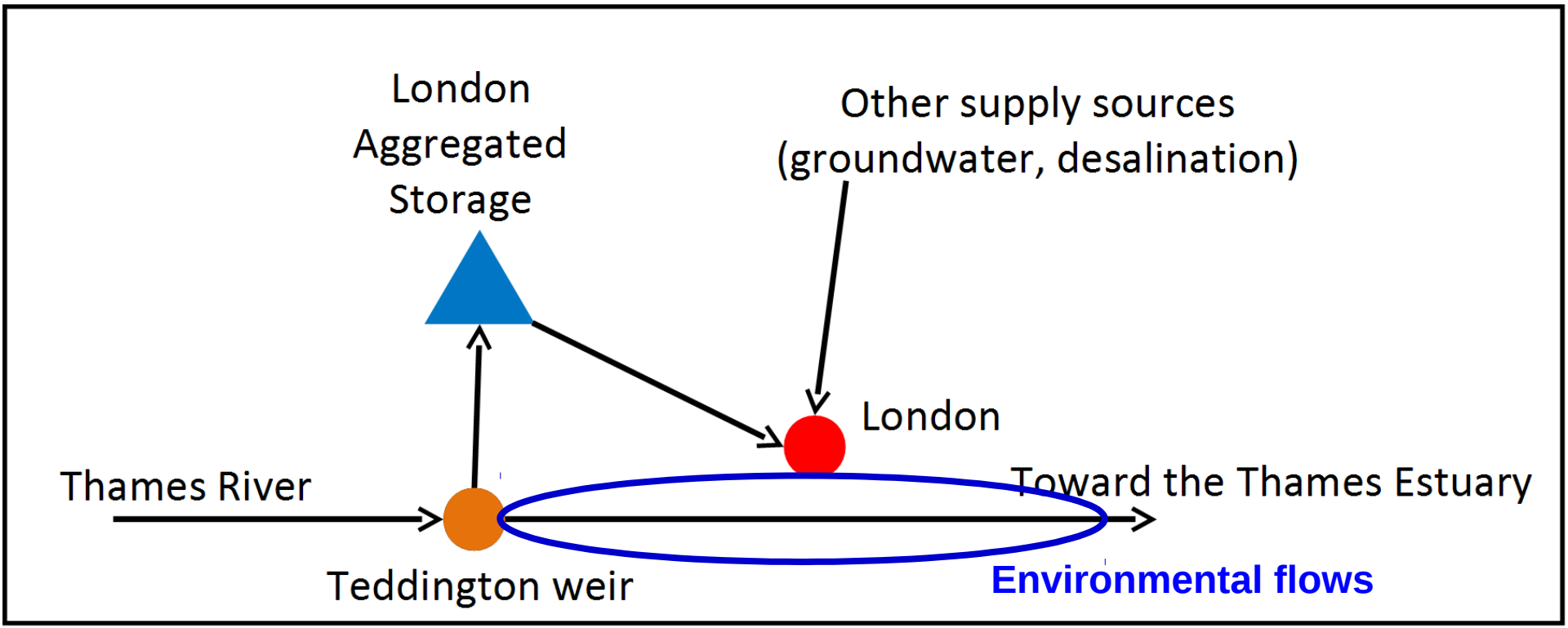
Scarcity raises the value of water

Efficient water pricing in London



- **Balancing residential demand with environmental flows** (ecosystem services, tourism, property valuation...)
- **Crash test:** historical streamflow with 2020 infrastructure and 2050 demands.

Efficient water pricing in London

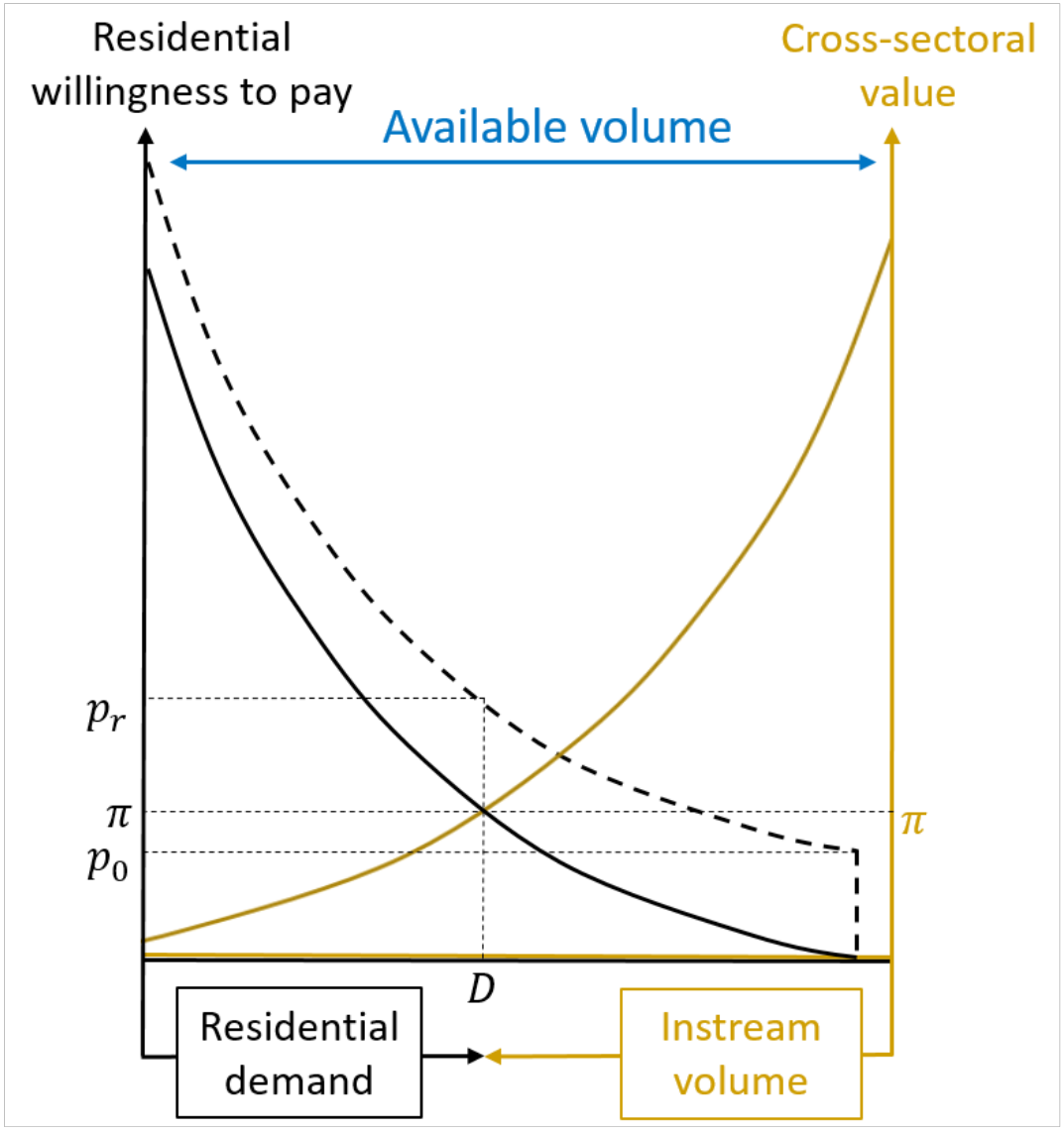


- **Balancing residential demand with environmental flows** (ecosystem services, tourism, property valuation...)
- **Crash test:** historical streamflow with 2020 infrastructure and 2050 demands.

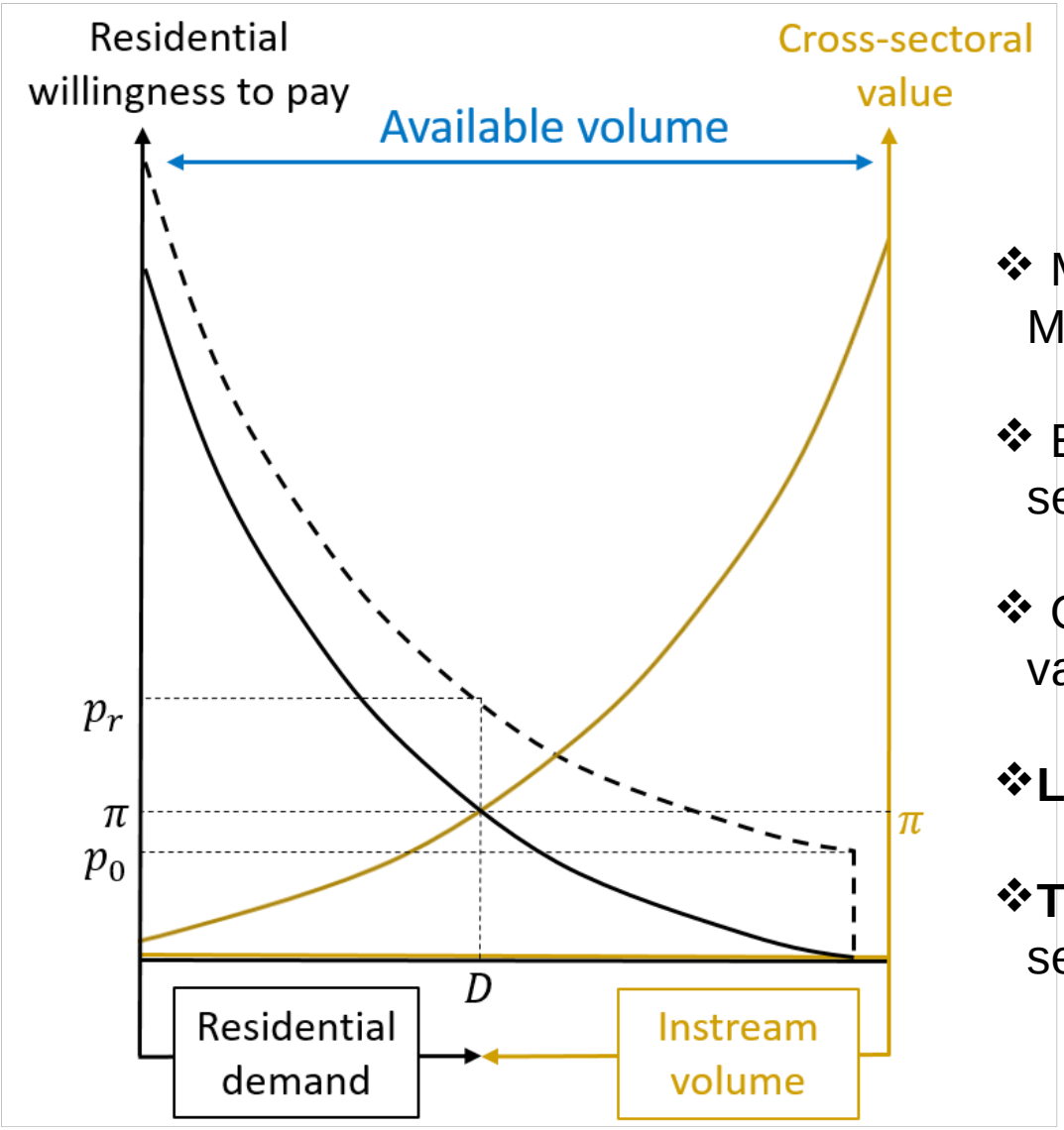
But how do we model the demand curves ?

Residential demand curve

- Assumption: constant price elasticity
- Plausible London values : from meta-analysis (Marzano, Rougé et al., 2018)



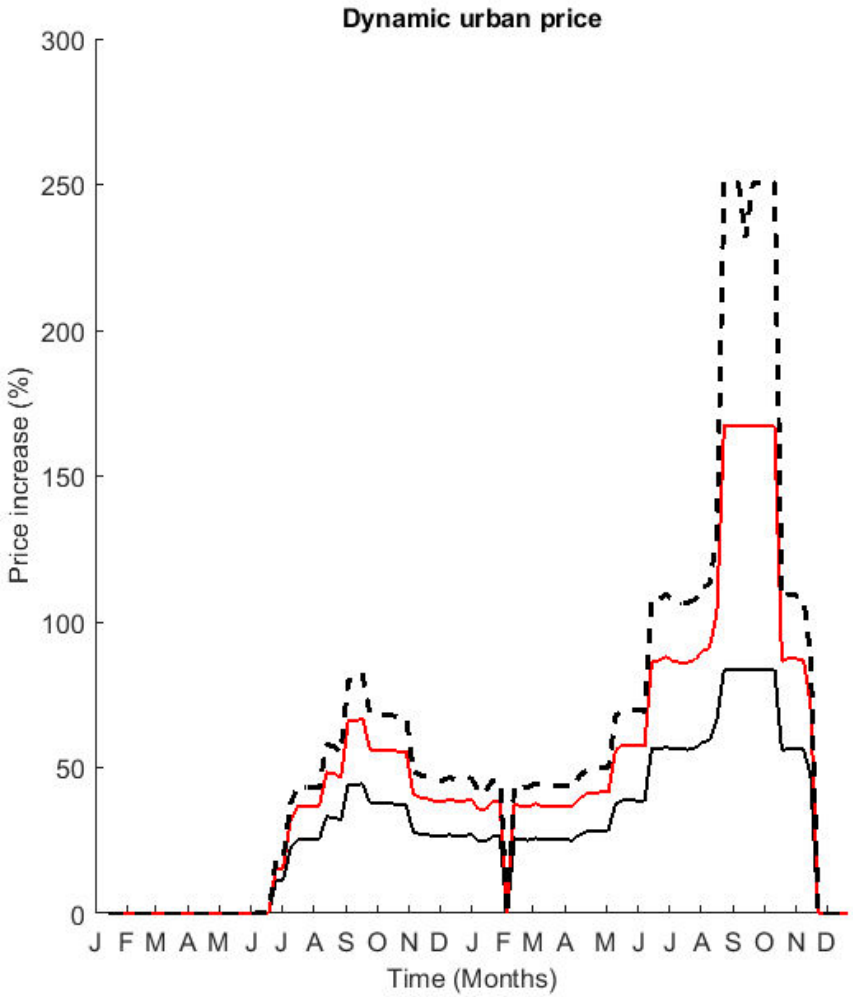
Ecological demand curve

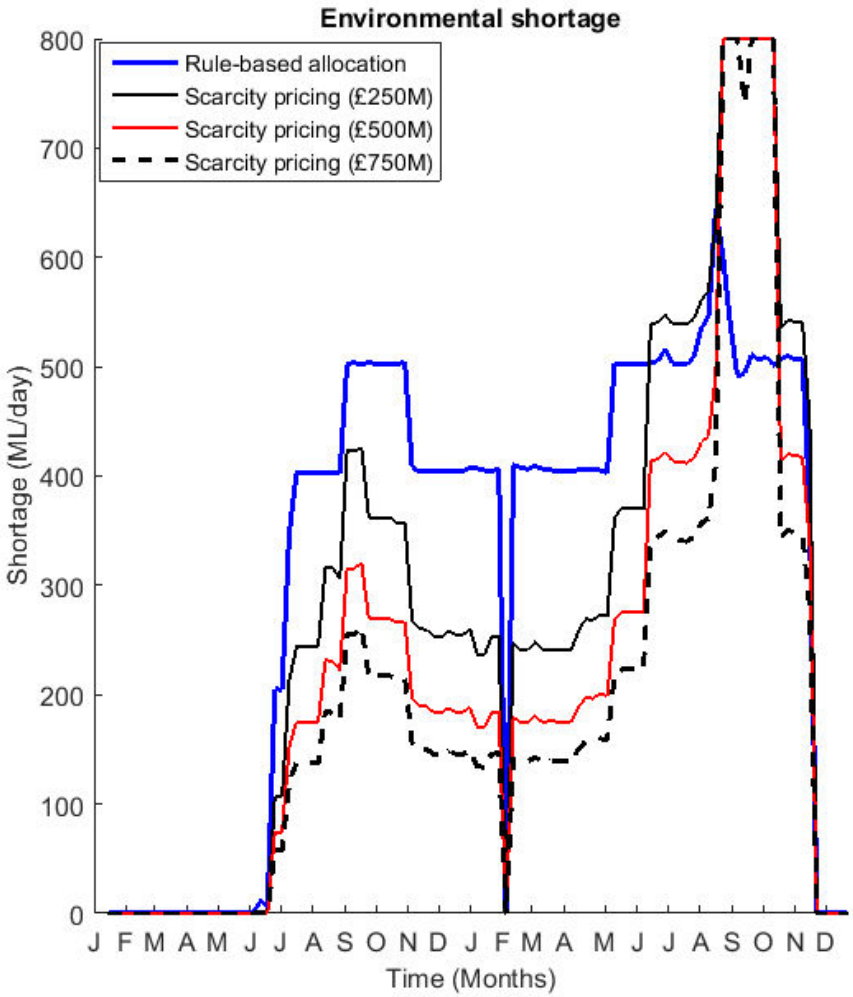


Environmental flows valuation

- Minimum environmental flows (800 ML/day upstream of London)
- Environmental value for ecosystem services: £250 M/yr (WTP studies)
- Other benefits (tourism, property valuation): non-evaluated
- **Linear** demand curve
- **Three valuations** of ecosystem services

Replaying the 1943-1944 drought





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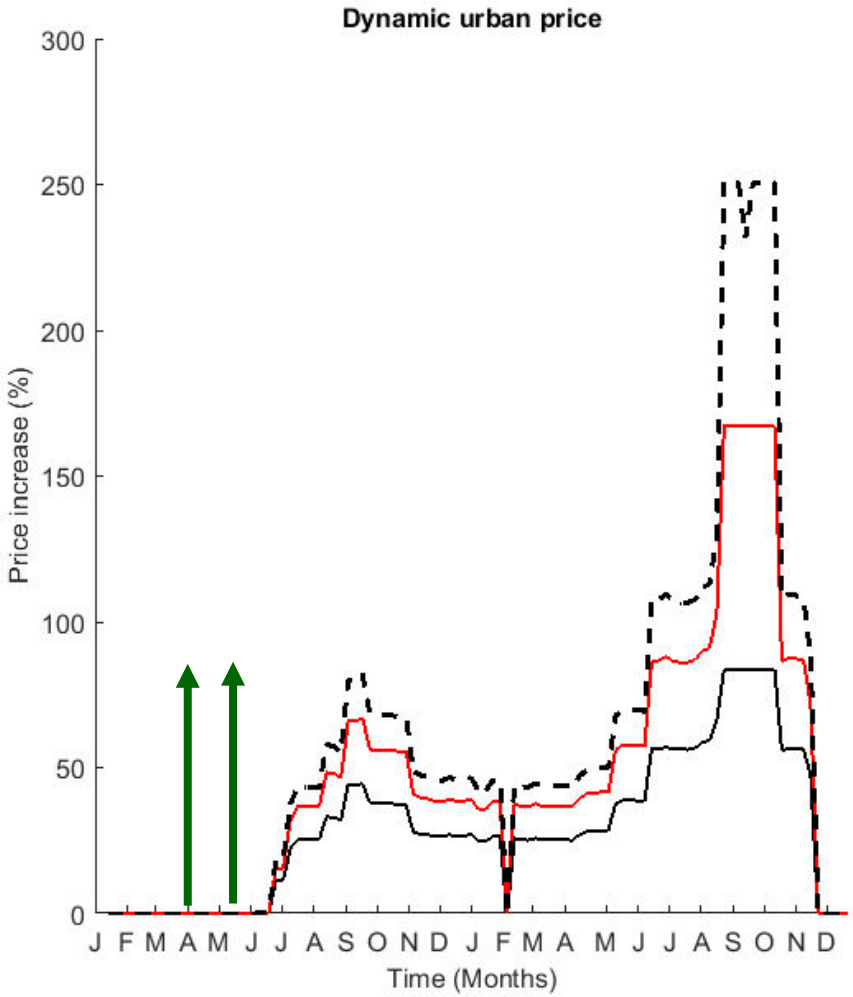

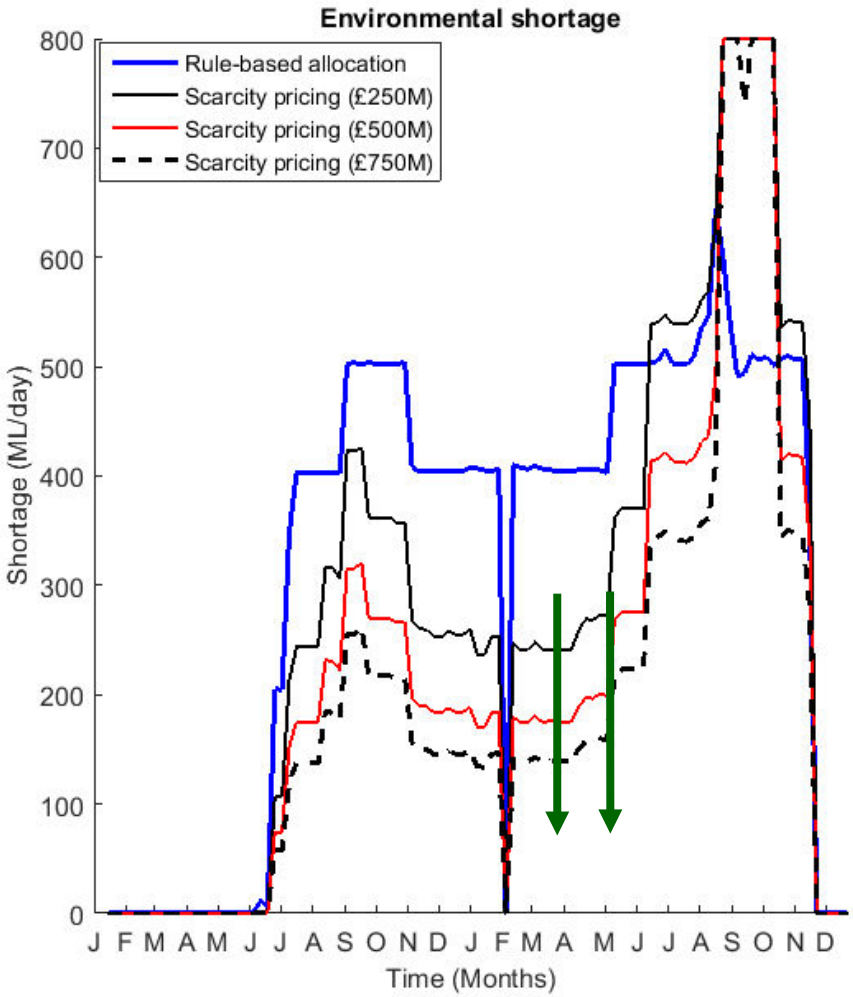

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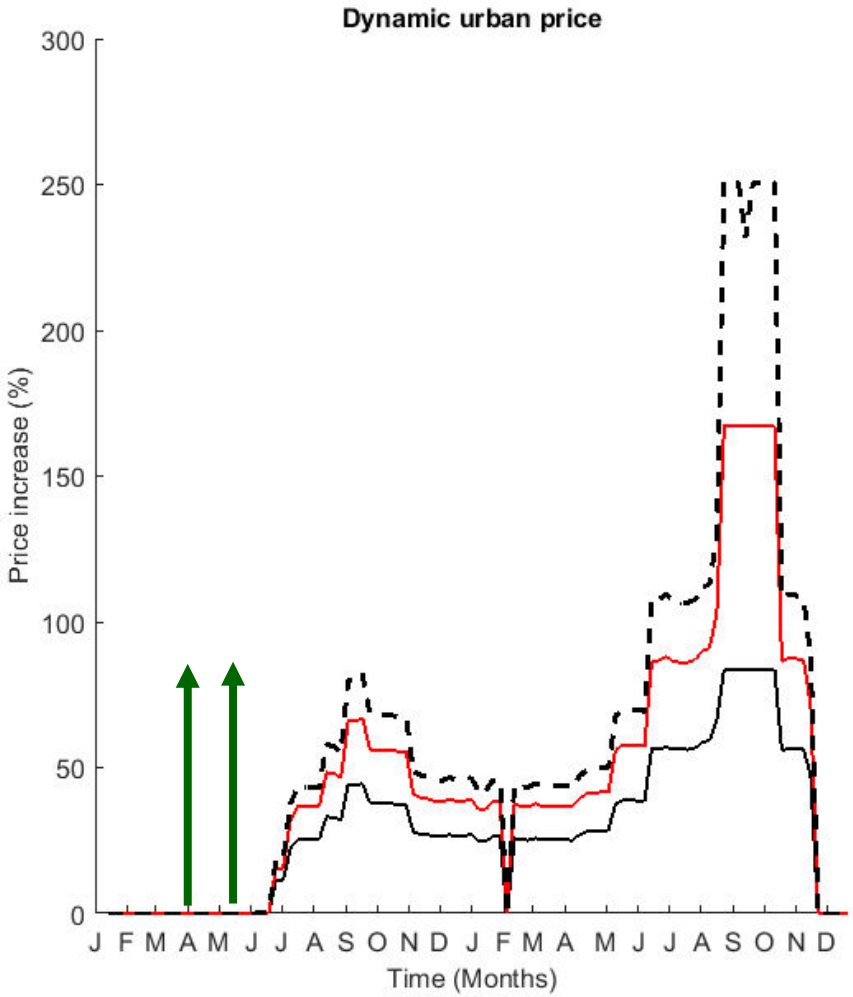
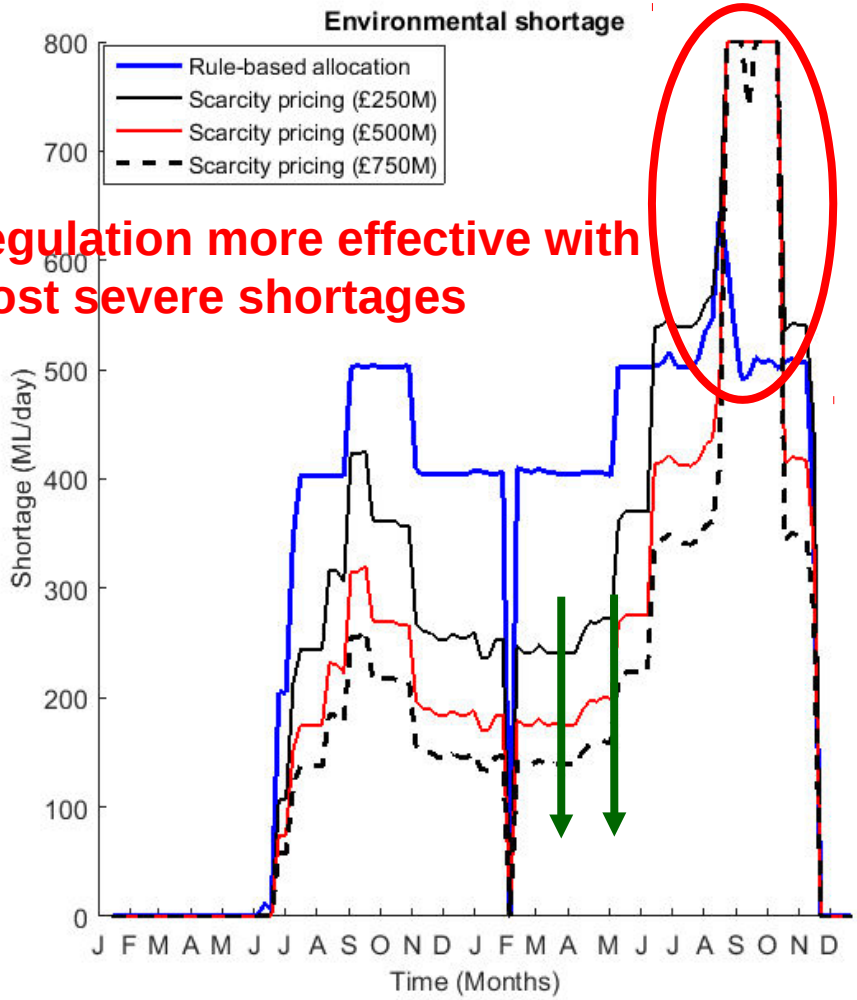
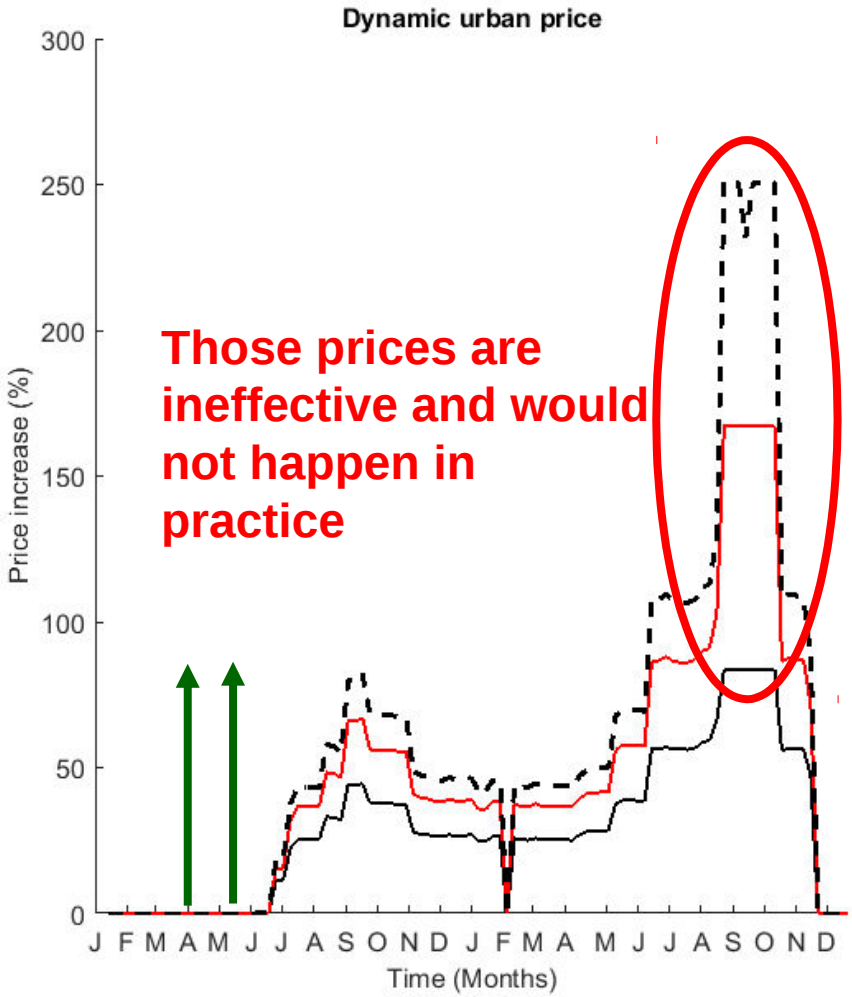


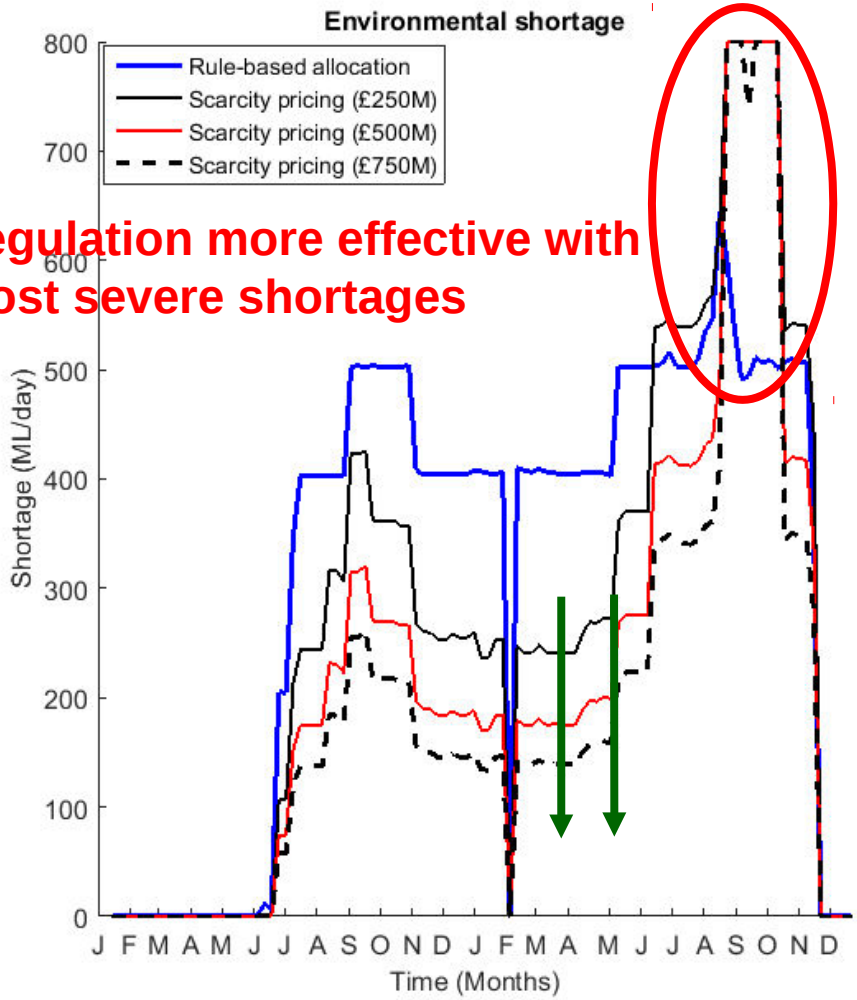


Regulation more effective with most severe shortages

Replaying the 1943-1944 drought



Those prices are ineffective and would not happen in practice



Regulation more effective with most severe shortages

Results : takeaways

1) Scenario matrix : 3 price elasticities, 3 environmental valuations

2) 22-63 % reduction in environmental flow shortage

3) Price increases capped in practice (+150 % is the limit across scenarios).

3) Challenges, obstacles… and opportunities

Considerable challenges

1) **Missing data:** economic valuations, price elasticity...

2) **Price elasticity is dynamic itself:** Impacts of repeated price changes?

3) **Scepticism from water utilities** (Fears of PR fallout even for experiments)

Considerable opportunities

1) **Opportunities for water management:**
Reducing water scarcity & promoting efficient use

2) **Opportunities for research collaboration:**
Transdisciplinary (economists, ecologists…)
Expertise needed at different scales (households, pipe network, river basin)

3) **Opportunities for systems engineering:**
Final impact evaluated at the basin / utility scale