

Non-Linear Tariffs & Consumption

Evidence from a Natural Experiment on Water in France

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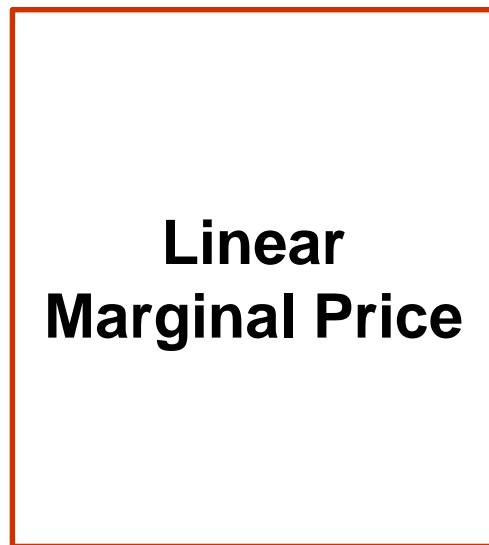
Legal Context for WSS Social Tariffs in France

- Existing social approaches in WSS services: subsidy from municipal social centre, subsidy from specific funds (FSL)
- Presently the law does not allow any modulation of WSS tariffs according to social criteria
- Legal experiment of social tariffs for WSS services allowed for 5 years (2013-2018), on a voluntary basis
- In 2018, based on experiment feedback, a new law will be passed to define social tariff setting allowed for WSS services

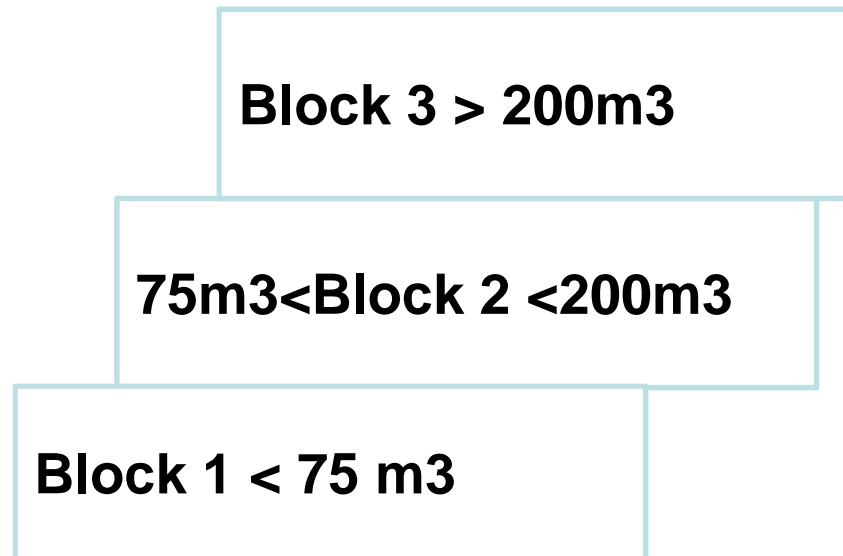
Natural experiment

- 'Eau du Dunkerquois' (more than 200, 000 inhabitants) in the North of France set up a new tariff based on three blocks

Before 2012



After 2012



Research questions

- What is the impact of non-linear tariffs on consumption ?
 - Which goals do these serve?
 - Are consumers sensitive to price change?
 - What are the basic welfare economics of these price changes?

Main findings of the paper

1. Linking consumer behavior & pricing:
 - Consumers react to both marginal & average pricing;
 - Price elasticity is significantly high compared to previous results;
 - **Consumers react to price !**
2. Quantifying the impact on allocative efficiency:
 - Our elasticity estimation yields high efficiency costs of non-linear pricing;
 - Transfers could probably be more efficient than non-linear tariffs to ensure redistribution;
 - Also raises questions in terms of water sustainability (does the deviation from marginal pricing equal the externality?)

Takeaways for managers

- Managers can design tariffs which have social impacts & can use tariffs to promote a sustainable use of water.
- However, non-linear tariffs have potentially strong efficiency impacts.
- Important to run experiments to measure the impact of tariff changes on consumption.

Dataset

- Unique dataset collected via Suez & Eaux du Dunkerquois
 - Representative panel of 1387 households in 2009-2013
 - Variables: consumption, price, house/flat, pluviometry, household size, district, city.
- Some drawbacks
 - Unbalanced panel
 - No data on households' income (see extensions)

Case Study

Marginal & average price before and after the reform Standard consumers



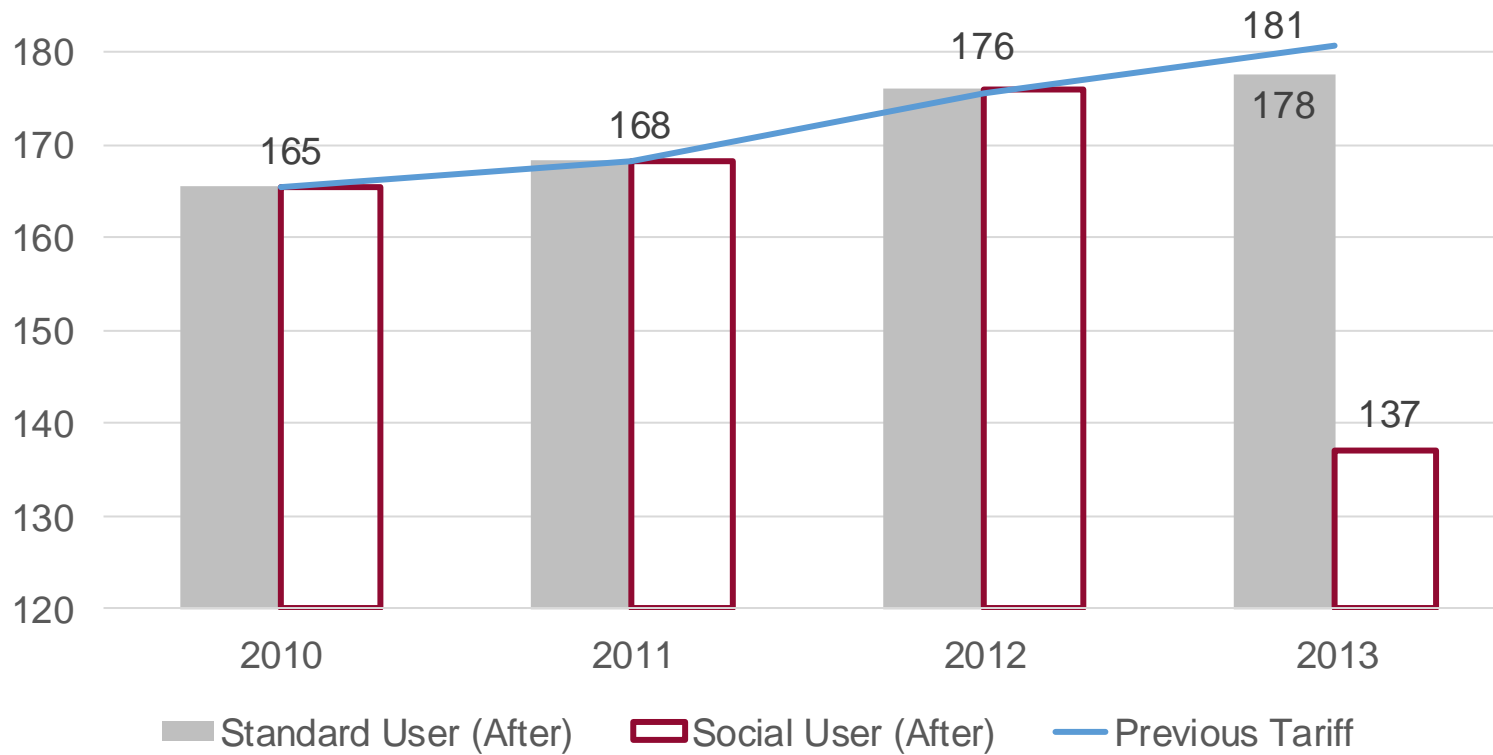
Case Study

Marginal & average price before and after the reform 'Social' Consumers



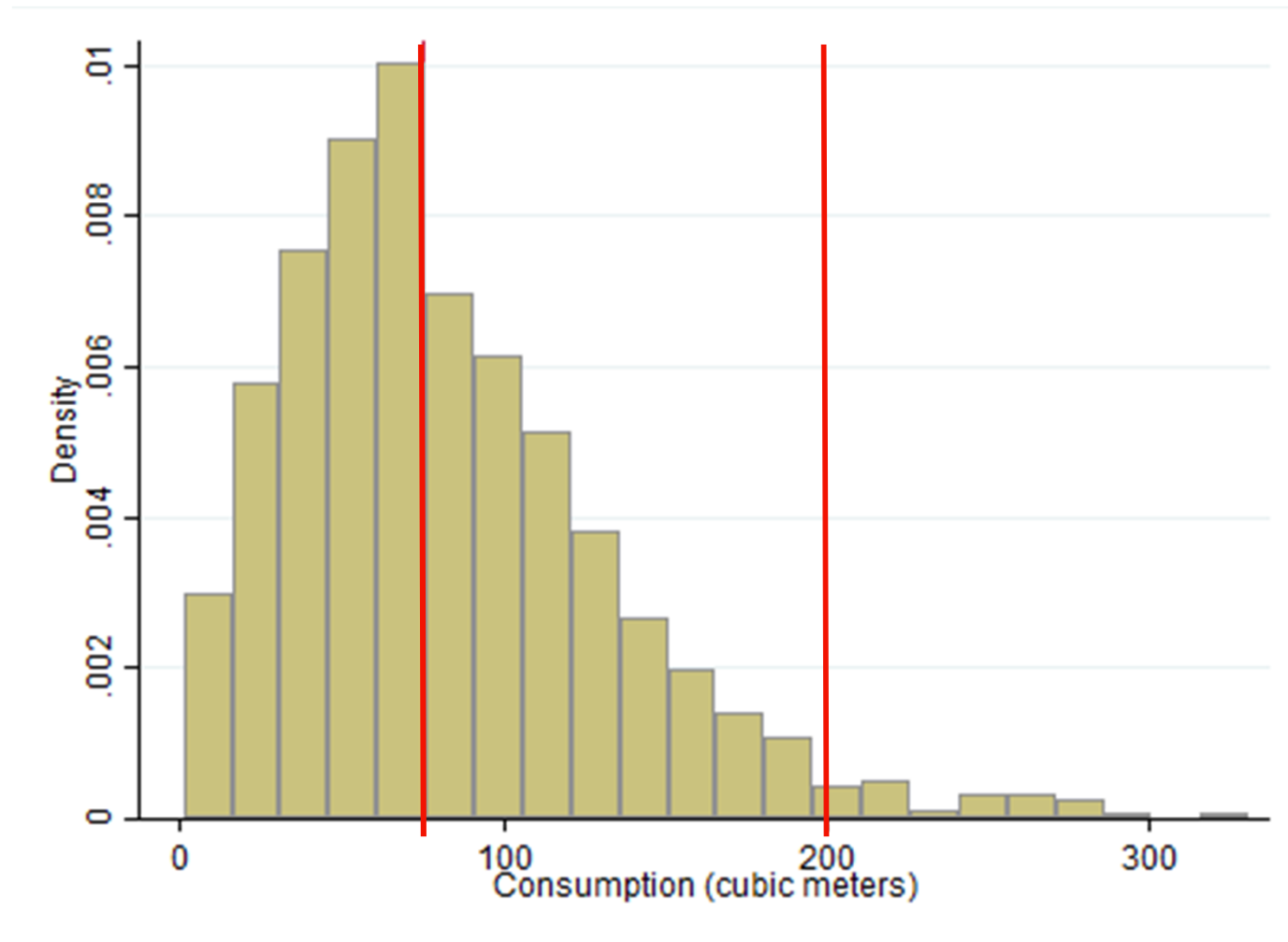
Case Study

Bills (incl. tax) before and after the reform



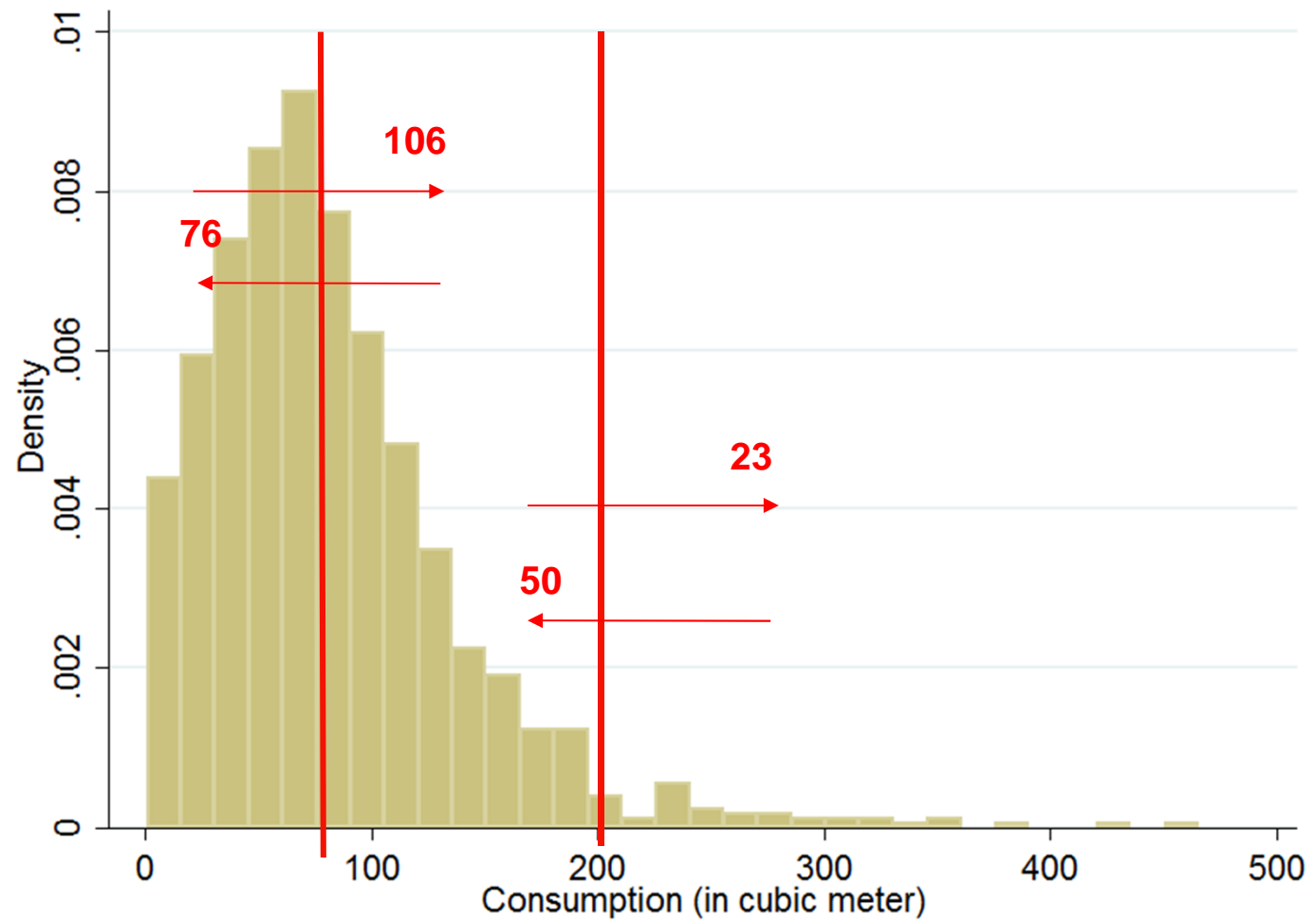
Do consumers bunch around kink points?

Consumption density in 2012



Do consumers bunch around kink points?

Consumption density in 2013



Consumers' response to change in average price

Instruments	Marginal Price Elasticity	Average Price Elasticity
RDD	-0.77***	-0.92***

Consumers' response to change in marginal price

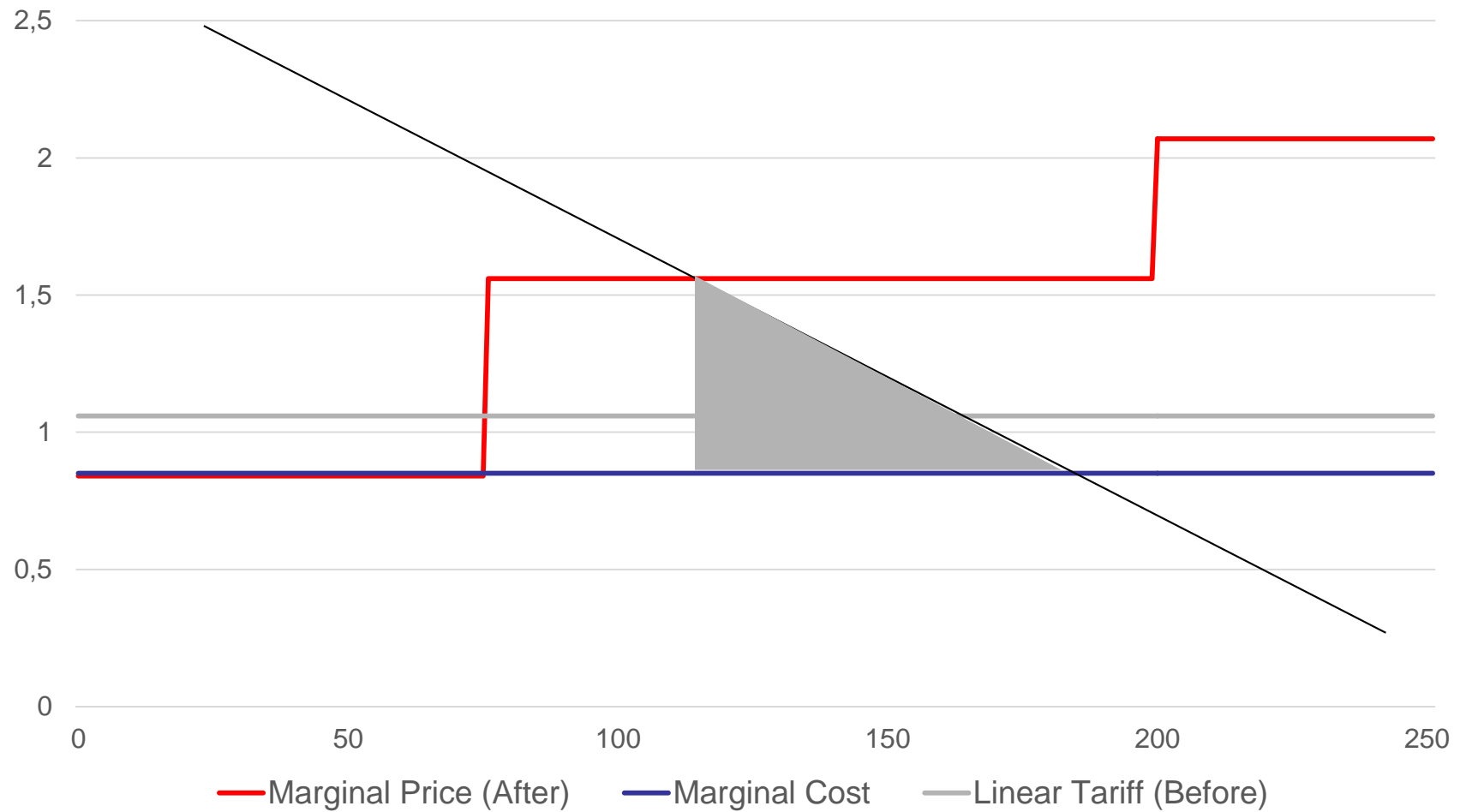
- Higher estimates than in the literature
 - Espey, Espey & Shaw (1997) : -0.51
 - Hewitt and Hanemann (1995): -1.6
 - Olmstead et al. (2007): -0.64
 - Ito (2013): -0.1
 - Porcher (2014): -0.25

Consumers' response to change in marginal price

- Changes in consumption
 - Catch-up effect from 'small consumers' +11%
 - 'Average consumers' -11%
 - 'Large consumers' -15%
- Sustainability achieved (decrease in consumption)

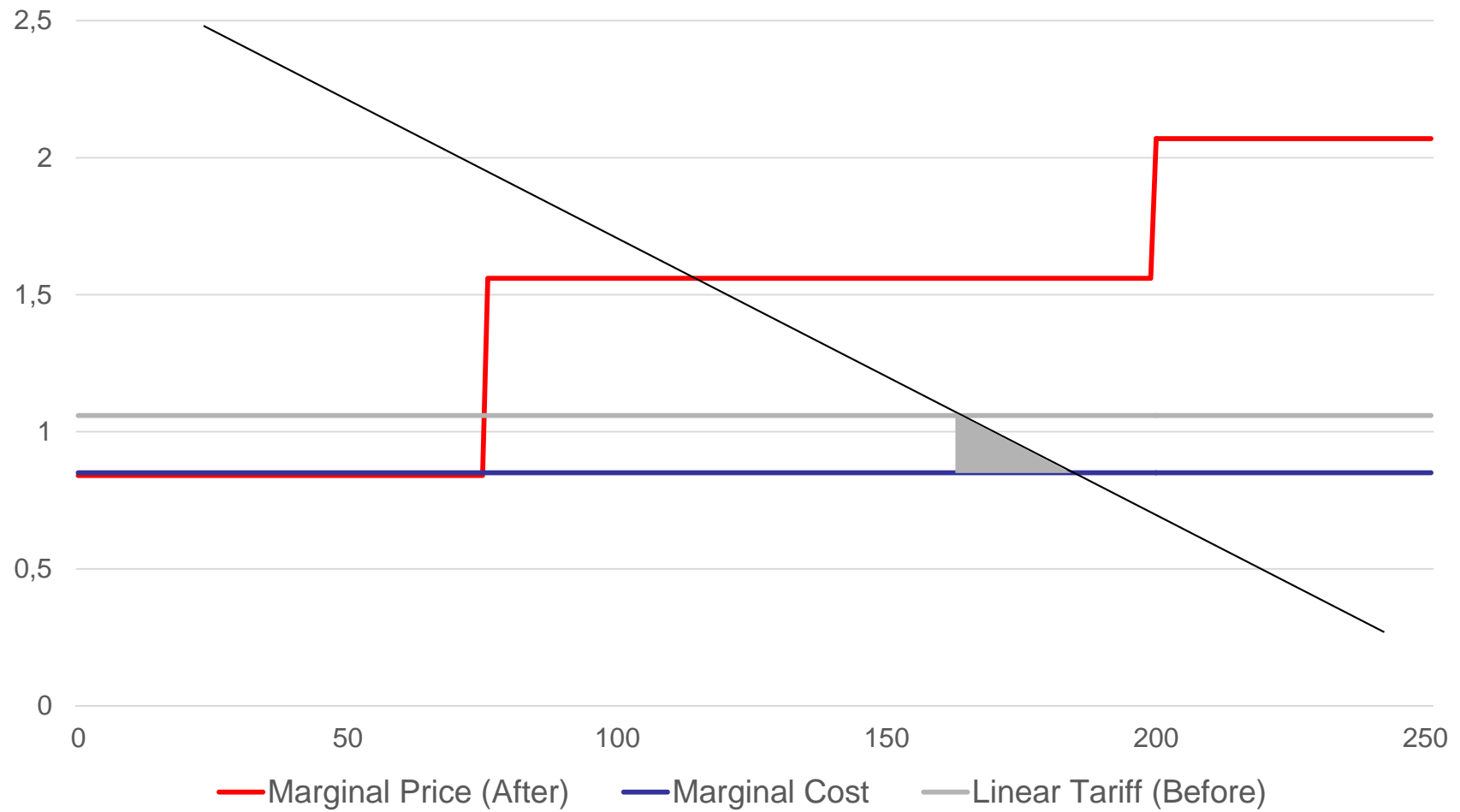
Efficiency Costs

Deadweight loss with non-linear pricing



Efficiency Costs

Deadweight loss with a linear tariff



Efficiency costs

- Assuming that...
 - Consumers' elasticity is the same for all consumers (-0.75)
 - And mp is set up at the mp of the first block
 - Reasonable as margins are around 20% (Porcher 2014)
- It is possible to benchmark efficiency costs:
 - Efficiency costs with linear price: 82,425 euros
 - Efficiency costs with non-linear pricing: 682,767 euros

Redistributional effects

	Welfare Gains	Efficiency Costs
First block	+11.24 (5.18)	+11.36 (5.69)
Second block	+11.94 (25.78)	+14.46 (4.37)
Third block	-246.86 (-)	+90.21 (-)

Extensions (in the making)

- A simple Diff-in-Diff to improve our understanding
 - Using Calais as a control group
 - No detailed characteristics of households but observable consumption before & after the reform
 - Possible to match households with the same-level of consumption before the reform...
 - ...and living in similar districts.

Extensions (in the making)

- Using customers' addresses & characteristics to match them with income data at the district level
 - Geo-localized data on incomes depending on different characteristics of households are available at INSEE
 - e.g. a household of n persons living in district X earns on average W euros per year
- Would give us better estimates of price elasticities & make the diff-in-diff more robust

Wrap-up

- Increasing-block tariffs
 - Decrease consumption for large consumers & vice versa
 - Have redistributive gains for small consumers
 - Have important efficiency costs
- Consumers react to marginal & average pricing

Thank you!
Comments welcome!