



Efficiency and acceptability of tradable white certificates compared to taxes, subsidies and regulations

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Outline

1. First insights on tradable white certificates (TWC)
2. The model
3. Results on economic efficiency
4. Insights on acceptability
5. Conclusion



1. First insights on TWC

Definition

- Obligation on energy suppliers to generate a certain amount of energy savings, with some flexibility:
 - Doing it themselves (Fully internal, outsourcing, sub-contracting...)
 - Buy to another supplier exceeding its target
- Optional: third parties can produce energy savings

Existing TWC schemes

- Already implemented in the UK, Italy and France
- Various design:
 - National specifications: fuel poverty in the UK, etc.
 - Targets represent roughly **1.5%** of final consumption
- First results:
 - Target generally overachieved
 - Similar measures in the 3 countries, although with different shares: insulation, lighting...
 - Some trade in Italy only (so far)

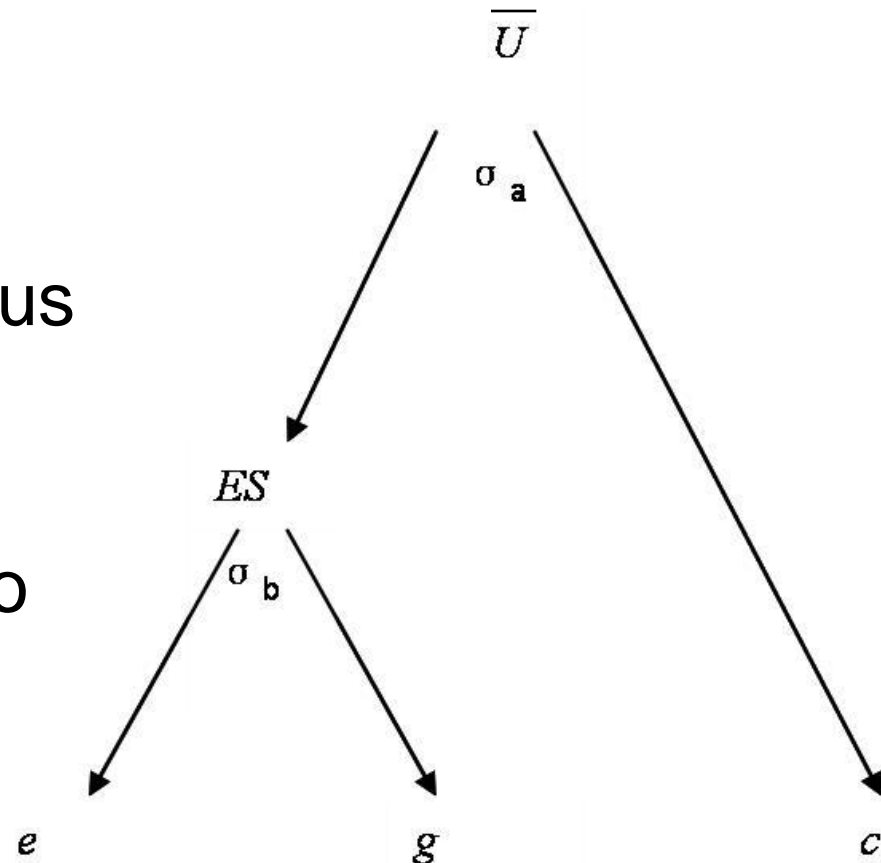


2. The model

Modeling approach

Nested CES utility function to:

- Model an endogenous demand for Energy Service (ES)
- Analyse sensitivity to the elasticities of substitution



$$\sigma_a < \sigma_b$$

The model in BaU

- Consumer:

$$(A) \begin{cases} \text{Min}_{\{ES, c\}} P_{ES} \cdot ES + P_c \cdot c \\ \text{s.t. } \bar{U} = (\alpha_{ES} \cdot ES^{\frac{\sigma_a-1}{\sigma_a}} + \alpha_c \cdot c^{\frac{\sigma_a-1}{\sigma_a}})^{\frac{\sigma_a}{\sigma_a-1}} \end{cases}$$
- $$(B) \begin{cases} \text{Min}_{\{e, g\}} P_e \cdot e + P_g \cdot g \\ \text{s.t. } ES = (\alpha_e \cdot e^{\frac{\sigma_b-1}{\sigma_b}} + \alpha_g \cdot g^{\frac{\sigma_b-1}{\sigma_b}})^{\frac{\sigma_b}{\sigma_b-1}} \end{cases}$$
- Suppliers (e.g. e): $Max_e \pi_e = P_e \cdot e - \left(\gamma_e \cdot e + \frac{\delta_e}{2} e^2 \right)$

6 Policy instruments represented

- 2 types of WC:
 - $WC_{\%}$: energy-saving target in % of energy sales
 - WC_A : absolute energy-saving target
- Taxes:
 - T_H : Receipts rebated lump-sum to households
 - T_F : Receipts rebated lump-sum to energy suppliers
- S: Subsidy on energy-efficient equipments
- R: Regulation requiring a minimum level of energy efficiency

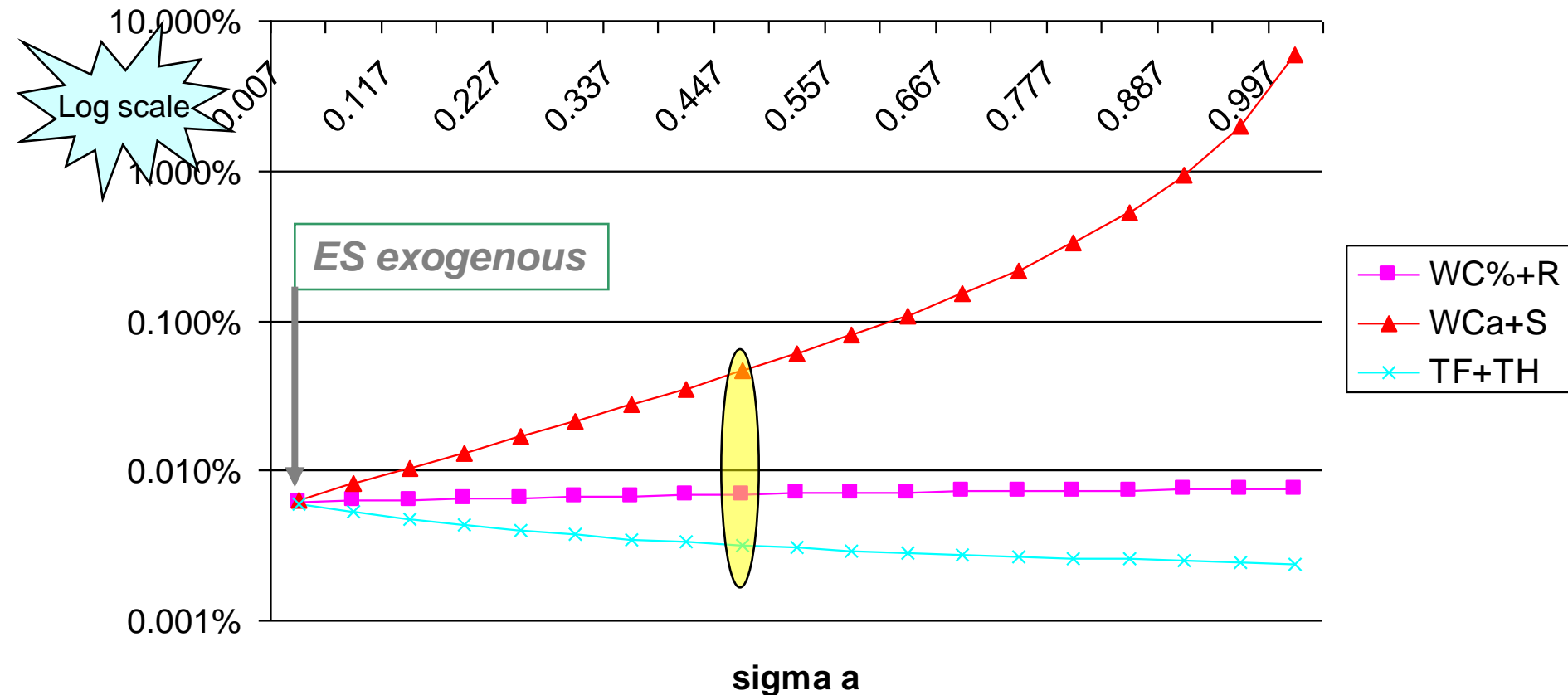
Modeling options

- Calibration in line with France's economy
 - Demand parameters reflect each good's budget share
 - Supply parameters reflect gross profits
- 2% decrease of final energy consumption
 - We compare the instruments *for the same level of energy savings*



3. Results on economic efficiency

Total cost



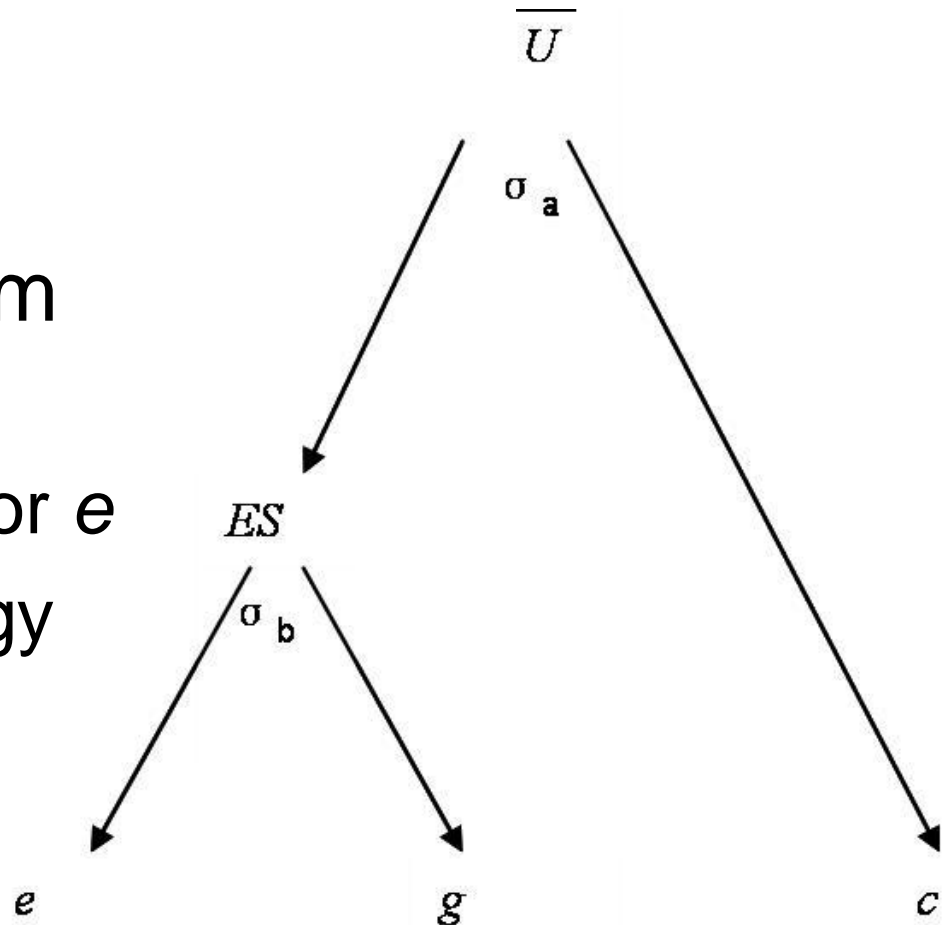
→ Instruments do not have the same overall cost except for $\sigma_a \approx 0$

Two channels for energy efficiency

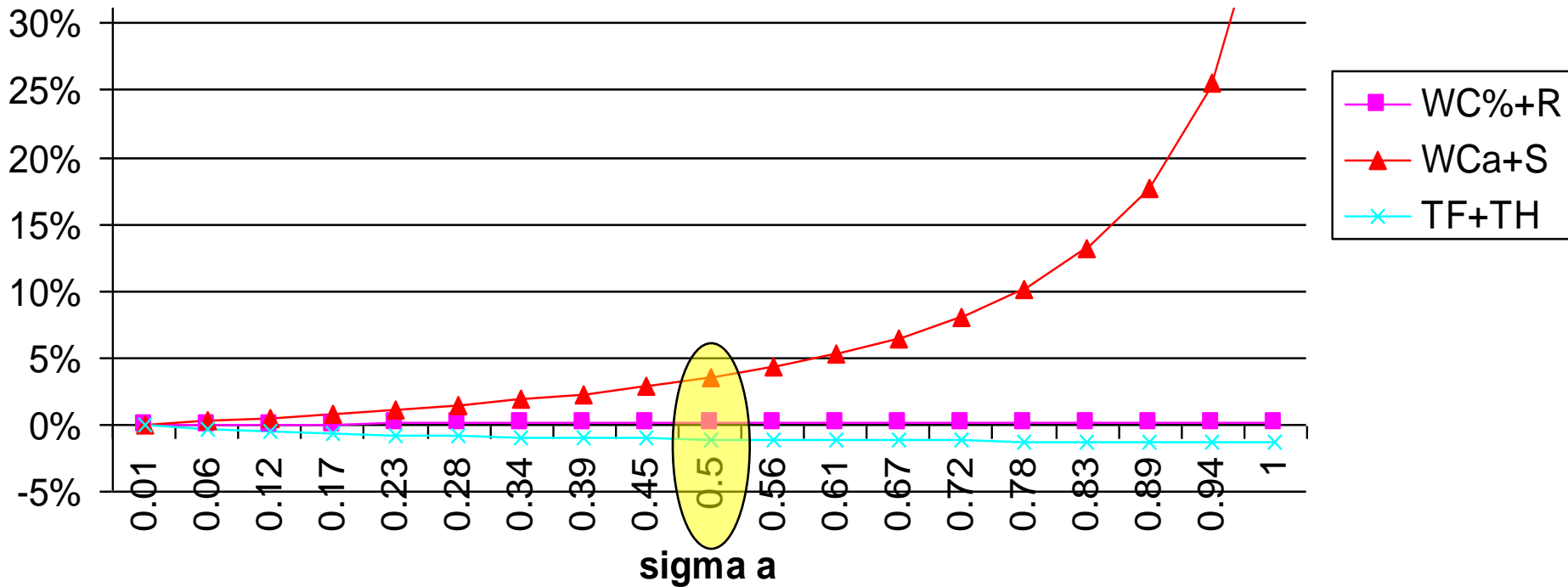
e decreases...

→ Economic optimum requires:

- Substitution of g for e
- Decrease in energy service (ES) level



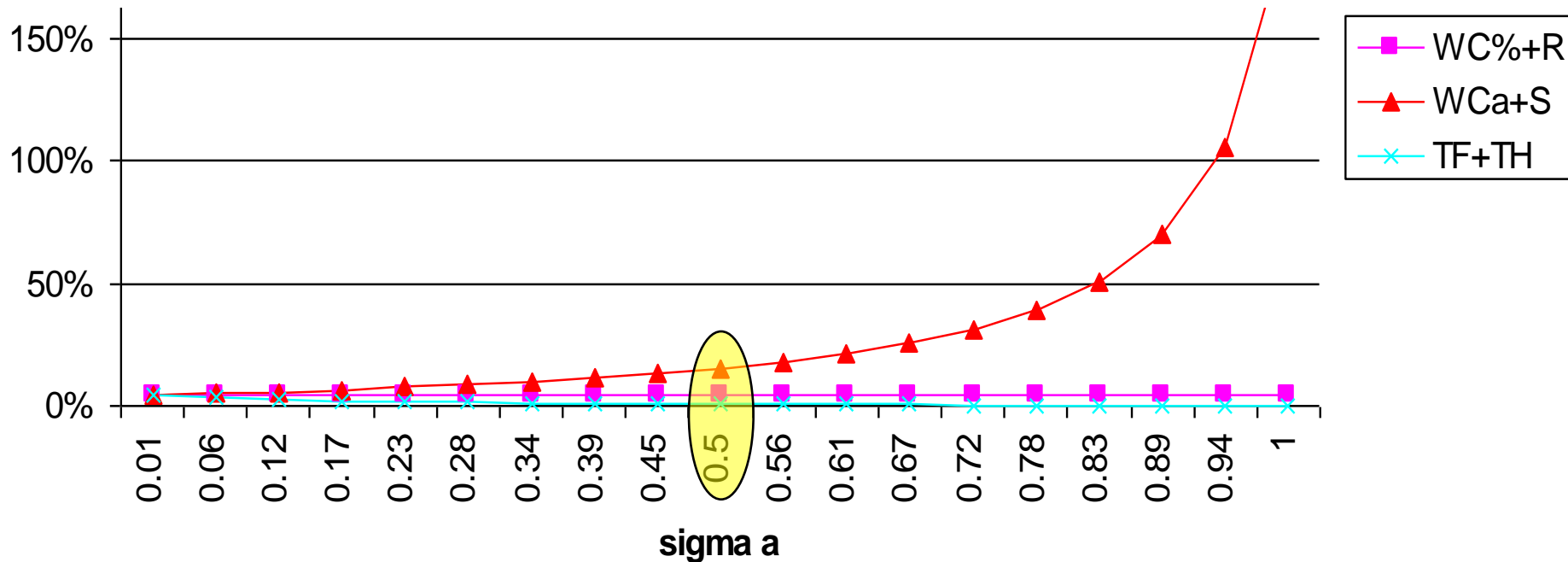
Quantities: ES



→ Only taxes entail the decrease in ES

→ Large rebound effect for WC_a & S

Quantities: g



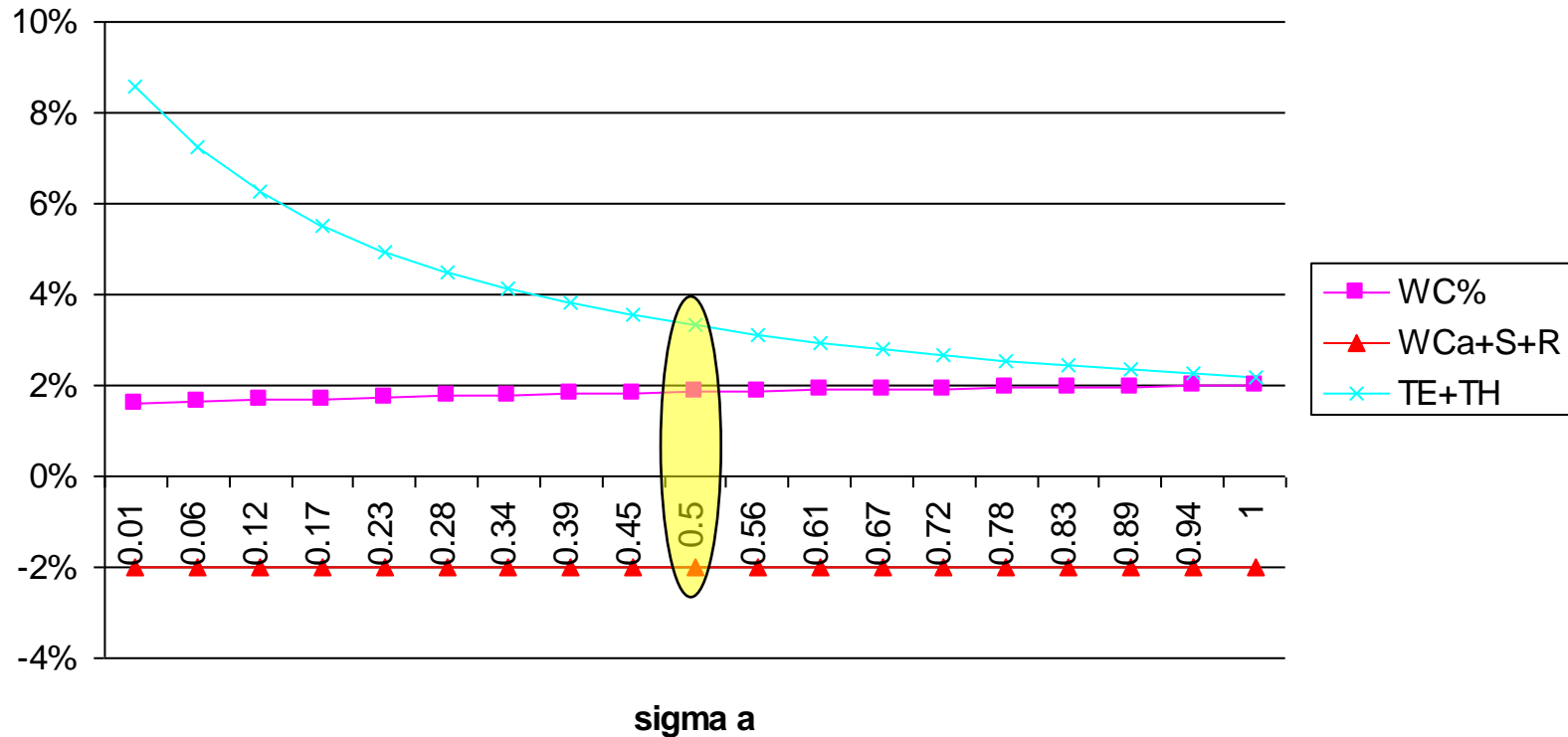
→ g increases very much with WC_a & S

→ Higher level of g necessary to compensate the higher level of ES



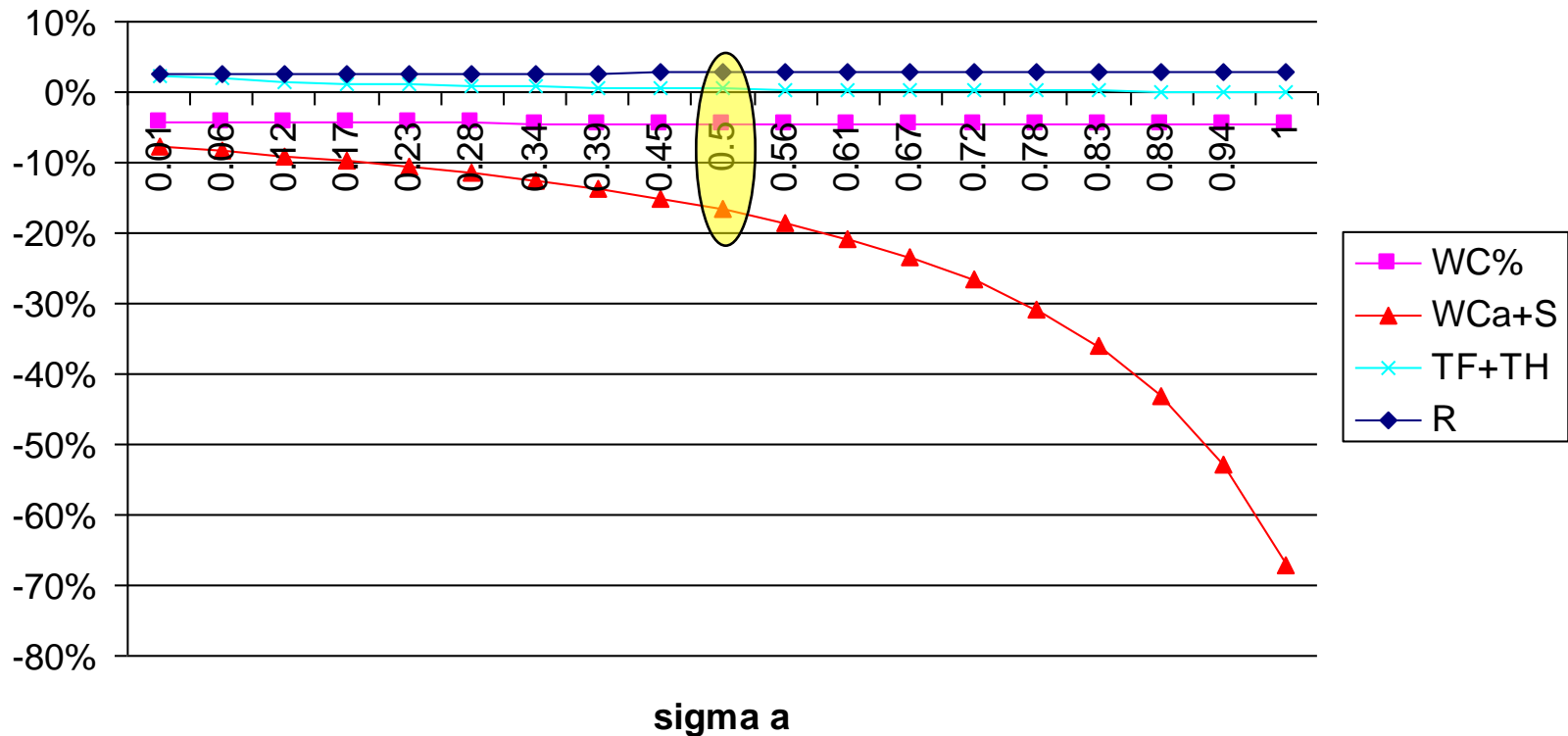
4. Insights on acceptability

Prices: P_e



- Lower increase with $WC_{\%}$ than with tax
- Currently a crucial issue

Prices: P_g



→ Decrease in consumer's price with WC & S



5. Conclusion

Main results

- Economic efficiency of TWC
 - when ES is endogenous:
 - Less efficient than taxes
 - As efficient as the regulation
 - Even worse when supplier's target are fixed
 - As inefficient as the subsidy
- On acceptability
 - More favourable than tax in terms of consumer's prices
 - Taxes costs are lower overall...but more “visible” costs

Limits and perspectives

- Issues not taken into account:
 - Equalisation of the marginal costs among energy suppliers
 - The « energy efficiency gap »
 - Transaction costs
- Work in progress:

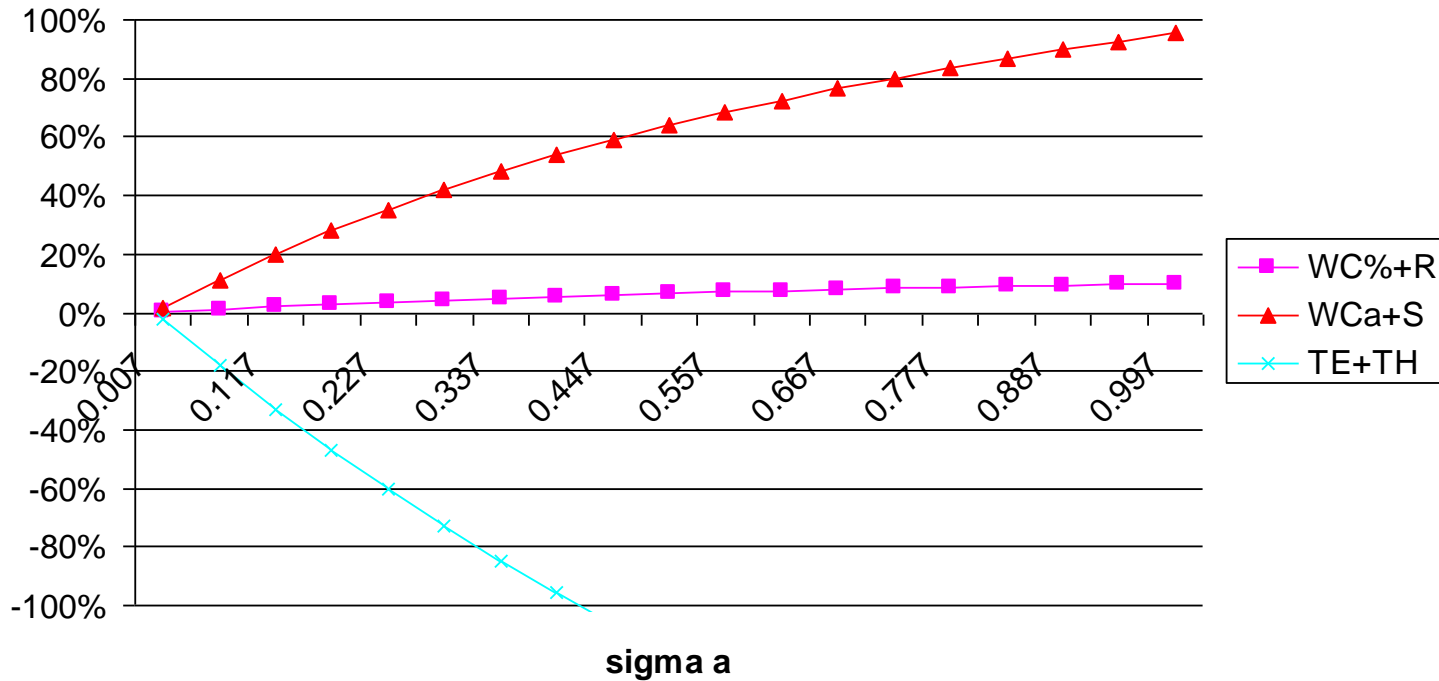
Larger scale simulation using CIRED's IMACLIM Model



Appendix

The rebound effect

rebound



$$\frac{\Delta ES / ES}{\Delta ES / ES - \Delta e / e}$$

White certificates

- $WC_{\%}$

$$w \cdot e \leq g$$

$$Max_e \pi_e = (P_e - P_w \cdot w)e - \left(\gamma_e \cdot e + \frac{\delta_e}{2} e^2 \right)$$

$$Max_g \pi_g = (P_g + P_w)g - \left(\gamma_g \cdot g + \frac{\delta_g}{2} g^2 \right)$$

- WC_a

$$W = g$$

$$Max_e \pi_e = P_e \cdot e - P_w \cdot W - \left(\gamma_e \cdot e + \frac{\delta_e}{2} e^2 \right)$$

$$Max_g \pi_g = (P_g + P_w)g - \left(\gamma_g \cdot g + \frac{\delta_g}{2} g^2 \right)$$

Taxes

- T_H

$$t \cdot e = LS$$

$$Max_e \pi_e = (P_e - t)e - \left(\gamma_e \cdot e + \frac{\delta_e}{2} e^2 \right)$$

$$TC = CC - (\pi_e + \pi_g + \pi_c) - LS$$

- T_F

$$t \cdot e = LS$$

$$Max_e \pi_e = (P_e - t)e - \left(\gamma_e \cdot e + \frac{\delta_e}{2} e^2 \right) + LS$$

Other instruments

- Subsidy

$$\text{Max}_g \pi_g = (P_g + S)g - \left(\gamma_g \cdot g + \frac{\delta_g}{2} g^2 \right)$$

$$TC = CC - (\pi_e + \pi_g + \pi_c) + LS$$

$$s \cdot g = LS$$

- Regulation

$$\frac{ES}{e} \geq r$$