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CENTRE
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SUR L'ENVIRONNEMENT
ET LE DÉVELOPPEMENT

The Energy Efficiency Gap: Sources, Magnitude, Solutions

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Today's Talk

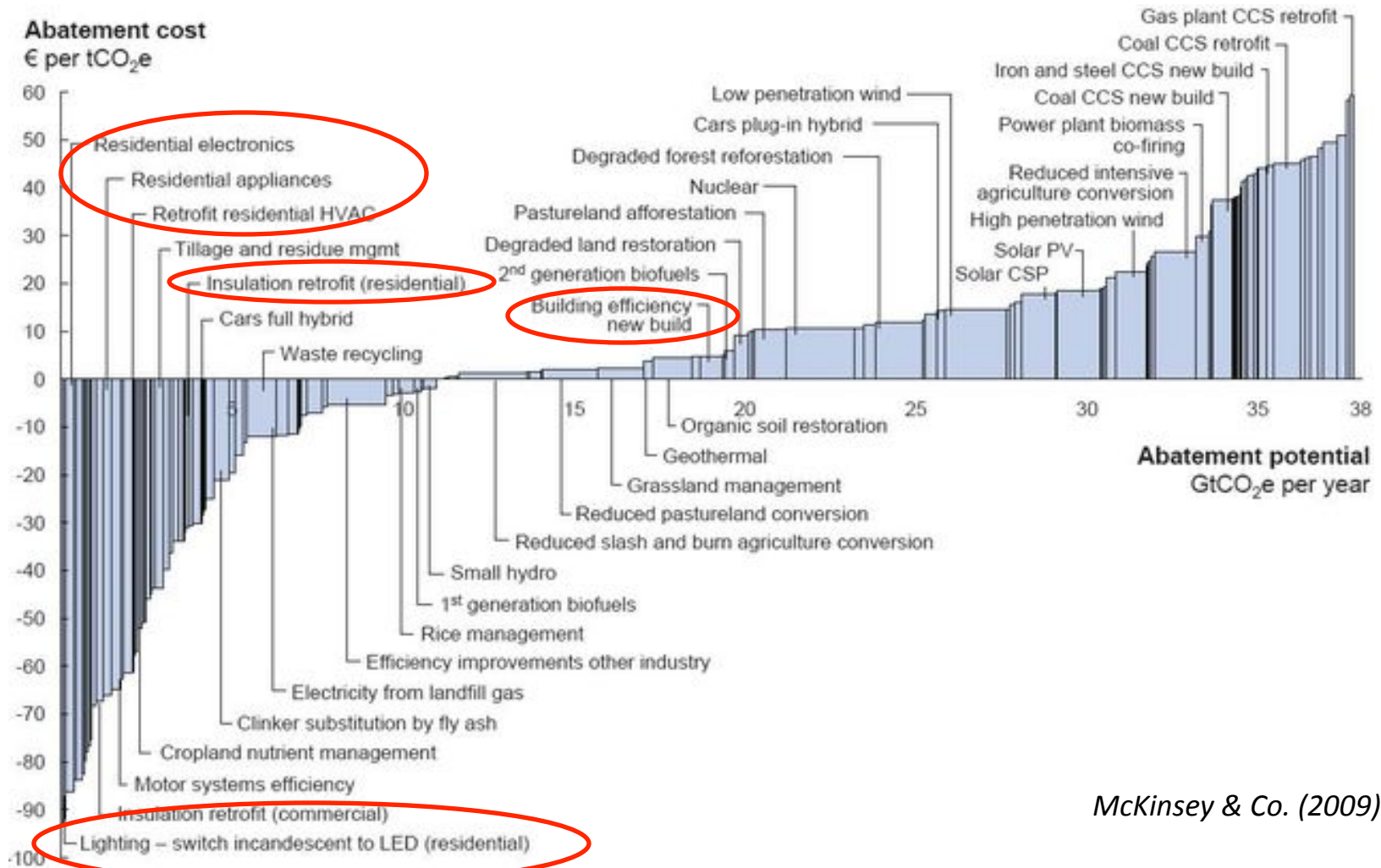
The Energy efficiency gap: An overview

Example #1: Moral hazard

Example #2: Price-quality discrimination

THE ENERGY EFFICIENCY GAP: AN OVERVIEW

Stylized Fact #1: Engineering Claims



McKinsey & Co. (2009)

Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO₂e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.0

Stylized Fact #2: Implementation (e.g. France)



38% energy demand reduction in existing buildings over the 2008-2020 period

500,000 home retrofits per year by 2020

Tax Credit

White Certificates

Soft Loans

Updated Building Code

Eco-conditionality

2005

2006

2009

2012

2015

Carbon tax?

Puzzle #1: Abnormally high discount rates

Train, 1985

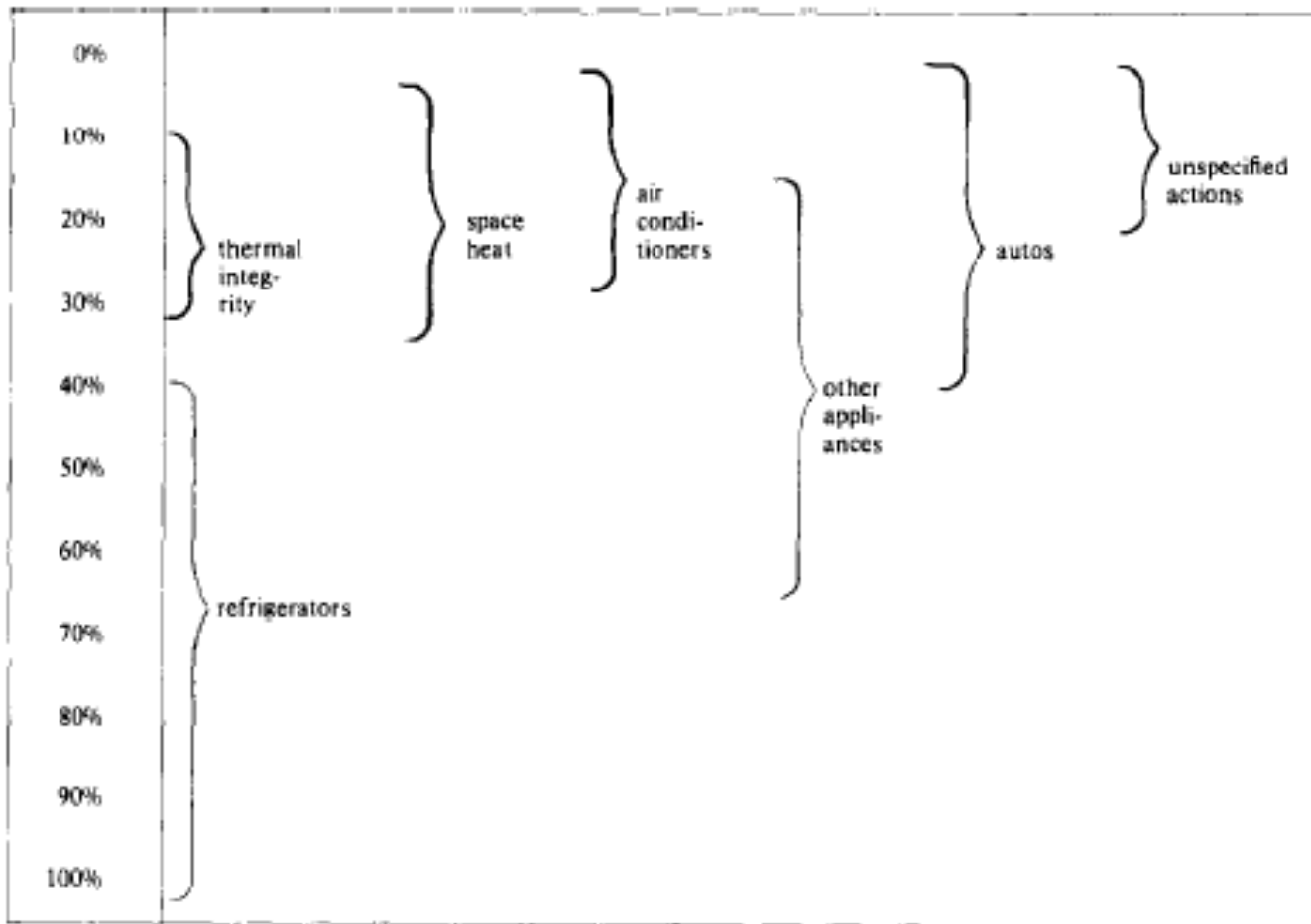
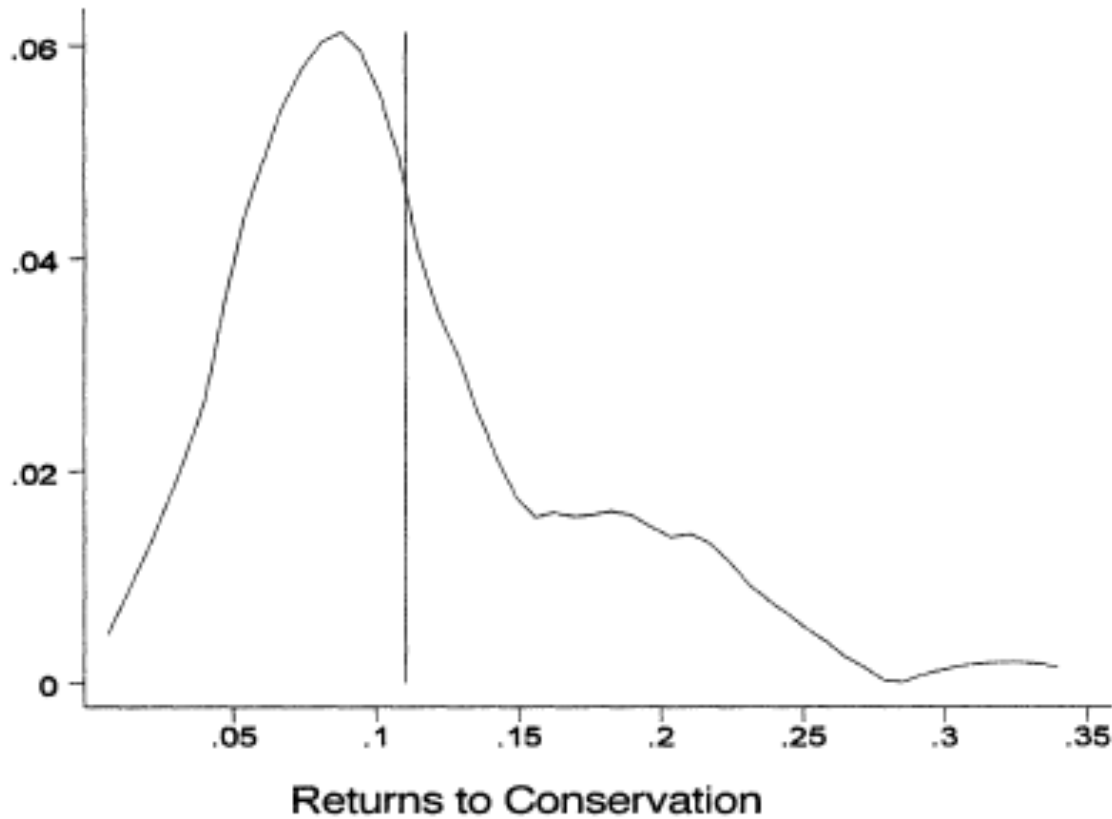


Fig. 1. Estimates of average discount rates.

Puzzle #2: Upward-biased predictions

Metcalf & Hassett, 1999

FIGURE 1.—ESTIMATED DENSITY OF RETURNS



Engineering
promises:
50%?



Zero (or even negative) costs? Really?

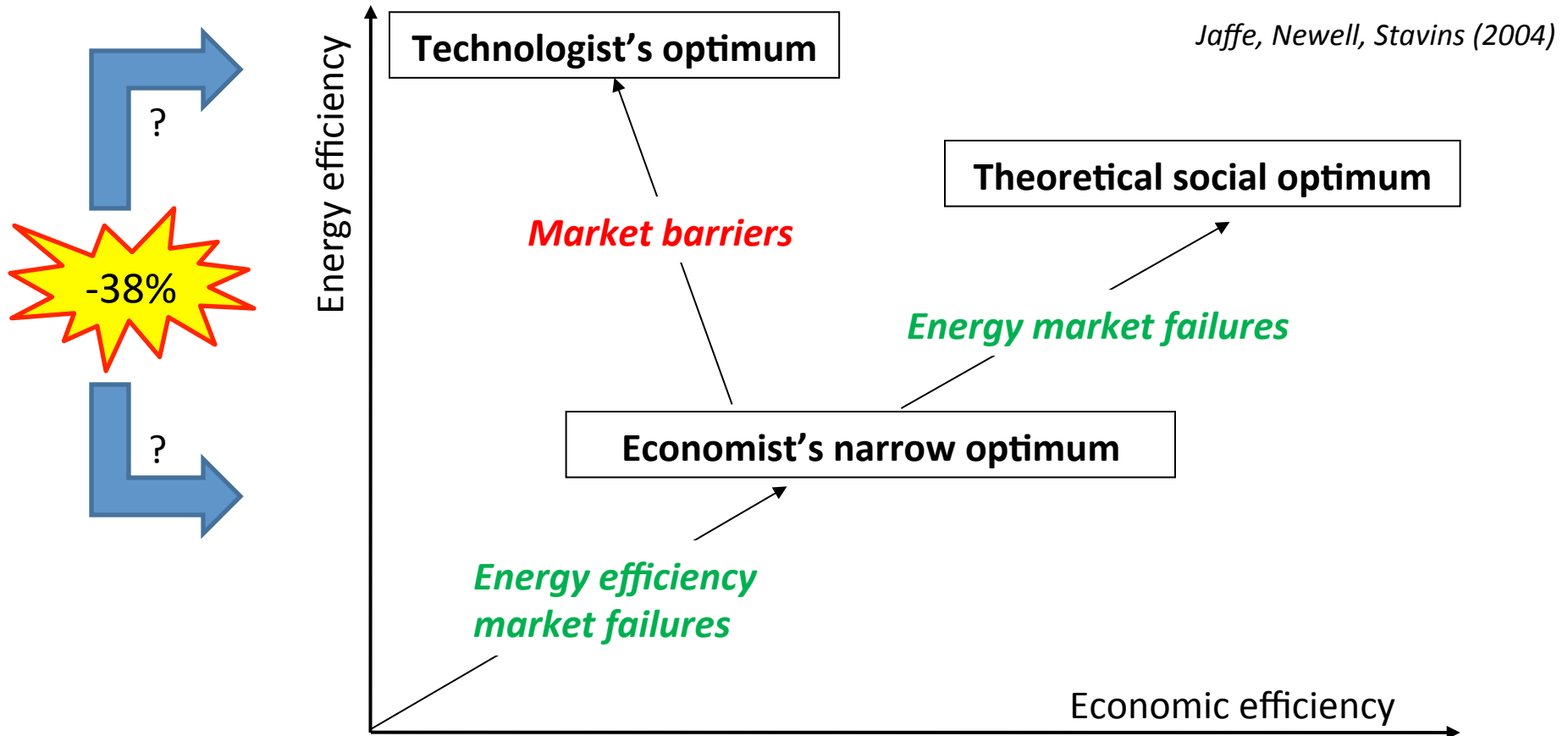
(naïve?)
engineer



(arrogant?)
economist

The Energy Efficiency Gap

Under-investment in energy efficiency compared to some optimal situation



Sources of the Gap

Gerarden et al. (2014)

Modeling flaws

e.g. Consumer heterogeneity (+/-),
Ancillary attributes (+/-),
Rebound effect

$$NPV(s, q) = [\theta V(s) - p\Delta E(q)] F(r, T) - C(q) + \varepsilon$$

Market failures

e.g. Externalities,
Information asymmetries,
Market power

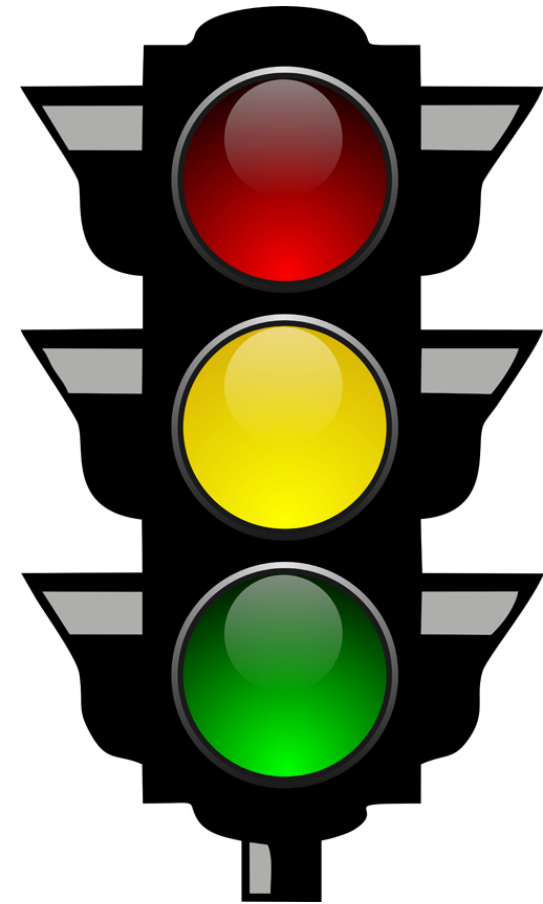
Behavioral effects

e.g. self-control, reference-
dependent decisions



Biases not systematically upward!

Policy Implication #1: Justification



Modeling flaws do not warrant policy intervention. Just get the model right.

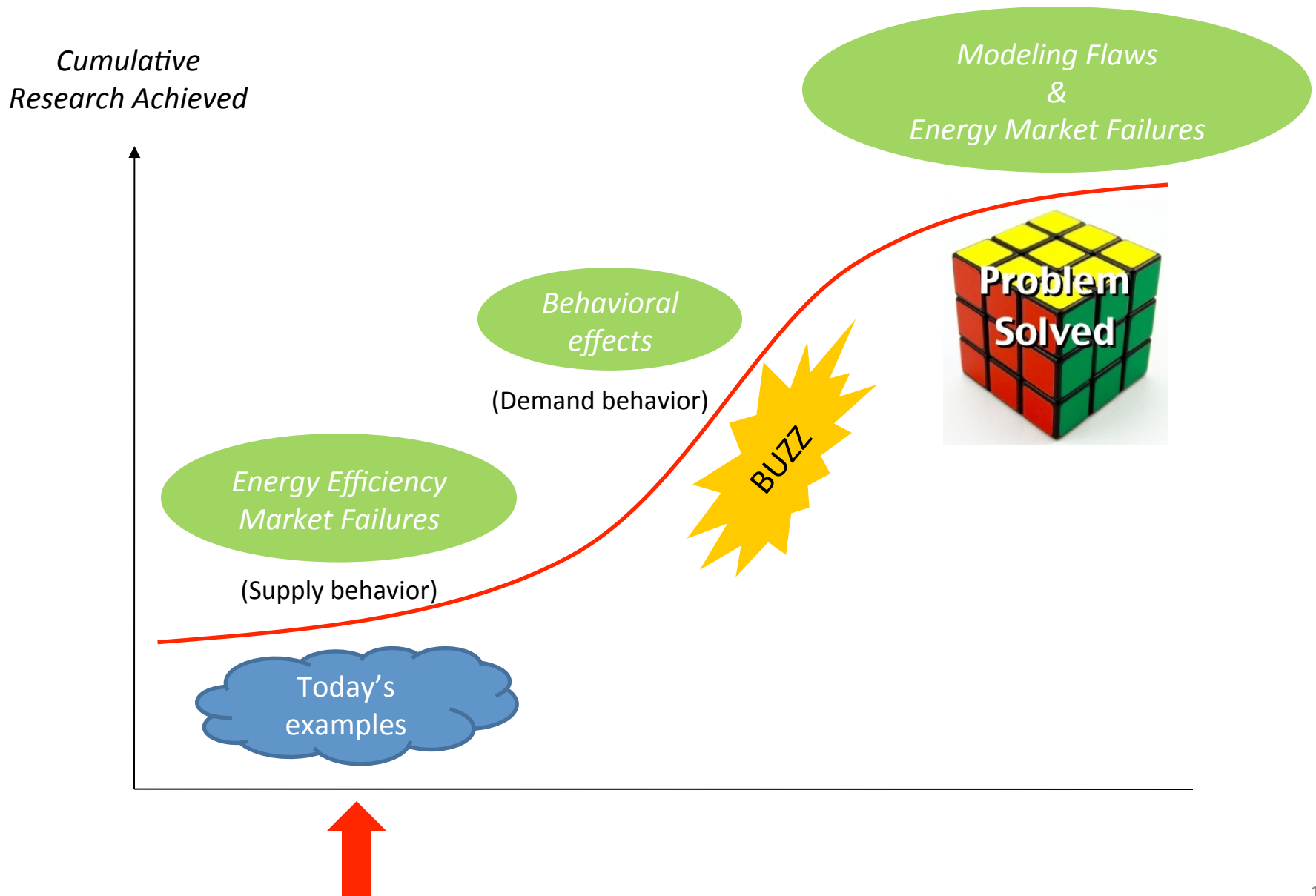
Behavioral effects (i.e. imperfect rationality) may call for debated “nudges” or “libertarian paternalistic” interventions.

Market failures (i.e. imperfect competition or information) disable the invisible hand. Textbook rationale for government intervention. (The regulator as a referee.)

Policy Implication #2: Evaluation

- Metrics
 - Efficiency: social (ex post) welfare
 - Effectiveness: not necessarily energy savings; specific to each objective (e.g. # new adopters per subsidized adopter, # certified jobs)
- Interactions
 - Tinbergen rule: N objectives \rightarrow N instruments
 - Influence on policy design

(My view on) State of Research



Giraudet, L.-G., S. Houde, “Double moral hazard and the energy efficiency gap”, E2e Working Paper, 2014

(DOUBLE) MORAL HAZARD: SOURCES, MAGNITUDE, SOLUTIONS

Moral Hazard in Building Retrofits



2013 Winner

“Best Construction Defect” Photo Contest

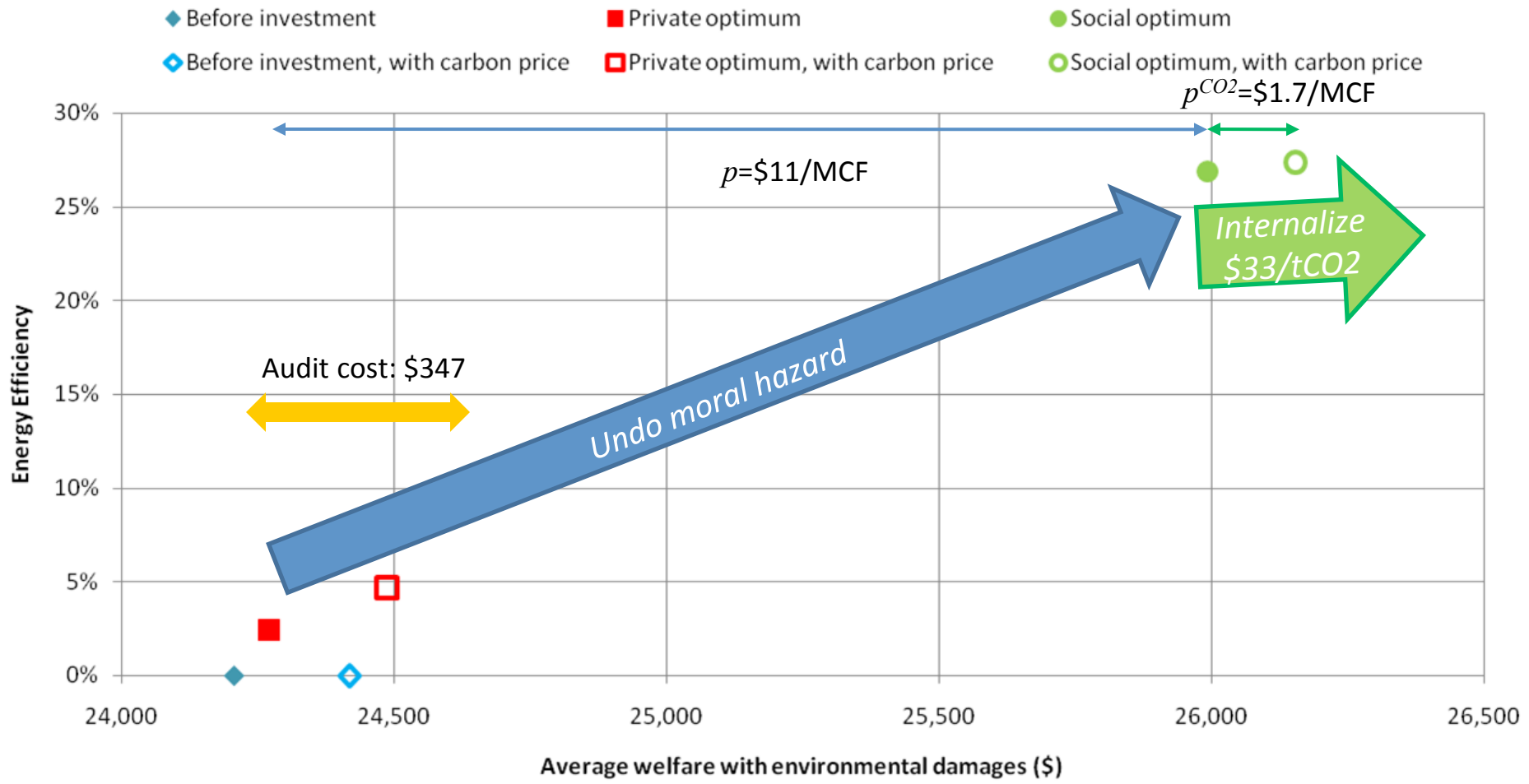
Awarded by AQC, the French Construction Quality Agency



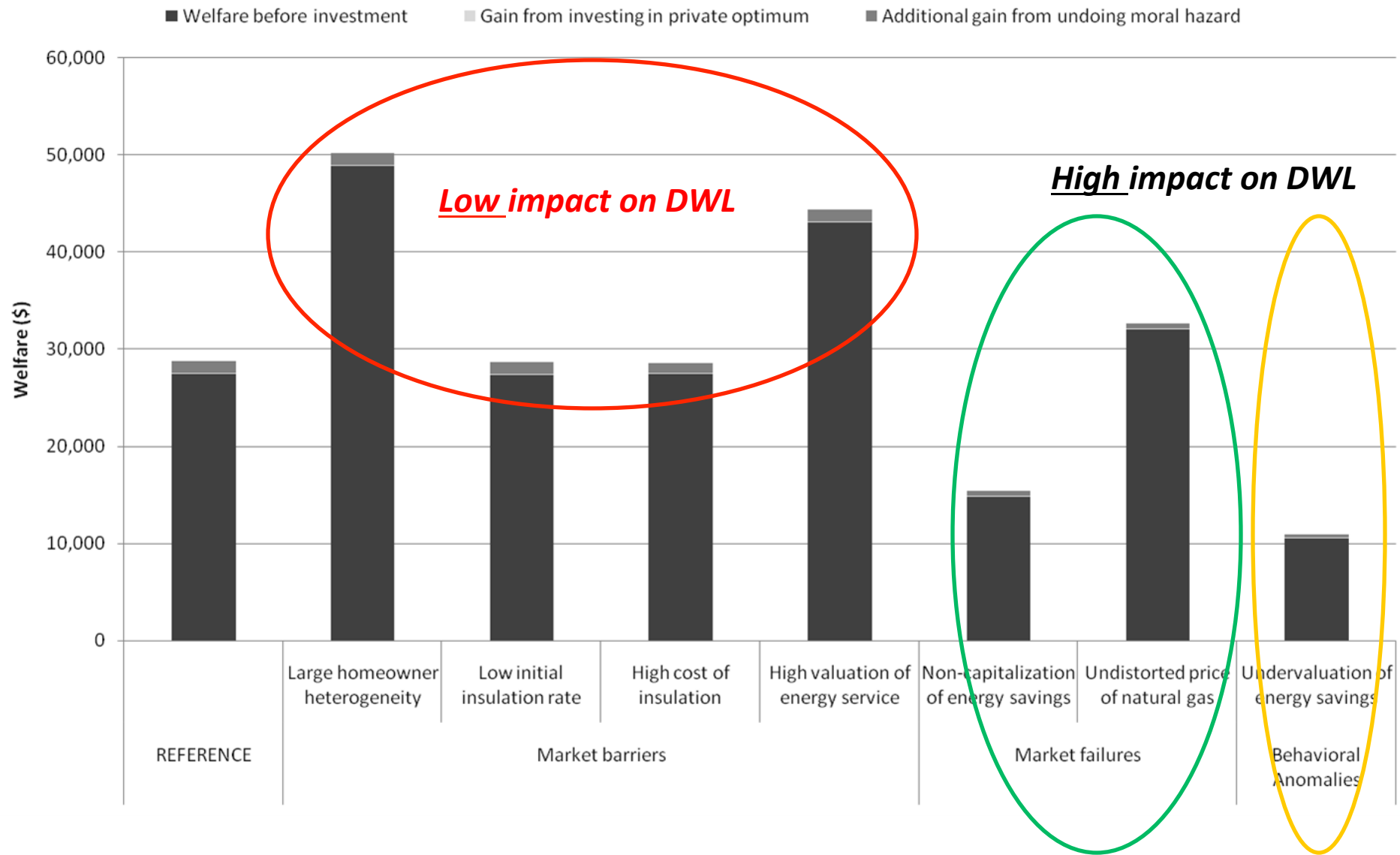
Magnitude

- Home energy retrofit as a credence good
 - Uncertainty: architectural design, weather conditions
 - Hidden actions: installation, consumer behavior
- Suggestive evidence
 - 10% actual savings versus 50% predicted savings for attic insulation (Metcalf and Hassett, 1999)
 - Only 15% air conditioning installations meet quality specifications in California (Messenger, 2008)
- Empirical challenges with estimation
 - Defects take time to be detected
 - Difficult access to home retrofit contracts
 - Highly non-standardized operations

Simulations



Sensitivity Analysis of Deadweight Loss



Remedies Found in the Marketplace (e.g. US)

Voluntary certifications



CERTIFIED
PROFESSIONAL



Problem:
control costs

Incentives

40%
energy
savings
guarantee

UP TO 30% ENERGY
SAVINGS
GUARANTEED!



Calculate Your
Savings
Now!

15% SAVINGS GUARANTEED*

CLICK HERE TO SEE YOUR SAVINGS!

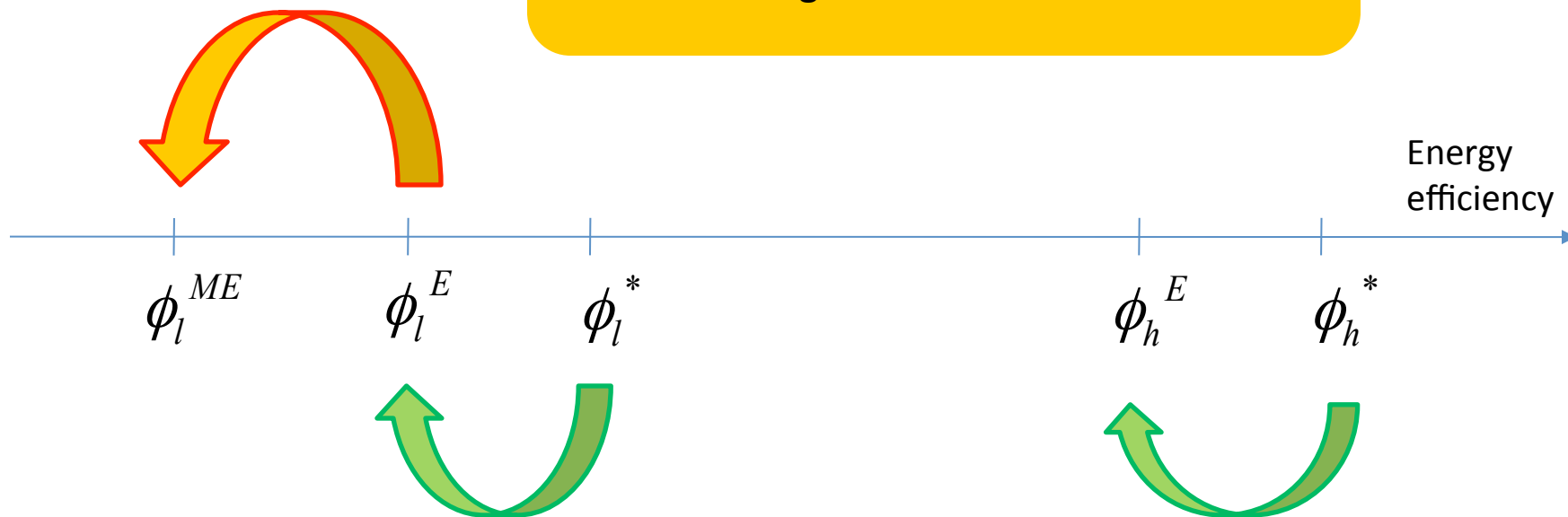
Problem: Incomplete contract due to
rebound effect (second moral hazard)

Nauleau, M.-L., L.-G. Giraudet, P. Quirion, “Energy efficiency policy with price-quality discrimination”, Working paper, 2015

PRICE-QUALITY DISCRIMINATION: SOURCE, MAGNITUDE, SOLUTIONS

Price-quality discrimination by a Monopolist

The monopolist cuts the quality of the low-end good to extract more surplus from high-end consumers



In addition, with energy-use externalities, the quality of both goods is sub-optimal

Suggestive Evidence (e.g. France)

Indices de concentration de type Hirschman-Herfindhal

Secteur	Nombre d'entreprises	Indice de concentration (en %)
Restaurants	123 174	0,084
Cafés	38 879	0,005
Coiffure	60 217	0,007
Réparation d'appareils ménagers	2 533	0,251
Réparation d'appareils HiFi	3 236	0,173
Appareils ménagers	172	7,312
Produits pour la réparation des logements	1 639	1,082
Vaisselle	1 750	1,226
Boissons alcoolisées	3 097	1,030

Policy Remedies

- Anti-trust regulation to counteract market power, e.g. France (Autorité de la concurrence, 2006)
- Improvement of the quality of the low-end good
 - Minimum quality standard
 - Subsidy
- Optimal policy with two market failures
 - Differentiated subsidies with decreasing rate
 - At odds with actual practice, e.g. French tax credit (25% for low-temperature boiler, 40% for condensing boiler)

CONCLUSION

The Energy Efficiency Gap

- Sources
 - Modeling flaws
 - Market failures in energy and energy efficiency markets
 - Behavioral effects
- Magnitude: ???
- Solutions
 - Addressing behavioral effects raise theoretical and moral issues
 - Market failures are already addressed...in a very messy way!!! e.g. energy efficiency subsidies

Beyond CO₂ externalities, there are many good reasons to implement energy efficiency policies.

But...

Straighten up the objectives

and

Get the metrics right