

Do Energy Efficiency Standards Hurt Consumers? Evidence from Household Appliance Sales

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Economist typically prefer prices over standards

In a University of Chicago survey, 93% of economists said they would prefer a gasoline tax over fuel economy standards.

In the 2015 New York University (NYU) School of Law survey, 81% of economists said a market-based system (e.g. carbon tax) would be most efficient in cutting pollution; only 13% preferred performance standards

"[The Corporate Average Fuel Economy Standards (CAFE)] is going to continue to be a very expensive way to reduce gasoline consumption compared to increasing the gas tax." - Lucas Davis, UC Berkeley

"Caps on energy or energy efficiency are less cost-effective than a price on pollution because they afford less flexibility." - Ted Gayer, Brookings

In practice, standards are more prevalent (at least in the US!)

- Corporate Average Fuel Economy Standards (CAFE)
- Building Standards
- Appliance Standards
- Energy Labels



Engineering and many consumer studies support the idea that consumers underinvest in energy efficiency



In 2016, roughly 50% of recent new bulb shipments to U.S. retailers are incandescent halogens!

Critique: unobserved product attributes confound consumer willingness to pay (WTP) for efficiency

2015 Lamborghini Aventador Roadster



12 MPG
\$443,804

2015 Honda Fit



36 MPG
\$16,725

Regulatory Challenges in the United States

Political gridlock in the United States.

**“Cap and Trade”
is Tax and Raid!**

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Efficiency standards can be implemented under the current law at the discretion of administering agencies.

The main hurdle: ***prove standards don't hurt consumers***

How might standards hurt consumers?

1. Drive up the cost and prices of regulated products
2. Reduce quality of regulated products



This study

Use microdata on home appliance sold in the US between 2001 and 2011 to track how price and quality change as standards changed.

Five Steps:

- 1 Develop constant-quality price index (CQPI)
- 2 Use CQPI to develop quality index
- 3 Develop a welfare indicator based on 1 & 2
- 4 Examine how CQPI, quality and welfare change with policies
- 5 Investigate mechanism of patterns we see

The CQPI

$$\text{CQPI}_t = \text{CQPI}_{t-1} \left(1 + \frac{2 \sum_{i \in \mathcal{I}_t} W_{it} \left(\frac{p_{it} - p_{it-1}}{p_{it} + p_{it-1}} \right)}{\sum_{i \in \mathcal{I}_t} W_{it}} \right), \forall t > 0 \quad (1)$$

where

$$\text{CQPI}_0 = \frac{\sum_{i \in \mathcal{I}_t} q_{i0} p_{i0}}{\sum_{i \in \mathcal{I}_t} q_{i0}}$$

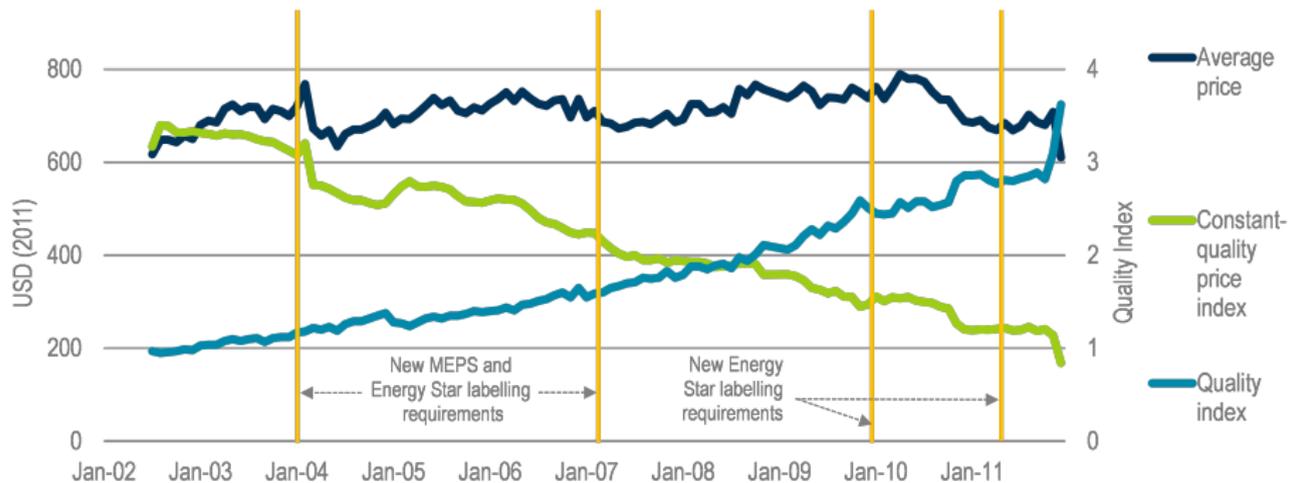
and

$$W_{it} = \frac{q_{it} + q_{it-1}}{2}, \forall i \in \mathcal{I}_t$$

CQPI: A Simple Illustration

Model	m1		m2		m3	
	price	sales	price	sales	price	sales
1	200	100	200	100	100	100
2	300	100	300	100	200	100
3	400	100	400	500	400	300
Ave. Price	300.00		357.14		300.00	
CQPI	300.00		300.00		246.67	

Average Price, CQPI, Quality Index (Clothes Washers)



Source: International Energy Agency, 2017

How has quality increased?

- Larger and more compact sizes
- More cycles and options
- Faster spin cycles
- Transition from top- to front-loading machines without agitator

Attributes that consumers may value and can also be synergistic with energy efficiency

Average Change in CQPI, Quality Index and Welfare, Washers vs. Refrigerators vs. Room AC, 2002-2011.

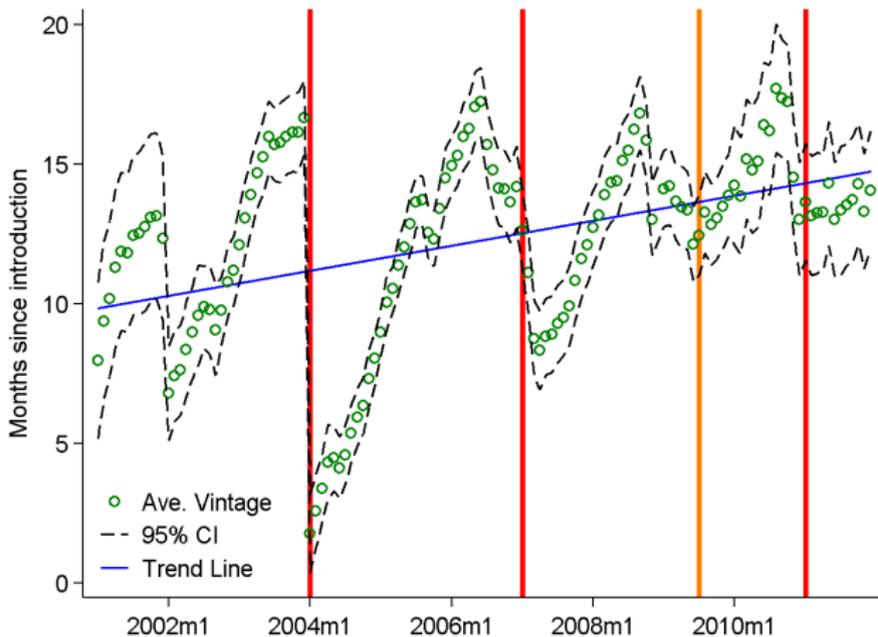
Period	Clothes Washers			Refrigerators			Room AC		
	CQPI	Quality	Welfare	CQPI	Quality	Welfare	CQPI	Quality	Welfare
Pre-2004	0.388	1.139	0.291	-0.246	1.322	3.113	-1.803	1.336	9.178
2004 ME & ES Policy	-1.659	1.390	9.173	-1.441	2.712	14.365	-0.981	0.181	3.830
Post-2004 Policy	0.256	0.910	-1.236	-0.874	1.269	7.405	-1.327	1.578	4.860
Pre-2007 Policy	-0.827	0.673	4.443	-0.551	1.177	4.333	-0.955	1.029	2.714
2007 ME & ES Policy	-1.845	1.984	8.665	-1.600	1.024	11.296	-0.174	0.460	1.148
2008 ES Policy	-0.578	0.890	2.288	-0.923	1.200	5.172	-0.959	1.496	2.192
2009 ES Policy	-1.752	1.400	5.797	-0.876	0.882	4.359	-0.882	2.161	2.161
2011 ME & ES Policy	-1.899	1.214	5.199	-0.710	0.529	3.003	-0.722	1.203	1.203

Why might standards improve welfare?

- 1 Standards reduce product heterogeneity and thereby increase competition for monopolistically competitive goods (Ronnen, 1990).
- 2 Standards push firms to accelerate innovation.

Competition and Innovation?

Standard changes associated with large changes in average vintage due to new product introductions.



Competition and Innovation

Changes in firm's pricing as a result of introduction (or withdrawals) of products

- For clothes washers, increasing average vintage from 10 to 15 months is associated with a 10% price increase.

Changes in firm's product pricing is affected by its own or other firms' introduction (or withdrawal) of products:

- For highly regulated clothes washers, the vintage-effect price declines are associated with within-manufacturer introduction, and not between manufacturers.
- We do not observe this strong pattern of intra-manufacturer cannibalism in the markets for room AC and refrigerators.

Conclusion

- ① Standards not hurting consumers and may be helping them, while also reducing pollution externalities. A free lunch?
- ② What explains this effect of standards on consumer welfare?
Policy-induced innovation, wherein firms lower prices of older models as they are forced to introduce new models meeting new, stricter efficiency standards.
- ③ Energy-consuming durable goods markets contain multiple market failures, including pollution externalities, imperfect competition, public-good aspects of innovation and consumer behavioral anomalies.

Thank you!

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Link to the working paper:

<http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2017/03/Working-paper-266-Brucal-Roberts.pdf>