Benefit-Cost Analysis
Problems with Product Failures

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Effects of Regulation on Product Quality

• Department of Energy appliance standards
  – Residential + commercial appliances
  – Over 60 regulated appliance categories
    • Air conditioners, furnaces, ovens, microwaves, refrigerators, dishwashers
  – Often require technological change

• What are the effects of mandated efficiency on product quality?
  – Some existing literature based on ex post studies
  – Numerous class action lawsuits provide information on product defects
    • Class action lawyers have an incentive to identify and develop information on product defects
Literature

• Sébastien Houde & C. Anna Spurlock (2015)
• Arlan Brucal & Michael Roberts (2015)
• Margaret Taylor, C. Anna Spurlock, and Hung-Chia Yang (2014)
• Ashenfelter, Hosken & Weinberg (2013)
• Hausman & Joskow (1982)
• Leland (1979)
• Common themes:
  – Recent papers suggest energy efficiency rules have produced complying higher “quality” products at a lower price than projected by DOE
    • “Quality” as measured by additional features such as shorter wash cycles, heated dry, etc.
    • Impetus for an increase in product features may come from:
      – Test procedures with credit for less energy intensive options (e.g., shorter wash cycles)?
      – Product differentiation (non-price competition) associated with prohibition on low price, lower energy efficiency products?
      – Regulation spurs product innovation?
Preliminary Takeaways

Product quality in terms of performance (including energy consumption) and reliability (repair record, product recalls, class action law suits, etc.)

**Strong assertion**: Design changes occasioned by energy efficiency standards have resulted in product quality problems.

**Weak assertion**: Energy efficiency standards have not resulted in improvements in product reliability.
## Case Studies: Appliance Class Action Suits

<table>
<thead>
<tr>
<th>Regulated appliance</th>
<th>Standard compliance date</th>
<th>Linked to regulation?</th>
<th>Successful litigation?</th>
<th>Costs</th>
<th>Scope</th>
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</thead>
<tbody>
<tr>
<td>Clothes Dryers</td>
<td>1994 &amp; 2015</td>
<td>?</td>
<td>✓</td>
<td>Safety hazard</td>
<td>?</td>
</tr>
<tr>
<td>Side-by-Side Refrigerators</td>
<td>2001 &amp; 2014</td>
<td>✓</td>
<td>✓</td>
<td>Repair, higher energy costs</td>
<td>30% + of refrigerator sales</td>
</tr>
<tr>
<td>Air Conditioners, Heat pumps, HVAC</td>
<td>2006</td>
<td>✓</td>
<td>✓</td>
<td>Repair, replacement, refrigerant costs</td>
<td>7 major manufacturers</td>
</tr>
</tbody>
</table>
Front Loading Clothes Washers

- DOE Energy Efficiency Standard, 2001
  - Based on energy savings from front loading washers

- Transition from top-loading washers to front-loading washers
  - Top loading washers accounted for >90% of market prior to 2003
  - Front-loading washers comprised roughly 50% of market over 2005 to 2011 period
Front Loading Clothes Washers

• **Problem: Moldy Washers (and Laundry)**
  – Whirlpool’s lead engineer stated in a 2004 memo that while mold can exist in any washer, their front-load machines are the “ideal environment for molds...we are fooling ourselves if we think we can eliminate mold...”

• **Class Action Settlements: Moldy Washers**
  – Whirlpool (includes Maytag and Kenmore), 2001 – 2010
  – LG, 2002 to 2006
  – Bosch/Siemens, 2004 to 2011

• **Other class action cases**
  – Samsung
  – Electrolux/Frigidaire
  – GE
Front Loading Clothes Washers

• Manufacturer and Consumer Report Recommendations: Moldy Washers
  – Wipe down the glass and door gasket daily
  – Leave door open
  – Run a hot water wash w/ chlorine bleach monthly
  – Use high efficiency detergent
  – Use “Affresh” (Whirlpool product) or other cleaning agent

• These recommendations incur operation & maintenance costs
  – Costs borne by consumers
    • Affresh revenues to Whirlpool reported at $195 million
    • Whirlpool indemnity payment to Sears of $100 million for service calls under warranty
Side-by-Side Refrigerators

- DOE Energy Efficiency Standard, 2001

- Side-by-side door refrigerators account for over 30% of market, 2001 to 2011

- Problem: Moisture/water leaks + ice-maker issues
Side-by-Side Refrigerators

• Class Action Settlements
  – GE: 2006 settlement
    • GE re-designed body to meet 2001 DOE standard; but retained the old door design causing moisture/water leakage problems
    • Settlement covered 2001 and 2002 models (although plaintiffs argued some GE models retained suspect doors through 2005)
Side-by-Side Refrigerators

• Other Class Action Settlements
  – Electrolux (Frigidaire & Crosley), 2015(?)
    • The lawsuit alleges that Electrolux has a history of making repairs it knows will not fix the ice maker malfunction. Electrolux thought it had a break-through in ice making technology. From the reports on Electrolux and Frigidaire branded fridges, the new technology does not work.
  – Whirlpool/KitchenAid, 2016
    • These 2 models—with Energy Star labels—were not in compliance with Energy Star requirements
  – LG/Sears, 2011
    • Models—with Energy Star labels—were not meeting Energy Star requirements
Side-by-Side Refrigerators

• Other Class Action Cases: Moisture Issues
  – Whirlpool/Kenmore, Samsung, Viking (Amana)

• Basis of Viking lawsuit
  – Viking built into their refrigerators electrical fixes to alleviate moisture problems; but these fixes were not electrically connected in the factory for DOE testing.
  – The fixes were connected in the home when moisture related service problems appeared or *en masse* pre-sale by distributors
  – Service repairman reported that Viking installed the needed equipment; other manufacturers left the task to repair services
Side-by-Side Refrigerators

• DOE Enforcement/Ice-makers
  – LG was required to remove the energy Star label from certain models (>20) of its refrigerators because it was certifying these models with its tube and ice ejection heaters in the “off” rather than “on” position. (2010 decision)
  – LG was required to make annual payments to consumers for their expected useful life for these LG and Kenmore-brand models to compensate for excess electricity consumption
Other Cases: HVAC & Furnaces

- **Central air conditioners & heat pumps**
  - Copper coil defects led to costly refrigerant leaks
  - Implicates several major manufacturers
    - York, Goodman, Aspen, Trane, Carrier, Lennox, Rheem
    - Successful litigation against York, Lennox, Johnson

- **High-efficiency furnaces**
  - Secondary heat exchangers failed
    - Necessary component of high-efficiency condensing furnaces
  - Affected 3 million consumers in U.S., Canada
    - Successful litigation against Carrier
Other Cases: Dishwashers

• DOE standard: 1994
• Class Action Lawsuits: Electrolux, Kenmore, KitchenAid and Whirlpool dishwashers
  – Electronic control boards overheat and may cause fires
  – Links to energy efficiency standards?
• Product Recalls to Address Fire Hazard
  – Bosch, Maytag, GE
  – Recalls covered over 6 million machines
Alternative Indices of Product Quality

Side-by-Side Refrigerators

- Consumer Reports tests found that refrigerators use about 20% more electricity than listed on EnergyGuide labels (2010)

- 2017 CR reports much higher repair rates ranging from 32% to 40% (ice-maker) and 32% to 47% (French door)

Front Loading Washers

- CR consistently downplayed the moldy washer problem; recommended front loaders over top-loader machines during 2003 – 2010

- 2017 CR reports much higher repair rates for front-loading washers ranging from 18% to 29%

Source: Taylor et al., Resources for the Future, 2015
Retrospective Benefit-Cost Analysis

• What role should this information play in ex post analysis?
  – Ex post appliance studies do not incorporate information on product defects (e.g., information from class action lawsuits)

• Discovery of ex post costs (e.g., repair costs, energy use, O&M costs):
  – Survey consumers? Appliance repair firms?
  – Track record on consumer purchases of warranties?
  – Product recalls?
  – Class action settlements are illustrative of problems
    • Do they provide relevant information on costs?
    • Counterargument: manufacturers are ultimately responsible for product quality (or lack thereof)
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