



How many people actually see the price signal? Quantifying market failures in the end use of energy

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Project Overview



- § Project initiated by the IEA, within the framework of its Energy Efficiency Working Party; Lead by the IEA Secretariat; Participating and sponsoring countries: Australia, Japan, the Netherlands, Norway and the United States

- § Ran from June 2005 until July 2006

- § This paper presents part of the larger IEA study; IEA book reporting the larger study forthcoming in 2007



Why did we do it?



- § Energy price is key factor in influencing efficient energy use and 'getting the price right' therefore a goal of many market-oriented energy policies (e.g. carbon taxes)
- § Many papers describe market failures and barriers, but often make no distinction between the two. **Moreover, none of these studies have ever tried to quantify the amount of energy consumption that is affected by the market failure and insulated from the price signal**
- § From economic theory perspective, important to distinguish between market *failures* and *barriers* because former, most economists would agree, justifies government intervention in markets whereas the latter does not



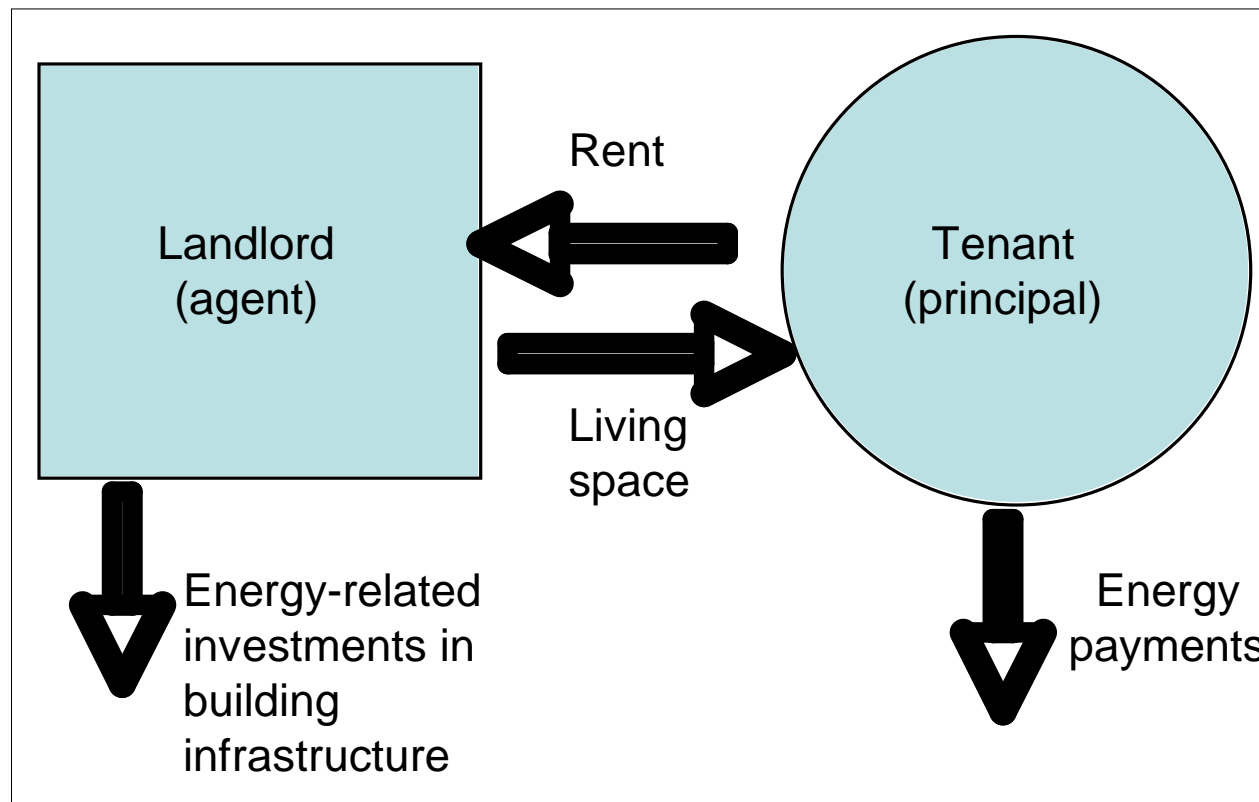


Scope of the overall study

- § Overall study set out to examine the extent to which consumers actually see the price signal and focused only on a market failure referred to as the *principal agent* (PA) problem (also called split incentives)
- § Sought examples that could be examined within a structure of international collaboration and case studies that could be replicated in more than one country
- § Examined 7 energy end-uses and one sector where PA problem was identified



Principal agent problem



How did we do it?



Steps: Identified situations where the *principal agent* problem exists;
Described transactions involved;
Estimated the energy consumption affected by the PA problem

Next step? Estimate energy savings if PA problems were removed;
Replicate these PA case studies in other countries;
Identify and do other case studies where PA problem exists



Identifying the problem

| | Can choose technology | Cannot choose technology |
|---------------------------------|--------------------------------------|---------------------------------|
| Pays energy bill | Case 1: No PA problem | Case 2: Efficiency problem |
| Does not pay energy bill | Case 3: Usage and efficiency problem | Case 4: Usage problem |

Case Studies



| PA problems examined in this study | |
|---|----------------------------|
| Case Study | Countries |
| Refrigerators | USA |
| Water heating | USA, Norway |
| Space heating | Netherlands, USA, Norway |
| Vending machines | Japan, Australia |
| Commercial HVAC | Japan, Netherlands, Norway |
| Company cars | Netherlands |
| Lighting | USA |
| Firms | Australia, Norway |



Findings

Water heaters in the United States



Shares of water heaters in different market situations in US

| | Household <i>can</i> choose technology | Household <i>cannot</i> choose technology |
|-------------------------------------|--|---|
| Household Pays Energy Bills | 21% of homes | <i>68% of homes</i> |
| Household Does Not Pay Utility Bill | Negligible | 10% of homes |



Adapted from Murtishaw and Sathaye, 2006

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Findings

Set-top matrix with relevant populations



| | Can choose technology | Cannot choose technology |
|---------------------------------|---|--|
| Pays energy bill | Case 1: No PA problem <i>1.5 million</i> | Case 2: Efficiency problem <i>141 million</i> |
| Does not pay energy bill | Case 3: Usage and efficiency problem <i>0.06 million</i> | Case 4: Usage problem <i>6 million</i> |



Fraction of energy use affected by PA problems in case studies



| End Use | Countries Examined | Fraction of Energy Use Affected by Principal-Agent Problem |
|---------------------------------|--------------------|--|
| Residential refrigerators | US | 25% |
| Residential water heating | NO, US | 38 – 77% |
| Residential space heating | NL, US | 46 – 48% |
| Residential lighting | US | 2% |
| Television set-top boxes | US | 100% |
| Company cars | NL | 32% |
| HVAC in commercial leased space | JP, NL, NO | 17 – 44 – 90% |
| Vending machines | JP, AU | 44 – 80% |



Residential energy use in the United States affected by principal agent problems in this study

| | Energy Use Affected by PA Problems | | |
|----------------------|------------------------------------|---------------------|-----------------------------|
| Case | Primary Energy Use (PJ) | Fraction of End Use | Fraction of All Residential |
| <i>Refrigerators</i> | 390 | 25% | 2% |
| <i>Water Heating</i> | 1060 | 42% | 6% |
| <i>Space Heating</i> | 2500 | 48% | 15% |
| <i>Lighting</i> | 23 | 2% | 0.1% |
| <i>Set-Top Boxes</i> | 160 | 100% | 1% |
| <i>Total</i> | 4130 | -- | 24% |

Conclusions



- Consumers do not always 'see' the energy price when market failures exist and/or has no incentive to act upon it
 - within the PA problem, we identified 3 different types of failures
- The energy use affected by market failures ranged from negligible to essentially 100% of the energy in an end-use, and they appeared in all countries (to varying degree)
 - no country is immune from PA problem
 - some countries have minimised problem by adopting unusual practices (e.g. Japanese vending machines, UK company cars), others have maximised problems, maybe inadvertently (such as set-top boxes and the rental schemes)
- Other market failures exist but are not addressed here (e.g. the Stern Review called climate change an externality and said it was the "greatest market failure in the world")



Policy implications and recommendations



Price signal is important *but* ...

- § Consumer response to a carbon tax (or any change in energy price) may be both reduced and slowed by PA problems
- § From policy making perspective, important to distinguish between market *failures* and *barriers* – former, economists generally agree, justifies government intervention in markets
- § The presence of a PA problem does *not* automatically infer that energy is being used in an uneconomic fashion, or that removal of the failure will lead to energy savings and the closing of the efficiency gap – others barriers may exist
- Efficiency policies cannot rely on prices alone to move markets (or at least not quickly or in desirable directions) but must include policies to address the different kinds of market failures identified in this study (with standards, regulation, incentives, fiscal instruments, etc.)





Thank you for your attention!

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