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Ibon Galarraga, David R. Heres and Mikel González-Eguino

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# **Evaluating the role of energy efficiency labels in the prices of household appliances: the case of refrigerators**

Ibon Galarraga, David R. Heres and Mikel González-Eguino<sup>1</sup>

*This article uses an statistical method to estimate the price premium paid for the highest energy-efficiency label (A+) in the refrigerators market of the Basque Autonomous Community (Spain). The estimated figure is 8.9% of the final price or about 60 euro, which represents one third of the energy savings that a consumer gets during the lifetime of a refrigerator with the highest energy-efficiency label. This figure is then combined with the conditions from a theoretically supported demand system to calculate the sensitivity of the demand for refrigerators to own and cross-price variations. The results indicate that the demand for refrigerators with the highest energy-efficiency label is highly sensitive to price variations. The information presented here can be very useful for policy design and analysis.*

Keywords: energy efficiency labelling, household appliances

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<sup>1</sup> Basque Centre for Climate Change (BC3), Alameda Urquijo 4, 4-1, 48008 Bilbao, Spain. Corresponding author E-mail: [ibon.galarraga@bc3research.org](mailto:ibon.galarraga@bc3research.org)

## 1. Introduction

The energy sector accounts for 84% of global carbon dioxide (CO<sub>2</sub>) emissions and 64% of the world's greenhouse-gas (GHG) emissions, and it is at the heart of the transformation needed to move towards a low carbon economy (IEA 2009). Energy efficiency policies are essential to reduce GHG emissions and save resources. The International Energy Agency (IEA) states that energy efficiency measures can reduce up to 10-15% of global CO<sub>2</sub> per year at no additional cost (IEA 2009). Among the existing abatement options, the replacement of old appliances is considered by some as the most cost-effective short term measure (McKinsey 2009). However, private investments in energy efficiency that at first glance might seem economically worthwhile are not always undertaken. The so-called energy efficiency paradox (Jaffe et al. 2004, Linares and Labandeira 2010) can be explained by existing barriers such as insufficient information, principal-agent problems, lack of access to capital or divergences between social and private discount rates. Understanding these barriers and what hinders widespread consumption of highly efficient appliances is very important for the design of effective policies.

Energy labelling is an interesting measure to overcome the lack of information barrier by providing consumers the necessary information. In fact, the use of information on energy and other resources consumption in household appliances in the European Union (EU) was regulated in early 1990s by the Council Directive 92/75/ECC and the following amending acts.<sup>2</sup> Since 2008 there exists a Proposal for a Directive of the European Parliament and of the Council on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (COM 2008a).

These days, energy labelling is acquiring a major importance in the light of the Climate and Energy package of the EU (COD 2008, and COM 2008b) that sets a target for reducing energy consumption by 20% by 2020 and an objective of 27% energy savings in the residential sector compared to 1990 (European Council 2006). It is fairly recent that information contained in the labels has been used to support other energy efficiency policies such as direct subsidies to

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<sup>2</sup> Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances.

consumers purchasing efficient appliances which are usually more expensive than less efficient ones.

This study analyses the effects of efficiency or different energy labels on the price of appliances. The first part of this paper estimates the price premium paid for the most energy-efficient labels in the refrigerators market. The second part of the study is devoted to the calculation of the sensitivity of the demand for refrigerators to own and cross-price variations. The final section of the paper lists some limitations of the study and presents conclusions and policy recommendations in the context of the household electrical appliances renewal program in the Basque Autonomous Community (BAC), Spain.<sup>3</sup> The program is part of the Spanish Energy Saving and Efficiency Action Plan that sets a minimum of 50 euro as a lump sum subsidy to consumers (both public or private) willing to purchase the most energy-efficient durables, i.e. labelled as class A+.<sup>4</sup>

## **2. Price premium for the most energy-efficient refrigerators**

The data used to estimate the price premium for the most energy-efficient refrigerators were collected in December 2009 from nineteen different retailers that include a representative number of malls, small town-shops and medium size specialised stores in the three provinces of the BAC.<sup>5</sup> The number of refrigerator models displayed in the stores was 404 representing 42 different brands produced by 26 different producers.

The mean price of the 676 refrigerators in our final sample is 658 euro and 24% of the refrigerators in the sample have the A+ label (the most energy-efficient, the rest having the A label). Furthermore, almost 70% come with a defrost mechanism, 2% can be integrated into the wall, and 32% are not white.

Everything else equal, the price of a refrigerator showing an A+ energy-efficiency label would be 8.9% higher than that with an A label. For an estimated average price of refrigerators of 658

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<sup>3</sup> This program is managed by the Institute for Energy Diversification and Saving (IDAE) [www.idae.es](http://www.idae.es)

<sup>4</sup> As the program is run by the Government of each of the Autonomous Communities the amount of the actual subsidy can vary from 50 to 95-100 euro depending on the region analysed.

<sup>5</sup> As each autonomous community manages its own version of the IDAE general program the amount of subsidy varies slightly among regions. Therefore it is reasonable to only focus on one of the markets that are affected by the instruments, in this case the Basque market. The Centre for Energy and Mining Savings and Development (CADEM) runs the program locally.

euro, only increasing efficiency and therefore the label from A to A+, would increase the price by 58.5 euro. Note that while the minimum subsidy regulated by the Royal Decree is 50 euro<sup>6</sup>, the authorities at the BAC subsidise up to 70 euro (and 105 euro in some special cases).

Our estimations also indicate, as expected, that larger refrigerators are more expensive, while refrigerators with defrosting mechanism and with colour other than white respectively have prices 8.9% and 19% higher everything else equal. Built-in refrigerators carry a price-premium of 14.5% over those that cannot be integrated.

**Table 1: Energy Savings and price premiums for refrigerators with different labels**

<b>Class</b>	<b>Energy Consumption in 15 years (kWh)</b>	<b>Average Total Cost in 15 years (€)</b>	<b>Total Savings if substitute by A+ (€)</b>	<b>Energy Savings Price Premium (€)</b>
A++	2956	414	-152.5	-21.2%
A+	4138	579	0	-
A	5420	759	163.4	24.8%
B	6406	897	294.5	35.7%

Source: Calculations based on data from IDAE (2007). Average energy consumption and 0.14€ per kWh are considered. The discount rate is 5%. The price premium is calculated dividing total discounted savings during the lifetime (15 years) of the refrigerator by the average cost of that type of refrigerator.

If it is considered that appliances with different energy labels result in different energy costs throughout the lifecycle of the good, it is possible to estimate how much the net saving is. This figure could also be interpreted as an energy savings premium. That is the amount that a consumer in a situation free from any of the barriers to adoption in Jaffe et al. (2004) would be expected to pay for a fridge with a higher-efficiency label. As shown in Table 1, over the lifetime of a refrigerator the total discounted savings of substituting an A labeled fridge for an A+ labeled one is 163 euro. This has been calculated taking into account average energy consumption,

<sup>6</sup> Royal Decree 208/2005, 25 February 2005, on electrical appliances and electronic devices and the management of their wastes.

average cost of the energy and the energy savings. This energy savings premium accounts for 24% of the average price. Indeed, a figure significantly higher (three times) than the market premium estimated. Nevertheless, as previous research has shown, private discount rates can be higher due to a myriad of factors including the uncertainty about future energy prices. This in turn would reduce the present value of the net savings.

### **3. Sensitivity to price changes of the demand for the most energy-efficient refrigerators**

Information about price differentials between highly energy efficient and other refrigerators is undoubtedly useful for energy policy formulations. However, a complete welfare assessment would necessitate estimates of the sensitivity of demand for the most energy-efficient refrigerators with respect to their own price as well as to the price of other less energy-efficient refrigerators. The conditions from a theoretically supported demand system are used and results are based on our estimated price premium as well as information about price sensitivity of the demand for all refrigerators and other goods. The results indicate that the demand for A+ refrigerators is much more sensitive to price variations than those with lower energy efficiency.

This type of information could be very useful for policy purposes as it allows the decision maker to more precisely calculate the levels at which different instruments such as taxes and subsidies need to be set in order to achieve specific policy objectives. Welfare analyses that aim at identifying which sectors are better and worse off from a given policy could also benefit from this information on demand sensitivity to own and cross-price variations of close substitutes.

### **4. Conclusions**

Important global environmental problems such as climate change are nowadays driving energy efficiency policies due to the great energy savings that authorities worldwide are aiming for. The EU 20-20-20 energy and climate package is a good example of ambitious energy saving targets. In this context, energy labelling is also acquiring a major role. Regulated since early nineties, it is around 2008 that has been growing in importance as a useful policy instruments for other policies such as energy taxation or the subsidy schemes used in Spain.

Controlling for other important characteristics, this study estimates that the price premium paid in the market for refrigerators carrying the highest energy efficient label is close to 9% (or about 60 euro of the average final price). This result is already an interesting contribution to the labelling and energy efficiency literature as it allows for a direct comparison with results from contingent valuation methods and other studies.

The number is approximately one third of price premium defined as “energy savings” premium, that is, the premium that consumer would be willing to pay if the discounted annual savings during the lifetime of the refrigerator were considered (see Table 1). These results reflect very well the so-called energy efficiency paradox. Even in a case where energy labels help to overcome, partially at least, the lack of information or the existing other barriers, the consumer would still be far away of what s/he would be willing to pay if had known with certainty the amount saved over the lifecycle of the appliance. Perhaps including some information on the energy saved in monetary terms in the labels for appliances could help, although the accuracy of such an estimate would still be subject to consumption patterns and energy prices in the future.

The results from our statistical method suggest that in the absence of this information on savings (and no other barriers such as severe budget restrictions) 60 euro should be enough to switch new-appliances-consumers to high energy efficient appliances. Note that the energy efficiency subsidy program at the BAC pays up to 70 euro (while a minimum of 50 euro is regulated for all Spain).

Preliminary information on the CADEM program that has been running for three years, as well as the market data collected in 2009 for this study suggest that the policy has been very successful so far. Nearly all of the household appliances sold in the market nowadays are labelled A or A+.

Finally, the information from the premium has been combined with the conditions from a theoretically supported demand system to estimate the demand sensitivity of refrigerators with different labels to own and cross price variations. This latter set of results suggest that the demand for the most energy-efficient appliances is much more sensitive than the demand for the rest. These results are important when considering energy efficiency policies as they allow for better supported welfare analyses.

## References

- COD (2008). Proposal for a Decision of the European Parliament and of the Council on the Effort of Member States to Reduce Their Greenhouse Gas Emissions to Meet the Community's Greenhouse Gas Emission Reduction Commitment up to 2020. 2008/0014 (COD)
- COM (2008a) 778 final. Proposal for a Directive of the European Parliament and of the Council of 13 November 2008 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products [COM (2008) 778 final.
- COM (2008b). Comunicación de la Comisión al Parlamento Europeo, al Consejo, al Comité Económico y Social Europeo y al Comité de las Regiones, "Dos veces 20 para 2020. El Cambio Climático, una Oportunidad para Europa".
- European Council (2006). Presidency Conclusions of 23/24 March 2006 (7775/1/06 REV1 of 18.05.2006).
- IDAE (2007). Spanish Institute for Energy Efficiency and Diversification, Spain.
- IEA (2009). Implementing Energy Efficiency Policies: Are IEA Member Countries on Track? OECD/IEA, Paris.
- Jaffe, A.B., Newell, R.G. and Stavins, R.N. (2004). Economics of energy efficiency. *Encyclopedia of Energy 2*: 79-90.
- Linares, P. and Labandeira, X. (2010). Energy efficiency: economics and policy. *Journal of Economic Surveys*, forthcoming.
- McKinsey (2009). Pathway to a Low-Carbon Economy: Version 3 of the Global Greenhouse Gas Abatement Cost Curve. McKinsey&Company.

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