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The price of energy efficiency in the Spanish housing market

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HIGHLIGHTS

- The Spanish housing market lacks data on energy efficiency (EE) labels.
- We determine the EE ratings of a sample of 1507 homes across Spain.
- Homes labelled A, B and C account for less than 10% of the housing stock.
- Energy efficient dwellings have a price-premium between 5.4% and 9.8%, *ceteris paribus.*

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ABSTRACT

The housing sector is a substantial consumer of energy, and therefore a focus for energy savings efforts. The Energy Performance of Buildings Directive (EPBD), introduced in 2002 and revised in 2010, is a key instrument to increase the energy performance of buildings across the European Union. Following the implementation of the EPBD into Spanish law, all properties offered for sale or rented out in Spain are required to have an Energy Performance Certificate (EPC). Given that the implementation of the EPC scheme for new, existing and advertised properties is still very low in Spain, unlike other European housing markets, the Spanish one lacks market data on energy efficiency (EE) labels and their impact on housing price. To overcome this gap, we determine the EE ratings of a sample of 1507 homes across Spain on the basis of information collected previously through household surveys. This allowed us to answer the question of whether or not, and to what extent, Spanish housing markets capitalise the value of EE. We apply the hedonic-price technique and observe that more energy efficient dwellings have a price-premium between 5.4% and 9.8% compared to those with the same characteristics but lower EE level.

1. Introduction

The primary driver of global Greenhouse Gas (GHG) emissions is the production and consumption of energy. Under the context of climate change and energy dependence, most developed countries are attempting to reduce fossil-fuel use in the different economic sectors, such as buildings, transportation and industry. Compared to baseline scenarios in which the global mean surface temperature increment is limited to 2 °C by the end of the 21st century, global investments in energy efficiency (EE) in the buildings, transportation and industry sectors are expected to grow by a further $336 billion annually over the next two decades 2010–2029 (IPCC, 2014).

The building sector is a major contributor of GHG emissions. According to the IPCC (2014), when emissions from electricity and heat production are attributed to the sectors that use the final energy (i.e. indirect emissions), industry accounts for 32% of global GHG emissions, followed by Agriculture, Forestry and Other Land Use (AFOLU) emissions at 24.8%, building at 18.4%, while 14.3% and 11% is attributed to transportation and other energy, respectively. Throughout Europe, residential and commercial buildings are responsible for approximately 40% of the total energy consumption, and 36% of CO_2 emissions. In Spain, residences account for nearly 17% of the total final energy consumption, whereas buildings in the tertiary sector contribute 9% (IDAE, 2012b). Direct energy used in homes represents one fifth of the GHG emissions of Spain. Considering also the emissions arising from the construction process itself, the residential sector contributes one third of the

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total national GHG emissions (WWF, 2010).

Under the EU's targets for climate and energy[1] (20% improvement in EE and 20% GHG emissions reduction by 2020; 27% EE goal and 40% emission reduction by 2030), buildings have a large potential for cost-effective energy savings through effective EE measures. Some of these EE measures are informative and/or educative, some are mandatory, and some use financial incentives to promote EE behaviour (de la Rue du Can et al., 2011; Dixon et al., 2010; Geller et al., 2006; Markandya et al., 2015).

The Energy Performance of Buildings Directive (EPBD) (Directive 2002/91/EC)[2] is the main EU policy instrument to improve the energy performance of buildings, taking into account cost-effectiveness, and local conditions and requirements (Bio Intelligence Service et al., 2013). If fully and properly implemented, energy savings from implementation of the EPBD are expected to reduce final energy demand by 96 million tonnes of oil equivalent (Mtoe) in 2020, or 6.5% of EU final energy demand.[3]

The EPBD ensures that when buildings are constructed, sold or rented out, an Energy Performance Certificate (EPC) is made available to the owner, or by the owner to the prospective buyer, or tenant. The EPC shows an EE rating for the energy performance of a home from A to G, where A is very efficient, and G is very inefficient. The idea is similar to the ratings currently applied to domestic appliances. In addition, EPCs must include information on the energy needs or consumption of a building including reference values, as well as recommendations for cost-effective improvement options to raise the rating of the building. The recast of the EPBD in 2010 (Directive 2010/31/EU)[4] clarified some aspects, promoted the role of the public sector, and reinforced the role of EPCs by demanding publication of the EPC at the time of advertising a building for sale or rental rather than at the time of signing a purchase agreement or rental contract.

The implementation and effectiveness of the EPBD in Europe vary from country to country and region to region depending on a range of factors including the local political and legal context, and the characteristics of the local housing market (Bio Intelligence Service et al., 2013). Arcipowska et al. (2014) provides an overview of EPC schemes across EU countries concerning the type of label (classes label vs. continuous scale), the EPC calculation methodology (calculated vs. actual energy consumption) and software (public vs. private), the requirements for qualified and/or accredited experts (registers, training courses, mandatory exam, periodic renewal of the license), as well as the quality control schemes (national vs. regional level) and bodies in charge (government bodies, professional associations or third parties). In addition, the Buildings Performance Institute Europe (BPIE) offers a public database containing EU country-specific information about the EPC scheme, including general information, training of experts, calculation methodology, procedure, as well as compliance, quality control and penalties.[5] As an example, the appendix of the paper presents a table summarising main features of the EPC scheme for buildings in some European countries.

In Spain, the EPBD 2002/91/EC was transposed into the Royal Decree 47/2007, requiring an EE certificate (in the form of an energy label) to be provided just for new buildings. The Royal Decree 235/2013 incorporated the 2010 EPBD recast and extended EPC scope to all buildings, including existing ones. Thus, onward from June 2013, all properties offered, promoted or advertised for sale, or rented out in Spain are required to have an EE certificate.[6]

Informational failures seem to be pervasive and relevant to foster energy efficiency in the residential sector (Ramos et al., 2015). The EPC is designed to address both informational (asymmetric and/or incomplete information, principal-agent problems, transaction costs and uncertainty) and behavioural (decision-making heuristics and biases) failures (Linares and Labandeira, 2010; Ramos et al., 2015) so that individuals can make efficient decisions through the provision of direct, reliable and costless information that otherwise would not be available. Moreover, the information presented through the EPC can be seen as an incentive for builders and owners to invest in EE measures, as it can be hypothesised that the improvement of the energy performance of a building should then also lead to higher transaction prices and rents on the market. Much of the empirical research of the effect of EE ratings on building's prices is focused on commercial real estate markets (Eichholtz et al., 2013, 2010; Reichardt et al., 2012; Wiley et al., 2008). The literature on residential buildings is still limited but generally shows a positive relation between EE ratings and home prices or rental rates. The EE influence is strongest in the sales segment (Brounen and Kok, 2011; Fuerst et al., 2015; Hyland et al., 2013).

This paper will focus just on residential sector. The implementation of the EPC scheme for new, existing and advertised properties is still very low in Spain, and therefore, the Spanish residential market, unlike other markets across Europe, lacks evidence on the EPC penetration rate. Empirical research on the existence and magnitude of the price effects of energy labelling in the residential market would be relevant in evaluating the potential effectiveness of this type of EE measure and helpful for proper design of the labelling system.

The main scope of this work is to carry out an estimation of the importance of EE in the Spanish residential market. This is done by estimating how much is actually paid in the market for EE attributes that could be represented by an energy label. This is usually interpreted in the literature as the actual willingness to pay (WPT). Many other studies have used energy labels as a good proxy to estimate the WTP for EE in the housing sector (Brounen and Kok, 2011; Hyland et al. 2013; Fuerst et al., 2015), private vehicles (Alberini et al., 2014; Galarraga et al., 2014) and household appliances (Galarraga et al., 2011b). As widespread availability and consumer experience on EE ratings is still very limited in the study area, we determine the energy ratings of a sample of 1507 homes across Spain on the basis of information collected previously through household surveys, and using the CE3X software developed by the Spanish Institute for Energy Diversification and Saving (IDAE, 2012a). The marginal price differential due to improvements in EE is determined using a hedonic analysis. We also present potential energy savings from a switch to more efficient dwellings from less efficient ones.

The rest of the paper is structured as follows. Section 2 reviews the EE literature, and Section 3 presents the hedonic pricing method, the data used and the specified regression model for the

[1] http://ec.europa.eu/clima/policies/strategies/index_en.htm.

[2] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

[3] Impact assessment document accompanying the Proposal for a recast of the EPBD (2002/91/EC). Consulted (April 2015): http://www.buildup.eu/es/publications/1274.

[4] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).

[5] http://www.buildingsdata.eu/data-search.

[6] According to the Spanish Royal Decree 235/2013, the EPC assessment should be carried out by an authorized technician. The technician collects information related to the building's physical characteristics (e.g. orientation, exterior exposure, window and door openings), and calculates the CO_2 emissions and the corresponding EE label by means of a computer software (known as CE3X) created by the Spanish Institute for Energy Diversification and Saving (*Instituto para la Diversificación y Ahorro de la Energía*, www.idae.es). A report presenting and assessing various recommendations for improvements along with the resulting EE letter grade (between A and G) is generated. The certificate is validated and registered by the competent Autonomous Administration, and an original copy will be delivered to the property owner to be kept on file for 10 years or until re-validated.