IEB
Institut
d'Economia
de Barcelona

IEB Working Paper 2016/20

FUEL POVERTY: EVIDENCE FROM HOUSING PERSPECTIVE

Paloma Taltavull de la Paz, Francisco Juárez, Paloma Monllor

Energy Sustainability

IEB Working Paper 2016/20

Fuel Poverty: Evidence from housing perspective

Paloma Taltavull de la Paz, Francisco Juárez, Paloma Monllor

Postal Address:
Chair in Energy Sustainability
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/John M Keynes, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
ieb@ub.edu
http://www.ieb.ub.edu

IEB Working Paper 2016/20

FUEL POVERTY: EVIDENCE FROM HOUSING PERSPECTIVE

Paloma Taltavull de la Paz, Francisco Juárez, Paloma Monllor

ABSTRACT: The literature has traditionally approached fuel poverty as a result of poverty. Fuel poor are those households who cannot pay fuel bill and have to live in cold ambient, with grave effects on their health. As fuel poverty is actually considered in poverty's analysis, there is little discussion about whether homeowners (who own housing wealth and, theoretically, cannot be poor) could suffer this problem. This paper assesses fuel poverty amongst Spanish households. It deeps on how poverty situations triggers fuel poverty in the context of housing and discusses whether or not housing tenure causes fuel poverty due to housing characteristics, those usually evaluated as poverty component. The paper finds empirical evidence about the relevance of tenancy when it comes to explain the likelihood of falling under the poverty line as well as about the fact that fuel poverty has become a systematic situation in all poor Spanish households regardless of their tenant status. Using micro-data obtained from the Quality of Life Survey (EU-SILC) for Spain, the data are segmented by residential tenure and household type, calculating poverty lines for homeowners, renters (both at market prices and below them), and free-rent housing –the four tenure formulas existing in the Spanish housing market– and including two variables to capture fuel poverty situations. A logistic regression model is applied and results suggest that fuel poverty clearly appears as an expression of poverty at any tenancy type.

JEL Codes: L11, Q41, C24

Keywords: Housing poverty, fuel poverty, Spain, tenancy types, homeownership, rental market

Paloma Taltavull de la Paz
Department of Applied Economic Analysis
University of Alicante
San Vicente del Raspeig Campus
03080 Alicante, Spain
Telephone No. +34.965909693
E-mail address: paloma@ua.es

Francisco Juárez
Department of Applied Economic Analysis
University of Alicante
San Vicente del Raspeig Campus
03080 Alicante, Spain
Telephone No. +34.965909693
E-mail address: fjuarez@ua.es

Paloma Monllor
University of Valencia
Faculty of Medicine
E-mail address: Paloma.monllor@uv.es

1. Introduction

Since the financial crisis started in 2007, poverty and inequality have risen until unimaginable levels in developed countries, and symptoms of poverty have become increasingly evident. The consequences deriving from poverty include the failure to meet housing costs and the subsequent loss of dwellings through eviction which generates hard social problems. It is considered that a family (household) fall into extreme poverty and deprivation when they do not have a house or lose it. Seeking to avoid such problems, households dedicate increasing proportion of their income to cover housing costs, which makes them fall into other forms of poverty that prevent them from properly covering basic needs such as food or energy costs. These problems appear systematically in most developed countries and, as a result, poverty rises especially associated with specific social groups. Furthermore, the Global Financial Crisis (GFC) has exacerbated the process with the growth of new unknown poverty forms seemingly linked to a large ever-increasing part of the population.

The existing evidence confirms that households pay housing costs first, after which they meet their other needs with the remaining income, commonly lowering the use of energy in the house to fit the remaining budget; this results in a lack of heating and cold rooms[1]: the so-called *fuel poverty*. An increasing number of research works are showing that the goal of paying the electricity bill has become unattainable for households, as a result of which a decision is made to reduce energy consumption rather than other expenses. This entails life in a cold environment which is detrimental to health, especially for some more sensitive social groups such as elderly people or children, and a considerable reduction of well-being levels.

Fuel poverty is difficult to identify and measure, even though the literature estimates that this kind of poverty exists. Fuel poverty arises when the household is "unable to obtain adequate energy services for 10% of its disposable income" (Boardman, 1991:21; Moore, 2012; and Liddle *et al*. 2011; Schuessler (2014), Helay & Clinch, 2004, amongst others) [2]. Empirical evidence has been found about the fact that those households with

[1] Or so hot in some periods.

[2] The definition of 'Fuel Poverty' has been linked to the minimum adequate thermal regime in a house, which is 21^{o}C in the living room and 18^{o}C in the bedroom.

a higher likelihood of suffering fuel poverty also tend to be largely dependent on housing cost payments; so as a clear correlation should exist between these two types of poverty.

This paper turns around the rational argument of poverty driving it to a house-focus based on assessing how housing tenure triggers poverty situations and could be associated with fuel poverty situations. To our best knowledge, this study represents the first attempt to do that in Spain. The article is organized in six sections – including this first introductory one. Section 2 deals with the concepts of poverty and the role of housing as treated by the literature. As for Section 3, it explains the model and methodology chosen to analyse poverty as a whole, and particularly fuel poverty, in Spain. In turn, Section 4 explains the data, after which Section 5 discusses the findings obtained, while Section 6 provides the main conclusions.

2.- Theoretical basis

Poverty is the situation in which an individual or household does not have sufficient resources to meet their basic needs, severely constricting their basic consumption goods (Watts, 1968). Poverty is also defined as a situation where the household resources fall below a poverty line (Goedhart *et al*., 1977). The concept of housing within poverty studies relies on the idea that the need for accommodation occupies a second level of priorities after sustaining life (Maslow, 1943) what support the evidence that households cover residential costs first –rather than other goods or services– with their income. This implies that expenditure on housing will be given priority in deteriorating income situations which can result in a household's veiled impoverishment that is not detected in overall poverty analysis. Fuel and power costs could be included in the same bundle of costs, insofar as a cold house is not liveable. In fact, the concept of poverty at home (Friedman, 1966) refers to a very specific situation in which, as a result of changes in economic conditions, a household reaches poverty thresholds for maintaining residential consumption standards.

A more precise concept of poverty actually refers to a complex phenomenon where multiple factors make it difficult to determine when an individual or household is under poverty conditions. Poverty is measured using three types of indicators: (1) targets (Rowntree, 1901); (2) subjective; and (3) multidimensional deprivation (Townsend, 1987; Callan, Nolan & Whelan, 1993; Sen, 2000; Anand & Sen, 1976, amongst other studies).

Most perspectives include housing through an evaluation focused on cost of living (rent, objective approach) without distinguishing tenure or lack of housing quality/services as a part of deprivation index. Residential deprivation is considered to reflect a low capacity to meet housing needs and it is measured as the lack of other consumer goods or services, including concepts such as 'overcrowded houses,' when deprivation indices are calculated in the literature (Atkinson, 2003).

Housing physical characteristics are key to avoid negative effects on health (Lubell *et al*., 2007), guarantee children's development (Gifford & Lacombe, 2006), or household well-being (Atkinson, 2003) while the current literature actually sees deprivation (from the physical housing perspective) as the main sign of poverty (Sen, 2000). Whitehead (1998) defines the minimum conditions that a UK dwelling should meet to be considered acceptable and physically affordable (showing good conditions).

The physical aspects of a house have served as the tool used by the literature on poverty to deal with housing through the measurement of housing facilities below that threshold in a deprivation index (Townsend, 1987; Mack & Lansley, 1985), for which different methodologies have been utilised (See Ayala & Navarro, 2004 for a literature summary). To estimate deprivation scope, those papers include having a toilet/bath, structural problems in the house, lack of gas, electricity or heating, overcrowding or housing conditions (quality). Few works specifically include lack or heating/energy as a measure of deprivation (Brandolini & D'Alessio, 2000; Chiappero, 2000).

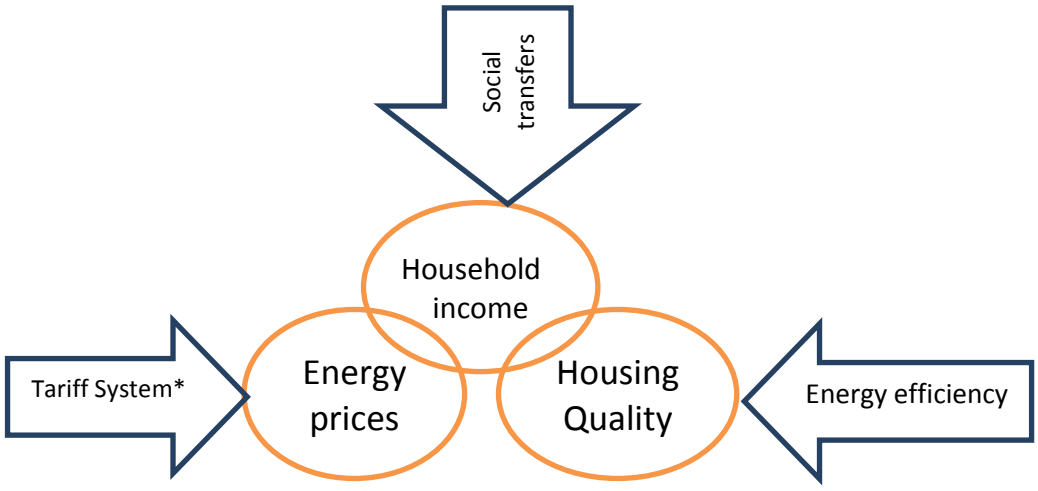
To this must be added that few studies focus on the role of ownership in reducing poverty (Burrows, 2003; Harkness & Newman, 2002; Lemanski, 2011) showing that home ownership can be a route to escape from the poverty trap providing a way to achieve a middle-class consolidation. From this perspective, ownership becomes a key issue in poverty studies which has not been fully explored yet.

Housing economics literature seeks to identify the housing poverty with lack on affordability which is the situation when a household cannot afford a house due to the amount of its current income. Lowering income during household life cycle could also result on this problem as the remaining income after to cover housing expenses could not be enough to guarantee basic needs. In those situations, the household not only reduces

consumption but also limits other expenses (e.g. energy) and approaches poverty risk situations (Marks & Sedgwick, 2008). If so, house is partly responsible household to fall under poverty. Such situation is extensively treated in housing literature. Hancock (1993:129) claims that housing consumption becomes essential in terms of meeting a basic need but without forgetting the existence of a certain amount of 'non-housing' consumption which should be guaranteed as a desirable minimum. The difficulty of measurement in this case has to do with the evolution of a person's circumstances over time (Bramley, 2006). Keeping such a minimum residual household income after having paid all the housing costs should definitely be a socially acceptable standard (Hancock, 1993; Burke, 2004; Stone, 2009). Housing literature coincide with poverty literature in identifying how poor houses are a sign of low affordability or poverty(Bramley (1990:16) specifies that "households should be able to get housing that complies with appropriate characteristics (given the nature and size of the home) and net income that leaves them with enough income to live without falling below the poverty line."). Low quality means lack of isolation and other structural insufficiencies which can be associated to an excess of expenses in other services, like energy. Under the 'fuel poverty-10% rule', not all households make the same effort to cover their housing needs, and a severe effect is caused on low-income households. The difficulty consists on identify how extend this problem appear in households and why.

Following Tirado Herrero *et al*., 2014, fuel poverty is triggered by a combination of three factors defined at a household scale: Income; energy prices; and housing-and-facility-related energy efficiency (Figure 1) which permits to understand how fuel poverty arises and provides guidelines for the definition of public policies.

Figure 1. Fuel poverty dimensions



*Refers to the fare system in the Electric sector
Source: Tirado Herrero *et al*. 2014,

All three dimensions refer to the socioeconomic arena, which determines the level and income stability in households, as well as to both supply- and demand-related aspects of the energy policy. From the supply side, energy prices are strongly influenced by the existing regulation. Instead, from the demand side, incentives to retrofit are relevant to lessen energy consumption together with CO^2 emissions in the housing markets, allowing for a general limitation (restriction) of energy consumption at an aggregate level and reducing energy bills to help low-income households (the larger the income, the lower the efficiency in the house). However, empirical research asserts that the willingness to pay or invest in housing improvements depends on whether the house is home-owned or rented.

The analysis to discover the existence and reasons of fuel poverty has been raising more and more interest in some countries, amongst them the United Kingdom[3], Ireland[4], Austria,[5] and New Zealand[6]. Thomson and Snell (2013) examine the case of the EU as a whole. Those studies have provided empirical evidence suggesting that households with some member above 60 years of age, families with children, handicapped or chronically ill household members constitute the most vulnerable groups (DTI, 2001, pp. 8-9, quoted in Boardman 2012, p 23) when it comes to fuel poverty. The reason for this lies in the fact that their energy expenses are larger than others corresponding to the rest of basic needs (O'Neill *et al*., 2006). Empirical evidence also suggests that energy expense is essential; in fact, households could be considered a 'captive demand' affected by market-control-decisions to fix prices –and this entails severe social effects.

Unlike what is outlined in poverty literature, energy literature identifies a number of relationships between fuel poverty and housing. The emphasis is placed on the analysis of social housing (Jenkins *et al*., 2011). Boardman (2012, pp. 138-140) states that the largest part of fuel poor households corresponds to tenants paying rent at market prices –rather than those with a lower rent coming from social benefits; market-rent households most probably fail on fuel poverty due to deficient isolation in their dwellings. She, then, claims that most of the fuel poor are found in the private sector rather than in the low income-rented sector, with a larger likelihood of private rented households becoming fuel poor due to lack of insulation in their houses. A

[3] See Hills (2012); Liddle and Morris (2010); Moore (2012); and Walker and Day (2012), as reference reports summarising this problem.
[4] McAvoy, Hellen (2007)
[5] Simshauer *et al*. (2011) and Brunner, K.M., Spitzer, M. and Christanell, A. (2012)
[6] Lloyd, B. (2006)

large proportion of homeowners also follow a similar pattern with a high percentage of outright-old homeowners who, despite being rich in assets (house), are poor in income and fuel poor too, as well as some younger households with pending mortgages payments that become fuel poor too. The link between fuel poverty and social imbalance (mainly associated with low income) has been a constant in the literature's attempts to identify the reasons for fuel poverty (Braubach & Fairburn, 2010). Young people with mortgage charges could find the loan repayment makes it very difficult for them to properly cover the cost of other consumer goods such as energy. Little evidence of these cases is available, though.

In the specific case of Spain, no evidence of fuel-consumption-related poverty exists, and only few mentions have been made of the connection with housing deprivation. Ayala and Navarro (2004) analyse the case of housing deprivation in Spain taking the works of Sen (1983, 2000). They did not find thorough evidence about whether lack of heating constitutes a deprivation problem '*due to the benign climate in some regions of Spain … as most households located in regions with high temperatures did not have heating'* (Ayala and Navarro, 2004:18). They coincide with Boardman (2012) in that "the relative risk of suffering from multiple housing deprivation is greater for households living in rented or freely-provided houses than those living in owned properties" (op.cit. page 27).

Summarizing, literature identifies that a household could fall under poverty when the residual income (after housing costs) does not allow for basic goods consumption. A household failing to cover the energy cost to heat its house is considered to be in fuel poverty. Fuel poverty occurs when a household cannot have adequate energy services for 10 per cent of its income due to a combination of causes, as low income, low energy-inefficient homes (Boardman, 2012:21) but also economic and institutional changes. The existing evidence suggests that vulnerability to fuel poverty affects families older than 60, with children, disabled people or people suffering from long-term diseases. Energy literature identifies some significant relationships between energy poverty and tenure, and identify how a household does not need to be poor to suffer fuel poverty (Boardman, 2012) and fuel poor appears most in private housing sector rather than in public-low income housing.

Following the approaches explained above, the structure of housing tenure could be key to analyse the existence of fuel poverty and the way in which housing poverty is related to fuel poverty. The present paper adds empirical evidence of the existence of fuel poverty using Spanish statistics to test two hypotheses. Ho_1 is whether and how (housing) deprivation signals are linked to fuel poverty; whereas Ho_2 tests the role of fuel poverty as an element directly affecting poverty. They both allow us to support the Boardman (2012) views about the group of households affected the most by fuel poverty.

3.- Model and methodology

This paper tests whether or not the house characteristics that the literature associates with poverty also has to do with the likelihood of being poor when tenancy comes into play. The model adds empirical evidence of the idea that lack of energy is one of those characteristics, supporting and measuring the impact of fuel poverty amongst poor households controlling by tenure throughout the 2004-2012 period.

Expressed differently, our paper tests the following relationship

(1) $$(H\_poor_i|T) = \alpha + \sum_{i=1}^{n} \beta_i x_i + \gamma_i Fp_i + \mu_i$$

Where:

H_poor_i is the household under the poverty line,

T is the tenancy type (four categories: ownership; rent at market prices; rent below market prices; and tenant for free)

Xi is a matrix of 9 house characteristics identified by the literature as signs of deprivation, namely: overcrowding (person per room); availability of a bath/shower, toilet; natural light in the room; noise; pollution; delinquency in the neighbourhood; and leaks/humidity in rooms. It also includes type of house (four categories: single family house, detached house, apartment low density or apartment high density) and urban density in population.

Fp is a measure of fuel poverty captured through the responses by household about the possible lack of an adequate temperature in the house (1= no, 2= yes)

α, β, γ are parameters to be estimated

μ is a random parameter

The model calculates the likelihood of being poor related to housing characteristics (following the physical housing deprivation approach), and including two proxy variables: One indirectly measures the capacity to pay energy for the home, and the second measures the association between housing quality and energy consumption, both distinguishing between tenure types. The data used here come from the Life Conditions Survey, the European survey for Spain (EU-SILC), which is representative of the whole population and was available from 2004 to 2012.[7]

The analysis requires to estimate the poverty line and classify the households according to. Firstly, an individual poverty line estimate is carried out in relation to each region. Following the literature, the poverty line is defined as 60% of the income distribution median. Thus, the calculation of (disposable) income distribution by region (Autonomous Community) was followed by the assignment of a poverty line to each observation varying per region and year. This means that the poverty line varies according to space and time in our model. Households are classified as poor or not poor depending on whether their yearly income falls under the assigned poverty line used as a threshold. A dummy variable taking value one for income levels below the Poverty line and zero otherwise is computed by household. Note that a household classification as poor can vary on a yearly basis allowing to capture entrances and exits from poverty as effects of independent variables in the model.

The use of multivariate techniques permits to define a binomial logistic regression model meant to test the likelihood of a specific household falling under the poverty line is related to house deprivation and fuel poverty depending on tenure and household type. The equation below serves to define the conditional probability to be poor:

$$\Pr(poor = 1 \parallel x, fp, T, H) = \pi_i(x, fp, \beta \parallel T, H) = [T_t, H_t] \left[\frac{exp(x,fp,\beta)}{1-exp(x,fp,\beta)}\right] \quad (2)$$

[7] Surveys for 2013 and 2014 are available but the data in Spain have undergone methodological changes affecting income variables that make it impossible to compare disposable income levels between years. That is why the present study ends in 2012.

In a binomial logistic model, conditional probability is expressed as follows:

$$\Pr(poor = 1 \parallel x, fp, T, H) = ln\left[\frac{\pi_i}{1-\pi_i}\right] = exp[X'\beta + \gamma fp] \parallel [T_t, H_t] \quad (3)$$

Where

Poor is a dummy variable taking value =1 if the household income is below the poverty line.

x is a matrix of the 'i' house characteristics referring to deprivation mentioned above.

fp stands for the variables approaching to fuel poverty

Tt is a housing tenure grouping variable, with t=1..4 (ownership; rent at market prices; rent at prices under the market; and free-of-charge (free-rent) housing)

H_t *is* the type of household with the six categories explained below.

β, γ are the parameters to be estimated.

Matrix 'x' includes 12 variables, ten of them are tested by literature as components of poverty indicators from the housing perspective. These are urban density (3 categories, low, average and dense, *urb_density*), type of house (four categories: apartment in high dense building, apartment in low dense building, detached house and single-family house, *type_house*), lacking of natural light in the house (2 categories, 1=yes, 2=no, *Nat_light*), problems with noise with the neighbours or in the neighbourhood like traffic (2 categories, 1=yes, 2=no, *Noise*), problems with contamination and dirty neighbourhood (2 categories, 1=yes, 2=no, *Pollution*), problems with delinquency or vandalism in the neighbourhood (2 categories, 1=yes, 2=no, *Delinquency*), the house have got bath or shower (2 categories, 1=yes, 2=no, *bath/shower*), the house have got a toilet with current water for private use (2 categories, 1=yes, 2=no, *toilet_in*), overcrowding (person per room, continuous variable) and the existence of leaks or humidity in the house (dummy, 0=yes, 1=no, *leaks/humid*)[8]. The variable approaching the fail on covering energy costs to maintain temperature indoors is the so-called '*temperature_winter*'. It is the answer to the question 'Is the (home) temperature adequate in winter?' (dummy, 0=yes, 1=no) included in the database. The answer is considered here as a measure of the willingness to pay energy costs. It is also considered here that fail to cover adequate temperature could also be related to the house quality. Those units where lack of temperature and the existence of leaks exist would

[8] The categories are the same that the existing ones in the database. Only Leaks has been recoded to 0/1

be showing that the reasons to fail adequate temperature are due to low housing quality. That is why an additional new variable is created by a combination of Leaks/humidity and temperature (so-called *leaks@temperature*).

The estimated parameters β and γ summarize the effect of each predictor. Logistic regression coefficients are interpreted when re-estimated as $\exp(\beta)$, meaning how likely the event is to occur when the predictor changes one unit.

Evidence to support the hypothesis is obtained by means of two successive models.

Model estimates the likelihood of falling under the poverty line associated with fuel poverty (the two measures of the insufficient energy consumption to keep the house conveniently heated) and controlling for those housing quality characteristics that reveal deprivation, depending on tenancy category (5)

(5) $$Pr_I(poor = 1 \parallel T) = e^{[\propto_I + \sum_{i=1}^{n} \beta_{I,i} x_i + \gamma_{I,i} Fp_i + \mu_i]T}$$

With the variables and parameters defined above. In this case, sub-index *I* refers to parameters in Model I, and the model is segmented by tenure category.

4 - Data and description

The data used in this study come from the Survey of Living Conditions (EU-SILC) with a temporal coverage from 2004 to 2012 (INE). It is a panel of micro-data with a total of 117,465 usable observations –reduced to circa 100,000 when housing characteristics are used. Table 1 summarize the basic statistics.

Insert table 1 around here

Both the Spanish Census and the Life Conditions Survey report the existence of four tenure forms in Spain, namely: (1) homeownership; (2) rental, with rent paid at market prices; (3) rental, with rent paid below

market prices; and (4) free-rent tenure (having a house for free). Table 1 shows how distribution is left centred with the largest group of households in the first category.

Table 2 shows the distribution, by tenure, total household income, estimated poverty line, and household weight by tenure. Tenure distribution is very similar in both household groups (total and households under poverty line): most households (82.8 % in total, and 83.02 % of those classified under the poverty line) are homeowners; 7.6% and 6.9 % are tenants paying rent at market prices and below market prices, respectively.

Insert table 2 around here

Figure 1 shows how the entire population's poverty rate reaches 26.7%, similar to that of homeowners (26.8%), with a lower weight in the case of rent at market prices (24.4%), a concentration of poverty amongst tenants paying rents at prices below market (27.5%), and amongst those who have access to free transfer housing (28.33%).

Insert Figure 1 around here

Finally, it is interesting to look at the 'history' of tenure in the Spanish households classified as poor. Figure 2 shows below-poverty-line households classified according to the year when they arrived at their current house. The picture illustrates the process through which access is gained to ownership in Spain. The blue line shows a continued access of households to homeownership since the 1960s, and how the rental market remains as a medium term (temporary) solution to cover housing needs, with contracts having an average 10-year length. The third tenancy type in relevance is free-rent houses, with a similar weight than rents at market prices.

Insert Figure 2 here

Figure 2 highlights the nature of substitutability in tenures: a majority of the households classified as poor in the LCA Survey declare that they became homeowners more than forty years ago, whereas the remaining renters appear to correspond to recent, shorter-term situations. This distribution suggests that the groups at risk of falling into poverty would use the rental market temporarily, and also that ownership access happens

independently of poverty. This reduces the perception according to which poor households must be living on rent.

5- . Results and discussion

The model defined above allows to estimate the relationship between poverty and fuel poverty controlling by housing quality and the main variables related poverty identified by the literature as low quality, overcrowding, delinquency, pollution or negative neighbourhood characteristics. It is considered here that when the remaining income does not allow households to cover the energy costs needed to heat the house, they consequently declare that the house is cold.

Table 3 contains the baseline logistic regression model estimated using five different functional forms in which the variables are step-wise added and parameters are recalculated. Model includes fuel poverty indicator (temperature) in all cases. In Models I, II and III, the combined variables measuring temperature associated to quality (leaks@temperature) and tenancy are added while in models IV and V, fuel poverty variable is time-varying tested (time dummy by year times temperature) in order to estimate their consistency along the period and the potential variability due to the crisis impact. All the models are highly significant with statistically significant Chi-2 showing consistency in the model specification in spite of small goodness of fit (Pseudo-R2 = 0.023-0.037 on average) which suggests that fuel poverty induce marginally poverty among Spanish households in poverty but it is systematically significant.

Regarding the parameters, results shows a clear association between fall in poverty and quality characteristics such as[9] lack of bath/shower (β= 0.94, that is a lack of bath is associated to a 157% on the probability to become poor ($e^{\beta}-1$)), natural light in the house (β= -0.155, suggests that to have sufficient light in rooms is associated to a decrease on the likelihood to become poor by a 14%), leaks and humidity (β= -0.229, that is, not having leaks or humidity problems in house reduce the likelihood to become poor by a 20%), delinquency (β=-0.143, not having delinquency problems reduce likelihood to become poor by a 13%), thus suggesting that the worse the quality characteristics in the house, the larger the likelihood of falling under the poverty line. Additionally, pollution is positively correlated to poverty (β= 0.07), which explains that not having contamination problems is associated to increase on probability to become poor in a 7%, so that, poor households are more likely to be located in polluted areas. Similar parameters for type of house suggest

[9] Parameters reflected here belong to Model I

that any household living in the three categories other than in dense-building apartment has an increasing likelihood of becoming poor, more in low dense apartment (β=0.27) and in single-family houses (β=0.22) than in detached houses (β=0.194). That is, estimated results suggest that switching from a high density apartment to a low density apartment increases the likelihood of becoming poor by 32% ($e^{\beta}-1$) and from there to a detached house does so by 21%. The mobility between housing types highlighted by Model I's results implies hard income sacrifices for households.

Taking the low density urban area as a reference, findings reveal that households are less likely to become poor when located in larger dense regions. The probability to fall below the poverty line decreases by 7.5% ((exp(-0.078))-1) when the household is located in average-dense cities rather than in low-dense cities, and similar proportion for high-dense -area location, suggesting that poor households are located in less dense areas (consistent with the idea of lower house prices).

Overcrowding is strongly associated with poverty likelihood (β= 0.405). This is a highly significant parameter, since an extra-person on average in each room increases the likelihood of falling under the poverty line by 50%. The parameter is according to the literature and consistently suggests that a higher number of individuals per room is associated with increasing likelihood to become poor.

Results confirm what other studies had previously found: poverty is associated with poor house conditions and in lower dense population urban areas[10]. The type of house variable points at a similar distribution of poor households across the different house typologies, which could be interpreted as poor households are not directly linked to a particular house type but rather that they could be spread across all of them. These results would imply that poverty happens at all housing type levels.

The variable 'temperature' shows the answer to the question of whether rooms have an appropriate temperature to live or not. The estimated parameter is large (β= 0.89) and statistically significant in all models which clearly shows the strong association between the lack of temperature and poverty. Our hypothesis here is that lack of appropriate temperature results from a low energy consumption; therefore, households' answers to the survey are revealing trouble with energy payment to heat the house. Our

[10] This result is consistent with the income used to estimate the poverty line, the region median income, as it is assumed that larger cities also shows larger household income. There is no information detailed at infra-regional level to be used as a reference in EU-Silc.

findings support this interpretation too: the increase of one category (i.e. passing from 0 – 'enough temperature'– to 1 –not enough temperature–) is associated with a 143% increase in the likelihood of falling under the poverty line. Therefore, heating the house has a direct connection with income level, and results in Model I strongly suggest the existence of fuel poverty.

Model extensions indicate that tenancy is significantly related to model variables and poverty (model II). In addition, the inclusion of the non-linear combined variable (leask@temperature) to capture the effect of lack on temperature associated to housing quality, is also statistically significant, reducing only a few the temperature parameter value[11] . Its parameter (β= 242, model III) suggests that any rise in temperature and reduction on leaks increases the likelihood to become poor in a 27%, as a potential measure of heating costs to be covered by household.

Models IV and V substitute the temperature variables by time-varying temperature variable, capturing how the likelihood of become poor due to fuel poverty by year rises during the whole period, especially strongly since 2010. Figure 3 shows graphically those results.

Insert Figure 3 around here.

As model V gives the better results, its functional form is adopted for the rest of the models in this paper.

- **Results of Model by tenancy type**

Table 4 includes the models specification estimated by each type of tenancy with Model VI for homeownership until model IX to free-rent households. Results show relevant variations when the model is segmented by tenancy.

The homeownership results (model VI) largely resemble those found in the baseline model. As for the estimated parameters, they have same signs and closed values, thus suggesting that the problem of houses increasing the likelihood of falling under the poverty line mentioned above in relation to the whole model

[11] There are no large correlation among the three variables (temperature, leaks/humedity and the combined) although they are statistically significant. In any case, correlation is larger than 0.1 so as we assume no multicolinearity severe problems into the model and include the new variable.

becomes fully visible in ownership-model. This contradicts a widespread idea in the literature according to which ownership is associated with larger income and, therefore, with a lower propensity to becoming poor.

In the case of poor homeowners, as expected, the house transition (change of housing type) is harder; the likelihood increases by 32% if households live in a detached home. Such result becomes very relevant, insofar as most medium-income young first-households become homeowner in the last decade by buying a detached houses, very popular in Spain during the last 20 years. Results about urban density, lack of natural light and delinquency replicate that commented above while noise, pollution or having toilet in the house are not significant in this model. Differences on quality are highlighted by the variable lack on bath/shower, largely associated to the likelihood to become poor (247%) while overcrowding show a very low probability of poverty (8%) which is consistent with larger houses owned. Fuel poverty indicator shows statistically significant probability to become poor associated to failing heating the house, which vary with time but is lower than in the baseline model as well as in the other tenancy types as explained below. Figure 3 represent the evolution of probability to become poor due to fuel poverty. In the case of fuel poverty-associated-to-housing-quality proxy, the model gives an statistically significant parameter suggesting that this problem mainly affect homeowners, with a probability to become poor of 23% (β=0.207).

In the case of tenants paying rent at market price, no large association seems to exist with deprivation-low quality characteristics (Table 4, model VII). Findings shows higher neighbourhood noise is associated with an increased poverty likelihood (β=0.19, probability of 21%), and humidity (β =-0.25, prob=21%[12]) in the house. Overcrowding parameter (β =1.078) suggests that an increase on one person by room rises the probability to become poor of 193%. In rental market, consistently fuel poverty associated to house quality is not statistically significant, supporting the perception of large quality in rental market with low dense apartments (β=0.178) and single houses (β=0.327), while fuel poverty indicator parameters (β=0.80 to 1.18 between 2007 and 2012) are strongly significant and suggesting large association with the likelihood to become poor (see Figure 3). This model shows a better goodness of fit (C&SR^2= 7.8% and NR^2=11.07%). A possible interpretation could be that Spanish houses in rent have better conditions (not associated with physical

[12] This parameter is expected to be negative when leaks are associated to probability to be poor because the variable codification: the existence of leaks is the lower value.

deprivation) than those in ownership, but also are associated to a lower energy payment capacity. Results suggest that rental are randomly distributed among urban areas; more concentrated in single houses and low dense apartment homes, (which suggests that rent market is represented in these house typologies), so that rental units have enough quality to be rented through the market –which in turn can be a sign of regulation about a minimum quality requirements to obtain permissions to be rented. Main physical deprivation is not related to rent houses at market prices, which contradicts to some extent what the literature has traditionally suggested. However, these tenants seem to suffer problems with leaks and temperature which also refers to the existence of fuel poverty in this group.

Renters paying below-market prices (Table 4, model VIII) show also good house conditions and no apparent likelihood exists of inducing poverty resulting of physical deprivation, although one variable –delinquency (β=-0.31) in the neighbourhood– is actually associated with an increased likelihood (22%) becoming poor. No type of houses are statistically significant in terms of association with this group, i.e. rental houses under the market price seem to be fully located in the dense apartment building. Overcrowding (β= 0.586) is statistically significant suggesting that the larger the household, the large (79%) the likelihood of becoming poor. In this case, results indicates that concentration in dense areas reduce the poverty likelihood in a 31% (β=-0.365).

Fuel poverty shows similar effect than in tenants-at-market-price model, that is, the inability to achieve a proper temperature is associated with poverty. Time parameters suggests that any increase on proper temperature in the house has probabilities to fall into poverty larger than 98% and increasing along the analysed period, being harder during the first years (2005-2009) rather than in the second (Figure 3).

The last segment includes households enjoying a house free of payments. Some sources suggest that household live in a house for free because (1) companies give the house for their workers to live in it as part of their salaries. (2) Households allow some of their members (young adults) to live in a secondary home for free; and (3) Municipalities give public houses to those extremely-low income households. The third group (low-income households, social houses) seems to arise with the model results which suggest the existence of a close pattern to the renters under market prices: it does not identify physical deprivation associated with

houses or house types; only delinquency (β=-0.194, prob=17%) reveals a certain degree of lack of quality more related to house location. Two additional results are also in keeping with the rest of models: (a) Overcrowding estimated parameter is significant but lower than in the rest of tenancy type (but ownership, β=0.196); and (b) the fuel poverty parameter is also strongly significant, and the largest one in the estimates (β=from 0.75 to 1.06), showing a worsening situation since 2009 (that is, from that year having a correct temperature increases between 1.11% to 190% the likelihood of household to fall under poverty line).

The bottom line in Table 4 includes the fuel poverty proxy parameter estimated in a model when it is not considered time varying. As it can be seen, estimated values are consistent with the above interpretation and gives a clear sign showing the existence of different exposures to fuel poverty depending on tenancy type. Results are consistent with the existing empirical evidence with extends impact of this problem and stronger effect on those household in rental market.

5 – Conclusions

This paper has analysed the relationship between poverty and fuel poverty associated with the different tenancy and household types throughout the Spanish housing market. Using data from the Quality Life Conditions Survey (EU-Silk), period 2004 to 2012, our study defines a logistic regression model to estimate the conditional effect of tenancy and household structure on the likelihood of falling under the poverty line as a consequence of housing deprivation and fuel poverty. Results give consistent and robust answers to the paper hypothesis, which can be outlined as follows:

(1) Models provide empirical evidence about that homeowners show the larger probability to fall into poverty associated with physical deprivation, as opposed to renters, who do not. It can be said that poor renters enjoy (on average) better houses than poor owners. All types are highly sensitive to those house characteristics which have to do with energy consumption. An explanation of these results could be on that the owner is who invest on housing refurbishing to rent the house to third households. However, most owners that bought a house long time ago and are surviving without covering current housing costs, could be facing deprivation due to income poverty –but not extreme-poverty thanks to ownership. From this perspective, ownership rates would prevent households from extreme poverty.

(2) Models focuses on how fuel poverty constitutes a mirror of poverty situations across every type of tenancy. Results are clear, suggesting that fuel poverty is largely associated with poverty at any type of tenancy –the situation being harder for households on a free-assigned-housing basis. Energy bill appears here as a relevant problem related to poverty, since the results obtained in this paper support the idea to develop policy measures focused on incentives to retrofit and adapt houses so that they can become energy-efficient. Such policies could contribute to achieve a twofold objective: (a) mitigating poverty pains; and (b) improving sustainable houses.

(3) Results identify and increase on fuel poverty problems among all type of tenure but harder in those tenants (at market prices, under market price and free-rent) and for young singles and 2-adults families as well as for couple with children. Those are the key groups suffering fuel poverty which induce them to fall in poverty with larger probabilities. Some changes in the market/electricity bills should be a shock in 2009 increasing the fuel poverty impact.

In the light of the results explained above, the paper adds empirical evidence on that fuel poverty plays a role increasing poverty signs and reducing welfare. Fuel poverty seems to affect the whole segments of poor households and the fuel poverty related to housing quality affects largely to homeowners suggesting that house retrofitting in homeowner sector is highly needed to improve welfare and reduce fuel poverty in the more vulnerable groups. As they are large number, it also can support the energy consumption (and emissions) reduction allowing policy measures to solve two problems at the same time.

References

Atkinson, A.B. (2003) Multidimensional deprivation: contrasting social welfare and counting approaches, *Journal of Economic Inequality*, 1: 51-65

Ayala Cañon, L. & Navarro Ruiz, C. (2004), Multidimensional indices of housing deprivation with application to Spain. *Papeles de trabajo del Instituto de Estudios Fiscales*. Serie Economía, 12: 1-31

Boardman, B. (1991) *Fuel poverty: from cold homes to affordable warmth*. S.l.: Pinter Pub Limited.

Boardman, B. (2011) 'Liberalisation and Fuel Poverty', in Ian Rutledge and Phillip Wright eds. UK Energy Policy and the End of Market Fundamentalism. Oxford: Oxford Institute for Energy Studies.

Boardman, B. (2012) Fixing Fuel Poverty. Challenges and Solutions, London: Earthscan

Bramley, G. (1990) Access, affordability and housing need. *School for Advanced Urban Studies*, University of Bristol, UK

Bramley, G. (2006), "Affordability comes of age," in P.Malpass & L.Carincross (ed) "*Building on the past visions of housing tenures*". Bristol: Policy Press

Brandolini, A. & D'Alessio, G. (2000). Composizione familiare e distribuzione del reddito in Italia e in alcuni paesi dell'Unione Europea. *Economia della famiglia e politiche sociali, CNEL, Roma*, (28): 308-361.

Braubach, M. & Fairburn, J. (2010), Social inequities in environmental risks associated with housing and residential location – a review of evidence. European Journal of Public Health, Vol. 20(1): 36-42

Brunner, K. M., Spitzer, M. & Christanell, A. (2012). Experiencing fuel poverty. Coping strategies of low-income households in Vienna/Austria. *Energy Policy*, *49*: 53-59.

Burke, T. (2004) "Measuring Housing Affordability," *Swinburne Monash AHURI Centre,* Swinburne University of Technology

Burrows, R, (2003) Poverty and home ownership in contemporary Britain, Bristol: The Policy Press.

Callan, T., Nolan, B. & Whelan, C.T. (1993) *Resources, deprivation and the measurement of poverty*. Economic and Social Research Institute, Dublin.

Friedman, Lawrence M., (1966) Public Housing and the Poor: An Overview, *California Law Review*, 54(2), available at http://scholarship.law.berkeley.edu/californiareview, (accessed 13 January 2006).

Gabriel, M., Jacobs, K., Arthurson, K. & Burke, T. with Yates, J. (2005) "Conceptualising and Measuring the Housing Affordability Problem," National Research Venture 3: *Housing Affordability for Lower Income Australians*, Research Paper 1. Melbourne: Australian Housing and Urban Research Institute (AHURI).

Gifford, R. & Lacombe, C. (2006) Housing quality and children's socioemotional health, *Journal of Housing and Built Environment*, 21: 177-189

Goedhart, T. Halberstadt, V., Kapteyn, A. & Van Praag, B. (1977) The Poverty line: Concept and Measurement, *The Journal of Human Resources*, 12(4): 503-520

Hancock, K. E. (1993) Can Pay? Won't Pay? or Economic Principles of Affordability, *Urban Studies*, 30(1): 127-145

Harkness, J. & Newman, S. (2002) Homeownership for the poor in distressed neighborhoods: Does this make sense? *Housing Policy Debate*, 13(3): 597-630

Healy, J. D. & Clinch, J. P. (2004). Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland. *Energy Policy*, *32*(2): 207-220.

Hills, J. (2012), Getting the measure of fuel poverty: final report of the Fuel Poverty Review. CASE report 72, LSE, London, available at http://eprints.lse.ac.uk/43153/1/CASEreport72(lsero).pdf) (accessed 10 Dec 2014)

Jenkins, D., Middlemiss, L. & Pharoah, R. (2011) A study of fuel poverty and low-carbon synergies in social housing, UKERC and NESTA report, available at http://eprints.whiterose.ac.uk/79391/1/FuelPovertyReport220711.pdf (accessed 5 Nov 2014)

Kutty, N., (2007) Housing Affordability in the United States: Price and Income Contributors, available at: http://ssrn.com/abstract=1002249 (accessed 18 June 2013)

Kutty, Nandinee K. (2005) A New Measure of Housing Affordability: Estimates and Analytical Results, *Housing Policy Debate* 16(1): 113-142

Lemanki, C, (2011) Moving up the ladder or stuck on the bottom rung? Homeownership as a solution to poverty in urban South Africa. *International Journal of Urban and Regional Research*, 35(1): 57-77

Liddle, C. & Morris, C. (2010), Fuel poverty and human health: a review of recent evidence. Energy Policy, 38(6): 2987-2997

Liddle, Morris, C, McKenzie, P. & Rae, G. (2010), *Defining Fuel poverty in Northern Ireland. A preliminary Review*. Belfats: The University of Ulster publ.

Lloyd, B. (2006). Fuel poverty in New Zealand. Social Policy Journal of New Zealand, vol. 27: 142-155

Lubell, Crain, R. & Cohen, R. (2007) Framing the issues – the positive impacts of affordable housing on health. *Center for Housing Policy*, Enterprise, available on https://s3.amazonaws.com/KSPProd/cache/documents/653/65301.pdf (accessed 12 Sept 2015)

Mack, J. & Lansley, S. (1985) *Poor Britain*. London: Allen & Unwin

Marks N. & Sedgwick, S.T. (2008) Is There a Housing Crisis?. The incidence and persistence of housing Stress 2001-2006, *The Australian Economic Review*, 41(2): 215-221

Martinetti, E. C. (2000). A multidimensional assessment of well-being based on Sen's functioning approach. *Rivista internazionale di scienze sociali*, 108(2): 207-239.

Maslo, A, (1943) A Theory of Human Motivation, *Psychological Review*, 50(4): 370-396.

McAvo, H. (2007), All-Ireland policy paper on fuel poverty and health, IPH (`Public Health Policy Centre), available at http://www.lenus.ie/hse/bitstream/10147/45784/1/9138.pdf (accessed 20 July 2014)

Moore, R. (2012), Definitions of fuel poverty: Implications for policy, Energy Policy, 49: 19-26

O'Neill, T., Jinks, C. & Squire, A. (2006), Heating is More Important Than Food, Older Women's Perceptions of Fuel Poverty, Journal of Housing for the Elderly, 20(3): 95-108

Rowntree, B.F., (1901) *Poverty- A Study of Town Life*, London: MacMillan

Schuessler, R. (2014). Energy Poverty Indicators: Conceptual Issues-Part I: The Ten-Percent-Rule and Double Median/Mean Indicators. *ZEW-Centre for European Economic Research* Discussion Paper, nº 14-037.

Sen, A. (1976) Poverty: an ordinal approach to measurement. *Econometrica*, *Journal of the Econometric Society*, 44(2): 219-231.

Sen, A. (1983) Poor, Relatively Speaking, *Oxford Economic Papers*, 35(2): 153-169.

Sen, A. (2000) *Libertad y desarrollo*, Bogotá: Editorial Planeta

Simshauer, P., Nelson, T, & Doan, T. (2011), The Boomerang Paradox, part I: How a nation's wealth is creating fuel poverty. *The Electricity Journal*, 24(1): 72-91,

Stone, M. E. (1993) Shelter Poverty: New Ideas on Housing Affordability, Philadelphia, Pennsylvania: *Temple University Press*.

Stone, M. (2009) Unaffordable 'Affordable' Housing: Challenging the U.S. Department of Housing and Urban Development Area Median Income, *Center for Social Policy Publication*, Paper 36. Available at http://scholarworks.umb.edu/csp_pubs/36, (accessed 5 March 2011).

Thomson, H. & Snell, C. (2013). Quantifying the prevalence of fuel poverty across the European Union. *Energy Policy*, *52*: 563-572.

Tirado Herrero, s., Jiménez Meneses, l., López Fernández, J.L., Martín García, J. & Perero-Van-Hove, E. (2014) Pobreza energética en España. Análisis de tendencias. Madrid: Asociación de Ciencias Ambientales

Townsend, P, (1987) Deprivation, *Journal of Social Policy*, 16(2):125-146.

Walker, G, & Day, R. (2012), Fuel poverty as injustice: Integrating distribution, recognition and procedure in the struggle for affordable warmth, *Energy Policy*, 49: 69-75.

Watts, Harold W., (1968) An economic definition of Poverty, in Moyniha N. & Daniel, P. *On Understanding Poverty,* New York: Basic Books

Whitehead, C.M.E. (1991) From Need to Affordability: An Analysis of UK Housing Objectives. *Urban Studies*, 28 (6): 871-887.

Whitehead, C.M.E. (1998) *The Benefits of Better Homes*, London: Shelter.

ANNEX. Tables and figures

Table 1. Basic Statistics

	YEAR	POORS	Tenancy	Population density	Noise	Pollution	Deliquency	Type of house	OVERCROWDING (persons per room)	shower	toilet	Light in rooms	Humidity	Temperature (Energy proxy)
N valid	117465	104751	104751	104751	104736	104735	104731	104539	90072	104730	104708	104735	104741	104726
Mean	2007.97	.2575	1.33	1.83	1.22	1.13	1.15	2.89	.5793	1.00	1.00	1.08	1.19	1.08
Median	2008.00	0.0000	1.00	2.00	1.00	1.00	1.00	3.00	.5000	1.00	1.00	1.00	1.00	1.00
St Dev	2.608	.43727	.818	.876	.414	.336	.356	1.133	.29797	.058	.048	.277	.390	.267
Variance	6.802	.191	.669	.768	.172	.113	.126	1.283	.089	.003	.002	.076	.152	.071
Asymmetry	-.015	1.109	2.477	.332	1.352	2.209	1.977	-.463	2.236	17.04	20.55	3.013	1.607	3.168
Kurtosis	-1.247	-.770	4.851	-1.617	-.173	2.882	1.907	-1.255	23.964	288.37	420.66	7.080	.583	8.034
Min	2004	0.00	1	1	1	1	1	1	.17	1	1	1	1	1
Max	2012	1.00	4	3	2	2	2	4	8.00	2	2	2	2	2

Table 2.

INCOME AMONG TENANCY TYPES. SPAIN, 2004-2012

	Income MEDIAN	Poverty Line *	% Household	% Household under Poverty line POOR
Ownership	13207.29	7924.37	82.8	83.02
Rent (mkt prices)	10532.02	6319.21	7.6	6.95
Rent (under Mkt prices)	9894.50	5936.70	3.1	3.26
Free Rent house	10009.98	6005.99	6.4	6.78

*** 60% of median of disposable income by region**

Source: Life Conditions Survey (EU-SILK), INE, 2004-2012

Table 3. Logistic regression baseline model of housing quality and fuel determinants of poverty.

Dependent variable: households under 60% of income median (dummy=1)

	Models:	I				II				III				IV				V			
Exp sign	Variables	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}
-	*urb_density*			16.0				14.8				15.8				14.9				12.14	
	Urb(dense)	-0.078***	0.022	12.9	0.93	-0.075***	0.022	11.8	0.93	-0.077***	0.022	12.7	0.93	-0.075***	0.022	12.1	0.93	-0.070***	0.022	10.29	0.93
	Urb(av)	-0.077***	0.023	11.0	0.93	-0.075***	0.023	10.3	0.93	-0.077***	0.023	10.9	0.93	-0.074***	0.023	10.2	0.93	-0.065***	0.023	7.76	0.94
+	*Type_house*			168.2				153.4				168.0				169.9	0.00			131.04	
	T1-house	0.224***	0.026	73.9	1.25	0.219***	0.026	70.8	1.24	0.224***	0.026	74.3	1.25	0.228***	0.026	76.9	1.26	0.221***	0.026	71.79	1.25
	T2-detache	0.194***	0.025	62.6	1.21	0.190***	0.025	59.9	1.21	0.195***	0.025	63.2	1.22	0.198***	0.025	64.8	1.22	0.187***	0.025	57.51	1.21
	T3-apart_low	0.275***	0.023	147.8	1.32	0.260***	0.023	131.9	1.30	0.274***	0.023	147.2	1.32	0.275***	0.023	147.6	1.32	0.231***	0.023	102.96	1.26
-	*Nat Light*	-0.155***	0.032	24.0	0.86	-0.134***	0.032	17.8	0.87	-0.157***	0.032	24.7	0.85	-0.161***	0.032	26.0	0.85	-0.131***	0.032	16.84	0.88
+	*Noise*	0.037	0.023	2.7	1.04	0.051**	0.023	5.1	1.05	0.038	0.023	2.7	1.04	0.036	0.023	2.5	1.04	0.052**	0.023	5.27	1.05
+	*Pollution*	0.070***	0.028	6.1	1.07	0.080***	0.028	8.0	1.08	0.070***	0.028	6.1	1.07	0.068**	0.028	5.8	1.07	0.069**	0.028	5.88	1.07
-	*Delinquency*	-0.143***	0.024	34.4	0.87	-0.138***	0.024	32.2	0.87	-0.142***	0.024	34.0	0.87	-0.143***	0.024	34.4	0.87	-0.144***	0.024	34.97	0.87
+	*Bath/shower*	0.944***	0.178	28.1	2.57	0.908***	0.178	25.9	2.48	0.961***	0.178	29.2	2.61	0.985***	0.177	30.8	2.68	0.889***	0.178	24.95	2.43
+	*Toilet_in*	0.546**	0.240	5.1	1.73	0.510**	0.241	4.5	1.67	0.553**	0.239	5.3	1.74	0.557**	0.239	5.4	1.75	0.526**	0.240	4.79	1.69
+	*Overcrowding*	0.405***	0.026	237.0	1.50	0.401***	0.026	233.1	1.49	0.405***	0.026	237.7	1.50	0.405***	0.026	237.7	1.50	0.381***	0.026	210.11	1.46
	Leaks/Humid	-0.229***	0.021	117.4	0.80	-0.213***	0.021	101.8	0.81	-0.267***	0.023	138.1	0.77	-0.266***	0.023	136.6	0.77	-0.235***	0.023	105.95	0.79
+	*Temperature_ winter*	0.890***	0.026	1149.3	2.43	0.884***	0.026	1131	2.42	0.730***	0.045	261.6	2.07								
	Leaks@temperature									0.242***	0.055	19.2	1.27	0.233***	0.055	17.6	1.26	0.237***	0.056	18.06	1.27
+	*Tenancy* [+]					0.105***	0.008	155.5	1.11									0.237***	0.009	705.03	1.27
	fuelp_05													0.564***	0.073	59.4	1.76	0.525***	0.074	50.90	1.69
	fuelp_06													0.615***	0.077	63.8	1.85	0.572***	0.077	54.58	1.77
	fuelp_07													0.812***	0.088	84.8	2.25	0.777***	0.089	76.80	2.17
	fuelp_08													0.693***	0.081	73.5	2.00	0.663***	0.081	66.51	1.94
	fuelp_09													0.804***	0.075	114.9	2.24	0.778***	0.075	106.19	2.18
	fuelp_10													0.873***	0.083	109.7	2.39	0.843***	0.084	100.97	2.32
	fuelp_11													0.774***	0.077	102.0	2.17	0.735***	0.077	90.83	2.09
	fuelp_12													0.815***	0.080	104.5	2.26	0.770***	0.080	92.17	2.16

Constant	-3.469***	0.233	222.0	0.03	-3.598***	0.234	236.9	0.027	-2.799***	0.228	150.7	0.06	-2.815***	0.228	152.7	0.06	-3.101***	0.230	182.34	0.05
Omnibus test of parameters		gl	Sig.			gl	Sig.			gl	Sig.			gl	Sig.			gl	Sig.	
χ2	2235.1	14	0.0		2386.5	15	0.0		2254.3	15	0.0		2272.5	22	0.0		2934.9	23	0.0	
log likelihood	96584,7				96433.3				96565.5				96547.3				95884.9			
Cox and Snell R^2	0,022				0,023				0,022				0,022				0,028			
Nagelkerke R^2	0,035				0,037				0,035				0,035				0,046			
Hosmer and Lemeshow test																				
χ2	76.2	8	0.0		58.8	8	0.0		83.1	8	0.0		84.2	8	0.0		121.8	8	0.0	

[+] *Tenancy is ordered as 1=ownership, 2=rent at market Price, 3=rent at lower than market Price, 4=free-rent*

*** p-value<0.01, ** p-value<0.05

Table 4. Logistic regression model by Tenure. Housing quality and fuel determinants of poverty

Dependent variable: households under 60% of income median (dummy=1)

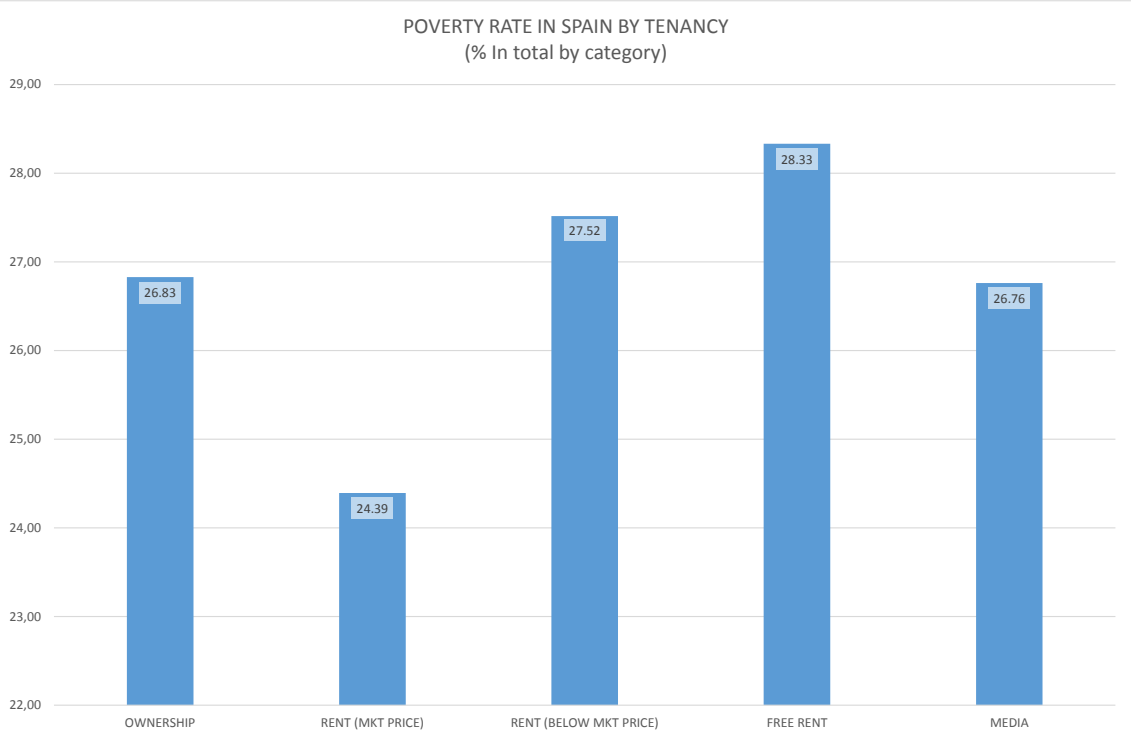
		Homeownersip				Rent at market prices				Rent under market prices				Free- rent households			
	Model	VI				VII				VIII				IX			
Exp. Sign	Variables	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}	β	St.Error	Wald	e^{β}
	urb_density			15.19				0.16				12.22				1.04	
	Urb(dense)	-0.092***	0.025	13.54	0.91	0.011	0.068	0.02	1.01	-0.365***	0.107	11.74	0.69	0.072	0.075	0.90	1.07
	Urb(av)	-0.078***	0.027	8.57	0.92	-0.016	0.076	0.04	0.98	-0.184	0.135	1.85	0.83	0.005	0.079	0.00	1.00
	Type_house			160.3				14.72				6.98				1.23	
	T1-house	0.316***	0.029	115.8	1.37	0.327***	0.105	9.66	1.38	-0.092	0.170	0.28	0.91	0.083	0.093	0.78	1.08
	T2-detache	0.284***	0.028	103.5	1.32	0.118	0.093	1.60	1.12	-0.236	0.134	3.11	0.79	0.087	0.090	0.94	1.09
	T3-apart_low	0.244***	0.027	79.4	1.27	0.178***	0.058	9.43	1.19	0.124	0.095	1.69	1.13	0.027	0.088	0.09	1.02
-	Nat Light	-0.154***	0.038	16.1	0.85	-0.026	0.085	0.09	0.97	0.007	0.131	0.00	1.00	-0.081	0.100	0.65	0.92
+	Noise	0.039	0.027	2.1	1.04	0.196***	0.065	9.09	1.21	0.009	0.098	0.00	1.00	0.049	0.080	0.37	1.05
+	Pollution	0.056	0.033	2.9	1.05	0.113	0.089	1.62	1.12	-0.041	0.118	0.12	0.95	0.137	0.100	1.85	1.14
-	Delinquency	-0.159***	0.028	32.2	0.85	-0.005	0.082	0.004	0.99	-0.310***	0.103	9.09	0.73	-0.194**	0.087	4.98	0.82
+	Bath/shower	1.245***	0.254	23.9	3.47	0.751	0.583	1.65	2.11	0.569	0.453	1.57	1.76	0.208	0.382	0.29	1.23
+	Toilet_in	0.317	0.329	0.92	1.37	0.015	0.821	0.00	1.01	2.135	1.144	3.48	8.45	0.808	0.457	3.11	2.24
+	Overcrowding	0.085**	0.034	6.34	1.08	1.078***	0.064	284.6	2.93	0.586***	0.110	28.28	1.79	0.196**	0.085	5.34	1.21
-	**Leaks/Humid**	-0.237***	0.026	80.0	0.78	-0.232***	0.071	10.82	0.79	-0.054	0.104	0.26	0.94	-0.096	0.075	1.63	0.90
	Leaks@temperatur	0.207***	0.069	9.03	1.23	0.218	0.149	2.13	1.24	0.278	0.224	1.54	1.32	0.211	0.177	1.41	1.23
+	**Temperature_winter by year** [+]																
	fuelp_05	0.478***	0.090	27.9	1.61	0.367	0.206	3.15	1.44	0.684**	0.287	5.67	1.98	0.751***	0.216	12.02	2.11
	fuelp_06	0.604***	0.094	40.8	1.83	0.168	0.220	0.58	1.18	0.625**	0.287	4.74	1.86	0.594***	0.227	6.84	1.81
	fuelp_07	0.663***	0.111	35.9	1.94	0.802***	0.220	13.33	2.23	1.134***	0.344	10.88	3.10	0.906***	0.294	9.47	2.47
	fuelp_08	0.650***	0.099	43.4	1.91	0.815***	0.212	14.71	2.25	0.715**	0.335	4.54	2.04	0.069	0.284	0.05	1.07
	fuelp_09	0.668***	0.092	52.4	1.94	1.076***	0.204	27.91	2.93	1.002***	0.298	11.28	2.72	0.798***	0.253	9.96	2.22
	fuelp_10	0.714***	0.105	46.3	2.04	1.108***	0.211	27.64	3.02	0.668**	0.323	4.26	1.95	1.065***	0.284	14.01	2.90
	fuelp_11	0.522***	0.098	28.5	1.68	1.110***	0.198	31.61	3.03	0.937***	0.303	9.54	2.55	1.028***	0.245	17.63	2.79

fuelp_12	0.545***	0.103	27.9	1.72	1.188***	0.196	36.62	3.27	1.307***	0.351	13.87	3.69	0.816***	0.249	10.73	2.26
Constant	-2.783***	0.290	92.1	0.06	-2.9***	0.686	17.89	0.05	-3.04***	1.157	6.90	0.04	-2.099***	0.546	14.77	0.12
Omnibus test of parameters		gl	Sig.			gl	Sig.			gl	Sig.			gl	Sig.	
χ2	1208.2	22.0	0.0		671.238	22	0.0		184.585	22	0.0		147.599	22	0.0	
log likelihood	74834,47				9469.17				3546.73				7198.58			
Cox and Snell R^2	0.014				0.0786				0.06124				0.02292			
Nagelkerke R^2	0.024				0.11076				0.08491				0.03347			
Hosmer and Lemeshow test:																
χ2	41.4	8.0	0.00		13.9193	8	0.083		20.2292	8	0.009		16.685	8	0.033	
[+] **Temper_winter**	**0.60*** **	**0.06**	**112.4**	**1.82**	**0.81*** **	**0.12**	**43.49**	**2.24**	**0.86*** **	**0.17**	**24.73**	**2.37**	**0.74*** **	**0.13**	**31.50**	**2.10**

Note: [+] temperature estimated parameter when dummies are not considered into the model. The others' model parameter reach close values and same sign

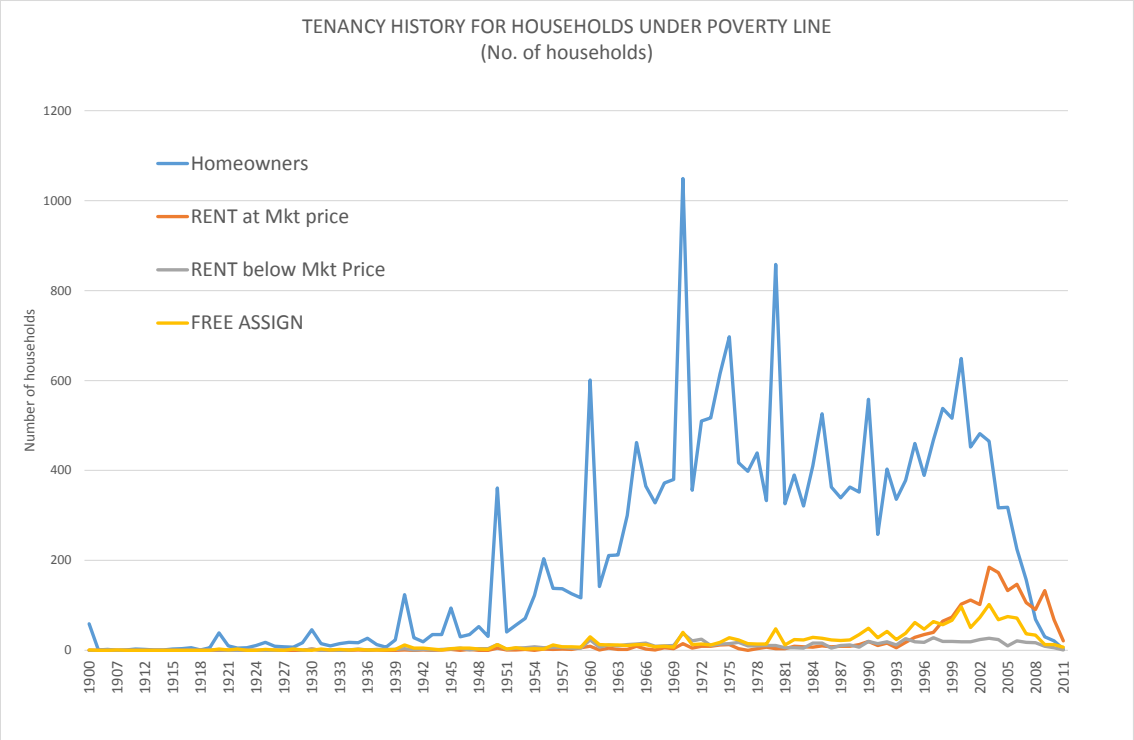
*** p-value<0.01, ** p-value<0.05

Figure 1. Poverty by tenancy in Spain



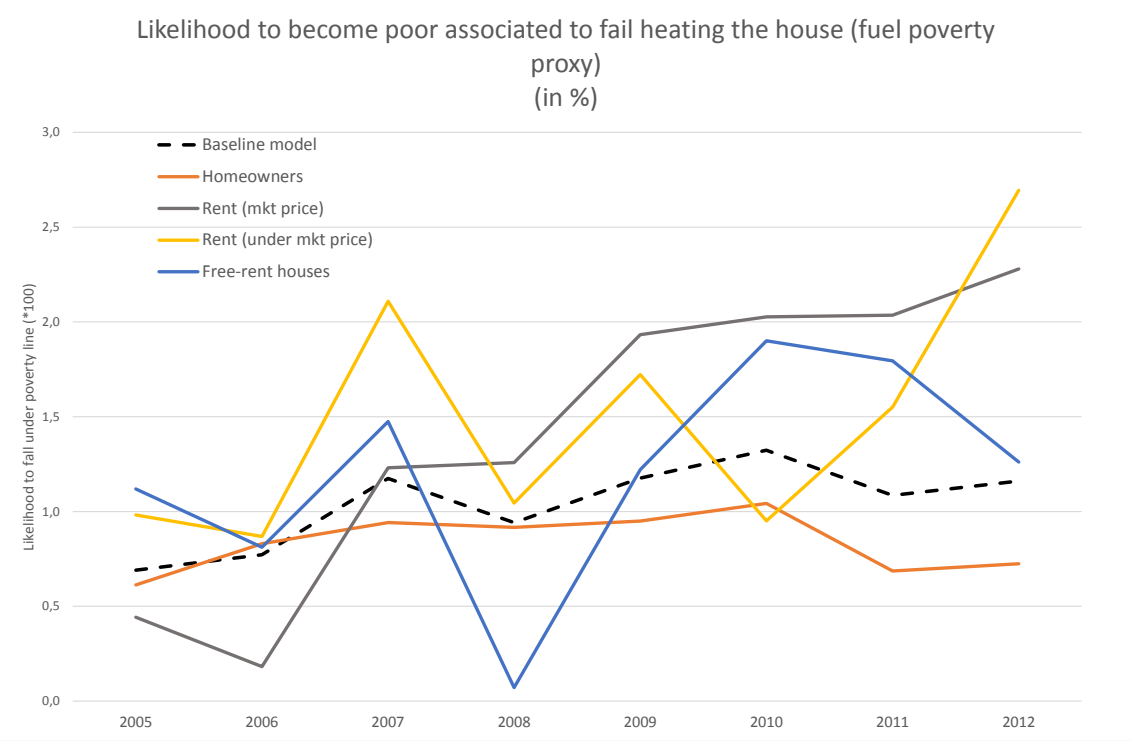
Source: Life Conditions Survey (EU-SILK), INE, 2004-2012

Figure 2



Source: Life Conditions Survey (EU-SILK), INE, 2004-2012 [Spanish-National Statistics Institute]

Figure 3


Likelihood to become poor associated to fail heating the house (fuel poverty proxy)
(in %)
Likelihood to fall under poverty line (*100)
3,0
2,5
2,0
1,5
1,0
0,5
0,0
Baseline model
Homeowners
Rent (mkt price)
Rent (under mkt price)
Free-rent houses
2005
2006
2007
2008
2009
2010
2011
2012

2012

2012/1, Montolio, D.; Trujillo, E.: "What drives investment in telecommunications? The role of regulation, firms' internationalization and market knowledge"
2012/2, Giesen, K.; Suedekum, J.: "The size distribution across all "cities": a unifying approach"
2012/3, Foremny, D.; Riedel, N.: "Business taxes and the electoral cycle"
2012/4, García-Estévez, J.; Duch-Brown, N.: "Student graduation: to what extent does university expenditure matter?"
2012/5, Durán-Cabré, J.M.; Esteller-Moré, A.; Salvadori, L.: "Empirical evidence on horizontal competition in tax enforcement"
2012/6, Pickering, A.C.; Rockey, J.: "Ideology and the growth of US state government"
2012/7, Vergolini, L.; Zanini, N.: "How does aid matter? The effect of financial aid on university enrolment decisions"
2012/8, Backus, P.: "Gibrat's law and legacy for non-profit organisations: a non-parametric analysis"
2012/9, Jofre-Monseny, J.; Marín-López, R.; Viladecans-Marsal, E.: "What underlies localization and urbanization economies? Evidence from the location of new firms"
2012/10, Mantovani, A.; Vandekerckhove, J.: "The strategic interplay between bundling and merging in complementary markets"
2012/11, Garcia-López, M.A.: "Urban spatial structure, suburbanization and transportation in Barcelona"
2012/12, Revelli, F.: "Business taxation and economic performance in hierarchical government structures"
2012/13, Arqué-Castells, P.; Mohnen, P.: "Sunk costs, extensive R&D subsidies and permanent inducement effects"
2012/14, Boffa, F.; Piolatto, A.; Ponzetto, G.: "Centralization and accountability: theory and evidence from the Clean Air Act"
2012/15, Cheshire, P.C.; Hilber, C.A.L.; Kaplanis, I.: "Land use regulation and productivity – land matters: evidence from a UK supermarket chain"
2012/16, Choi, A.; Calero, J.: "The contribution of the disabled to the attainment of the Europe 2020 strategy headline targets"
2012/17, Silva, J.I.; Vázquez-Grenno, J.: "The ins and outs of unemployment in a two-tier labor market"
2012/18, González-Val, R.; Lanaspa, L.; Sanz, F.: "New evidence on Gibrat's law for cities"
2012/19, Vázquez-Grenno, J.: "Job search methods in times of crisis: native and immigrant strategies in Spain"
2012/20, Lessmann, C.: "Regional inequality and decentralization – an empirical analysis"
2012/21, Nuevo-Chiquero, A.: "Trends in shotgun marriages: the pill, the will or the cost?"
2012/22, Piil Damm, A.: "Neighborhood quality and labor market outcomes: evidence from quasi-random neighborhood assignment of immigrants"
2012/23, Ploeckl, F.: "Space, settlements, towns: the influence of geography and market access on settlement distribution and urbanization"
2012/24, Algan, Y.; Hémet, C.; Laitin, D.: "Diversity and local public goods: a natural experiment with exogenous residential allocation"
2012/25, Martinez, D.; Sjögren, T.: "Vertical externalities with lump-sum taxes: how much difference does unemployment make?"
2012/26, Cubel, M.; Sanchez-Pages, S.: "The effect of within-group inequality in a conflict against a unitary threat"
2012/27, Andini, M.; De Blasio, G.; Duranton, G.; Strange, W.C.: "Marshallian labor market pooling: evidence from Italy"
2012/28, Solé-Ollé, A.; Viladecans-Marsal, E.: "Do political parties matter for local land use policies?"
2012/29, Buonanno, P.; Durante, R.; Prarolo, G.; Vanin, P.: "Poor institutions, rich mines: resource curse and the origins of the Sicilian mafia"
2012/30, Anghel, B.; Cabrales, A.; Carro, J.M.: "Evaluating a bilingual education program in Spain: the impact beyond foreign language learning"
2012/31, Curto-Grau, M.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Partisan targeting of inter-governmental transfers & state interference in local elections: evidence from Spain"
2012/32, Kappeler, A.; Solé-Ollé, A.; Stephan, A.; Välilä, T.: "Does fiscal decentralization foster regional investment in productive infrastructure?"
2012/33, Rizzo, L.; Zanardi, A.: "Single vs double ballot and party coalitions: the impact on fiscal policy. Evidence from Italy"
2012/34, Ramachandran, R.: "Language use in education and primary schooling attainment: evidence from a natural experiment in Ethiopia"
2012/35, Rothstein, J.: "Teacher quality policy when supply matters"
2012/36, Ahlfeldt, G.M.: "The hidden dimensions of urbanity"
2012/37, Mora, T.; Gil, J.; Sicras-Mainar, A.: "The influence of BMI, obesity and overweight on medical costs: a panel data approach"
2012/38, Pelegrín, A.; García-Quevedo, J.: "Which firms are involved in foreign vertical integration?"

2012/39, Agasisti, T.; Longobardi, S.: "Inequality in education: can Italian disadvantaged students close the gap? A focus on resilience in the Italian school system"

2013

2013/1, Sánchez-Vidal, M.; González-Val, R.; Viladecans-Marsal, E.: "Sequential city growth in the US: does age matter?"
2013/2, Hortas Rico, M.: "Sprawl, blight and the role of urban containment policies. Evidence from US cities"
2013/3, Lampón, J.F.; Cabanelas-Lorenzo, P-; Lago-Peñas, S.: "Why firms relocate their production overseas? The answer lies inside: corporate, logistic and technological determinants"
2013/4, Montolio, D.; Planells, S.: "Does tourism boost criminal activity? Evidence from a top touristic country"
2013/5, Garcia-López, M.A.; Holl, A.; Viladecans-Marsal, E.: "Suburbanization and highways: when the Romans, the Bourbons and the first cars still shape Spanish cities"
2013/6, Bosch, N.; Espasa, M.; Montolio, D.: "Should large Spanish municipalities be financially compensated? Costs and benefits of being a capital/central municipality"
2013/7, Escardíbul, J.O.; Mora, T.: "Teacher gender and student performance in mathematics. Evidence from Catalonia"
2013/8, Arqué-Castells, P.; Viladecans-Marsal, E.: "Banking towards development: evidence from the Spanish banking expansion plan"
2013/9, Asensio, J.; Gómez-Lobo, A.; Matas, A.: "How effective are policies to reduce gasoline consumption? Evaluating a quasi-natural experiment in Spain"
2013/10, Jofre-Monseny, J.: "The effects of unemployment benefits on migration in lagging regions"
2013/11, Segarra, A.; García-Quevedo, J.; Teruel, M.: "Financial constraints and the failure of innovation projects"
2013/12, Jerrim, J.; Choi, A.: "The mathematics skills of school children: How does England compare to the high performing East Asian jurisdictions?"
2013/13, González-Val, R.; Tirado-Fabregat, D.A.; Viladecans-Marsal, E.: "Market potential and city growth: Spain 1860-1960"
2013/14, Lundqvist, H.: "Is it worth it? On the returns to holding political office"
2013/15, Ahlfeldt, G.M.; Maennig, W.: "Homevoters vs. leasevoters: a spatial analysis of airport effects"
2013/16, Lampón, J.F.; Lago-Peñas, S.: "Factors behind international relocation and changes in production geography in the European automobile components industry"
2013/17, Guío, J.M.; Choi, A.: "Evolution of the school failure risk during the 2000 decade in Spain: analysis of Pisa results with a two-level logistic mode"
2013/18, Dahlby, B.; Rodden, J.: "A political economy model of the vertical fiscal gap and vertical fiscal imbalances in a federation"
2013/19, Acacia, F.; Cubel, M.: "Strategic voting and happiness"
2013/20, Hellerstein, J.K.; Kutzbach, M.J.; Neumark, D.: "Do labor market networks have an important spatial dimension?"
2013/21, Pellegrino, G.; Savona, M.: "Is money all? Financing versus knowledge and demand constraints to innovation"
2013/22, Lin, J.: "Regional resilience"
2013/23, Costa-Campi, M.T.; Duch-Brown, N.; García-Quevedo, J.: "R&D drivers and obstacles to innovation in the energy industry"
2013/24, Huisman, R.; Stradnic, V.; Westgaard, S.: "Renewable energy and electricity prices: indirect empirical evidence from hydro power"
2013/25, Dargaud, E.; Mantovani, A.; Reggiani, C.: "The fight against cartels: a transatlantic perspective"
2013/26, Lambertini, L.; Mantovani, A.: "Feedback equilibria in a dynamic renewable resource oligopoly: pre-emption, voracity and exhaustion"
2013/27, Feld, L.P.; Kalb, A.; Moessinger, M.D.; Osterloh, S.: "Sovereign bond market reactions to fiscal rules and no-bailout clauses – the Swiss experience"
2013/28, Hilber, C.A.L.; Vermeulen, W.: "The impact of supply constraints on house prices in England"
2013/29, Revelli, F.: "Tax limits and local democracy"
2013/30, Wang, R.; Wang, W.: "Dress-up contest: a dark side of fiscal decentralization"
2013/31, Dargaud, E.; Mantovani, A.; Reggiani, C.: "The fight against cartels: a transatlantic perspective"
2013/32, Saarimaa, T.; Tukiainen, J.: "Local representation and strategic voting: evidence from electoral boundary reforms"
2013/33, Agasisti, T.; Murtinu, S.: "Are we wasting public money? No! The effects of grants on Italian university students' performances"
2013/34, Flacher, D.; Harari-Kermadec, H.; Moulin, L.: "Financing higher education: a contributory scheme"
2013/35, Carozzi, F.; Repetto, L.: "Sending the pork home: birth town bias in transfers to Italian municipalities"

2013/36, Coad, A.; Frankish, J.S.; Roberts, R.G.; Storey, D.J.: "New venture survival and growth: Does the fog lift?"
2013/37, Giulietti, M.; Grossi, L.; Waterson, M.: "Revenues from storage in a competitive electricity market: Empirical evidence from Great Britain"

2014

2014/1, Montolio, D.; Planells-Struse, S.: "When police patrols matter. The effect of police proximity on citizens' crime risk perception"
2014/2, Garcia-López, M.A.; Solé-Ollé, A.; Viladecans-Marsal, E.: "Do land use policies follow road construction?"
2014/3, Piolatto, A.; Rablen, M.D.: "Prospect theory and tax evasion: a reconsideration of the Yitzhaki puzzle"
2014/4, Cuberes, D.; González-Val, R.: "The effect of the Spanish Reconquest on Iberian Cities"
2014/5, Durán-Cabré, J.M.; Esteller-Moré, E.: "Tax professionals' view of the Spanish tax system: efficiency, equity and tax planning"
2014/6, Cubel, M.; Sanchez-Pages, S.: "Difference-form group contests"
2014/7, Del Rey, E.; Racionero, M.: "Choosing the type of income-contingent loan: risk-sharing versus risk-pooling"
2014/8, Torregrosa Hetland, S.: "A fiscal revolution? Progressivity in the Spanish tax system, 1960-1990"
2014/9, Piolatto, A.: "Itemised deductions: a device to reduce tax evasion"
2014/10, Costa, M.T.; García-Quevedo, J.; Segarra, A.: "Energy efficiency determinants: an empirical analysis of Spanish innovative firms"
2014/11, García-Quevedo, J.; Pellegrino, G.; Savona, M.: "Reviving demand-pull perspectives: the effect of demand uncertainty and stagnancy on R&D strategy"
2014/12, Calero, J.; Escardíbul, J.O.: "Barriers to non-formal professional training in Spain in periods of economic growth and crisis. An analysis with special attention to the effect of the previous human capital of workers"
2014/13, Cubel, M.; Sanchez-Pages, S.: "Gender differences and stereotypes in the beauty"
2014/14, Piolatto, A.; Schuett, F.: "Media competition and electoral politics"
2014/15, Montolio, D.; Trillas, F.; Trujillo-Baute, E.: "Regulatory environment and firm performance in EU telecommunications services"
2014/16, Lopez-Rodriguez, J.; Martinez, D.: "Beyond the R&D effects on innovation: the contribution of non-R&D activities to TFP growth in the EU"
2014/17, González-Val, R.: "Cross-sectional growth in US cities from 1990 to 2000"
2014/18, Vona, F.; Nicolli, F.: "Energy market liberalization and renewable energy policies in OECD countries"
2014/19, Curto-Grau, M.: "Voters' responsiveness to public employment policies"
2014/20, Duro, J.A.; Teixidó-Figueras, J.; Padilla, E.: "The causal factors of international inequality in co2 emissions per capita: a regression-based inequality decomposition analysis"
2014/21, Fleten, S.E.; Huisman, R.; Kilic, M.; Pennings, E.; Westgaard, S.: "Electricity futures prices: time varying sensitivity to fundamentals"
2014/22, Afcha, S.; García-Quevedo, J,: "The impact of R&D subsidies on R&D employment composition"
2014/23, Mir-Artigues, P.; del Río, P.: "Combining tariffs, investment subsidies and soft loans in a renewable electricity deployment policy"
2014/24, Romero-Jordán, D.; del Río, P.; Peñasco, C.: "Household electricity demand in Spanish regions. Public policy implications"
2014/25, Salinas, P.: "The effect of decentralization on educational outcomes: real autonomy matters!"
2014/26, Solé-Ollé, A.; Sorribas-Navarro, P.: "Does corruption erode trust in government? Evidence from a recent surge of local scandals in Spain"
2014/27, Costas-Pérez, E.: "Political corruption and voter turnout: mobilization or disaffection?"
2014/28, Cubel, M.; Nuevo-Chiquero, A.; Sanchez-Pages, S.; Vidal-Fernandez, M.: "Do personality traits affect productivity? Evidence from the LAB"
2014/29, Teresa Costa, M.T.; Trujillo-Baute, E.: "Retail price effects of feed-in tariff regulation"
2014/30, Kilic, M.; Trujillo-Baute, E.: "The stabilizing effect of hydro reservoir levels on intraday power prices under wind forecast errors"
2014/31, Costa-Campi, M.T.; Duch-Brown, N.: "The diffusion of patented oil and gas technology with environmental uses: a forward patent citation analysis"
2014/32, Ramos, R.; Sanromá, E.; Simón, H.: "Public-private sector wage differentials by type of contract: evidence from Spain"
2014/33, Backus, P.; Esteller-Moré, A.: "Is income redistribution a form of insurance, a public good or both?"
2014/34, Huisman, R.; Trujillo-Baute, E.: "Costs of power supply flexibility: the indirect impact of a Spanish policy change"

2014/35, Jerrim, J.; Choi, A.; Simancas Rodríguez, R.: "Two-sample two-stage least squares (TSTSLS) estimates of earnings mobility: how consistent are they?"
2014/36, Mantovani, A.; Tarola, O.; Vergari, C.: "Hedonic quality, social norms, and environmental campaigns"
2014/37, Ferraresi, M.; Galmarini, U.; Rizzo, L.: "Local infrastructures and externalities: Does the size matter?"
2014/38, Ferraresi, M.; Rizzo, L.; Zanardi, A.: "Policy outcomes of single and double-ballot elections"

2015

2015/1, Foremny, D.; Freier, R.; Moessinger, M-D.; Yeter, M.: "Overlapping political budget cycles in the legislative and the executive"
2015/2, Colombo, L.; Galmarini, U.: "Optimality and distortionary lobbying: regulating tobacco consumption"
2015/3, Pellegrino, G.: "Barriers to innovation: Can firm age help lower them?"
2015/4, Hémet, C.: "Diversity and employment prospects: neighbors matter!"
2015/5, Cubel, M.; Sanchez-Pages, S.: "An axiomatization of difference-form contest success functions"
2015/6, Choi, A.; Jerrim, J.: "The use (and misuse) of Pisa in guiding policy reform: the case of Spain"
2015/7, Durán-Cabré, J.M.; Esteller-Moré, A.; Salvadori, L.: "Empirical evidence on tax cooperation between sub-central administrations"
2015/8, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Analysing the sensitivity of electricity system operational costs to deviations in supply and demand"
2015/9, Salvadori, L.: "Does tax enforcement counteract the negative effects of terrorism? A case study of the Basque Country"
2015/10, Montolio, D.; Planells-Struse, S.: "How time shapes crime: the temporal impacts of football matches on crime"
2015/11, Piolatto, A.: "Online booking and information: competition and welfare consequences of review aggregators"
2015/12, Boffa, F.; Pingali, V.; Sala, F.: "Strategic investment in merchant transmission: the impact of capacity utilization rules"
2015/13, Slemrod, J.: "Tax administration and tax systems"
2015/14, Arqué-Castells, P.; Cartaxo, R.M.; García-Quevedo, J.; Mira Godinho, M.: "How inventor royalty shares affect patenting and income in Portugal and Spain"
2015/15, Montolio, D.; Planells-Struse, S.: "Measuring the negative externalities of a private leisure activity: hooligans and pickpockets around the stadium"
2015/16, Batalla-Bejerano, J.; Costa-Campi, M.T.; Trujillo-Baute, E.: "Unexpected consequences of liberalisation: metering, losses, load profiles and cost settlement in Spain's electricity system"
2015/17, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Impacts of intermittent renewable generation on electricity system costs"
2015/18, Costa-Campi, M.T.; Paniagua, J.; Trujillo-Baute, E.: "Are energy market integrations a green light for FDI?"
2015/19, Jofre-Monseny, J.; Sánchez-Vidal, M.; Viladecans-Marsal, E.: "Big plant closures and agglomeration economies"
2015/20, Garcia-López, M.A.; Hémet, C.; Viladecans-Marsal, E.: "How does transportation shape intrametropolitan growth? An answer from the regional express rail"
2015/21, Esteller-Moré, A.; Galmarini, U.; Rizzo, L.: "Fiscal equalization under political pressures"
2015/22, Escardíbul, J.O.; Afcha, S.: "Determinants of doctorate holders' job satisfaction. An analysis by employment sector and type of satisfaction in Spain"
2015/23, Aidt, T.; Asatryan, Z.; Badalyan, L.; Heinemann, F.: "Vote buying or (political) business (cycles) as usual?"
2015/24, Albæk, K.: "A test of the 'lose it or use it' hypothesis in labour markets around the world"
2015/25, Angelucci, C.; Russo, A.: "Petty corruption and citizen feedback"
2015/26, Moriconi, S.; Picard, P.M.; Zanaj, S.: "Commodity taxation and regulatory competition"
2015/27, Brekke, K.R.; Garcia Pires, A.J.; Schindler, D.; Schjelderup, G.: "Capital taxation and imperfect competition: ACE vs. CBIT"
2015/28, Redonda, A.: "Market structure, the functional form of demand and the sensitivity of the vertical reaction function"
2015/29, Ramos, R.; Sanromá, E.; Simón, H.: "An analysis of wage differentials between full-and part-time workers in Spain"
2015/30, Garcia-López, M.A.; Pasidis, I.; Viladecans-Marsal, E.: "Express delivery to the suburbs the effects of transportation in Europe's heterogeneous cities"
2015/31, Torregrosa, S.: "Bypassing progressive taxation: fraud and base erosion in the Spanish income tax (1970-2001)"

2015/32, Choi, H.; Choi, A.: "When one door closes: the impact of the hagwon curfew on the consumption of private tutoring in the republic of Korea"
2015/33, Escardíbul, J.O.; Helmy, N.: "Decentralisation and school autonomy impact on the quality of education: the case of two MENA countries"
2015/34, González-Val, R.; Marcén, M.: "Divorce and the business cycle: a cross-country analysis"
2015/35, Calero, J.; Choi, A.: "The distribution of skills among the European adult population and unemployment: a comparative approach"
2015/36, Mediavilla, M.; Zancajo, A.: "Is there real freedom of school choice? An analysis from Chile"
2015/37, Daniele, G.: "Strike one to educate one hundred: organized crime, political selection and politicians' ability"
2015/38, González-Val, R.; Marcén, M.: "Regional unemployment, marriage, and divorce"
2015/39, Foremny, D.; Jofre-Monseny, J.; Solé-Ollé, A.: "'Hold that ghost': using notches to identify manipulation of population-based grants"
2015/40, Mancebón, M.J.; Ximénez-de-Embún, D.P.; Mediavilla, M.; Gómez-Sancho, J.M.: "Does educational management model matter? New evidence for Spain by a quasiexperimental approach"
2015/41, Daniele, G.; Geys, B.: "Exposing politicians' ties to criminal organizations: the effects of local government dissolutions on electoral outcomes in Southern Italian municipalities"
2015/42, Ooghe, E.: "Wage policies, employment, and redistributive efficiency"

2016

2016/1, Galletta, S.: "Law enforcement, municipal budgets and spillover effects: evidence from a quasi-experiment in Italy"
2016/2, Flatley, L.; Giulietti, M.; Grossi, L.; Trujillo-Baute, E.; Waterson, M.: "Analysing the potential economic value of energy storage"
2016/3, Calero, J.; Murillo Huertas, I.P.; Raymond Bara, J.L.: "Education, age and skills: an analysis using the PIAAC survey"
2016/4, Costa-Campi, M.T.; Daví-Arderius, D.; Trujillo-Baute, E.: "The economic impact of electricity losses"
2016/5, Falck, O.; Heimisch, A.; Wiederhold, S.: "Returns to ICT skills"
2016/6, Halmenschlager, C.; Mantovani, A.: "On the private and social desirability of mixed bundling in complementary markets with cost savings"
2016/7, Choi, A.; Gil, M.; Mediavilla, M.; Valbuena, J.: "Double toil and trouble: grade retention and academic performance"
2016/8, González-Val, R.: "Historical urban growth in Europe (1300–1800)"
2016/9, Guio, J.; Choi, A.; Escardíbul, J.O.: "Labor markets, academic performance and the risk of school dropout: evidence for Spain"
2016/10, Bianchini, S.; Pellegrino, G.; Tamagni, F.: "Innovation strategies and firm growth"
2016/11, Jofre-Monseny, J.; Silva, J.I.; Vázquez-Grenno, J.: "Local labor market effects of public employment"
2016/12, Sanchez-Vidal, M.: "Small shops for sale! The effects of big-box openings on grocery stores"
2016/13, Costa-Campi, M.T.; García-Quevedo, J.; Martínez-Ros, E.: "What are the determinants of investment in environmental R&D?"
2016/14, **García-López, M.A; Hémet, C.; Viladecans-Marsal, E.:** "Next train to the polycentric city:
The effect of railroads on subcenter formation"
2016/15, Matas, Anna; Raymond, José-Luis; Dominguez, Andrés: "Changes in fuel economy: An analysis of
the Spanish car market"
2016/16, Leme, Alfonso; Escardíbul, Josep-Oriol: "The effect of a specialized versus a general upper secondary school curriculum on students' performance and inequality. A difference-in-differences cross country country comparison"
2016/17, **Scandurra, Rosario Ivano; Calero, Jorge**: "Modelling adult skills in OECD countries"
2016/18, **Fernández-Gutiérrez, Marcos; Calero, Jorge**: "Leisure and education: insights from a time-use analysis"
2016/19, Del Rio, Pablo; Mir-Artigues, Pere; Trujillo-Baute, Elisa: "Analysing the impact of renewable energy regulation on retail electricity prices"

IEB
Institut
d'Economia
de Barcelona

UNIVERSITAT DE
BARCELONA

ieb@ub.edu
www.ieb.edu

Energy Sustainability

IEB Working Paper