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POVERTY IN SPAIN

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THE IMPACT OF THE *BONO SOCIAL DE ELECTRICIDAD* ON ENERGY POVERTY IN SPAIN

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Declaration of interest

None

Abstract

The *Bono Social de Electricidad (BSE)* is a government programme to energy poverty in Spain. Applying differences-in-differences and propensity score matching to household data between 2008 and 2011, we find no statistically significant impact on the ability to keep the house adequately warm, nor on the presence of damp walls, rotting windows and leaking roofs. Delays in paying electricity bills have increased. The *BSE* has not reduced energy poverty, if anything it has made it worse.

Key words

Energy poverty, Spain, household data, policy evaluation, *Bono Social de Electricidad*

JEL Classification

I38, Q48

Abbreviations[1]

[1] BSE: Bono Social Eléctrico
CNMC: Comisión Nacional de los Mercados y la Competencia
DiD: Difference in Differences
PSM: Propensity Score Matching

1. Introduction

Spain has the fourth-highest incidence of winter deaths related to energy poverty in Europe (EU Energy Poverty Observatory, 2019). The Spanish Government has attempted to reduce energy poverty by the creation of the *Bono Social de Electricidad* (BSE) in 2009. The subsidy consists of a discount for electricity prices for retirees and large families. However, the levels of energy poverty are still rising ten years after the implementation of the subsidy. In this paper, we analyze the impact of the BSE.

We use a difference-in-differences (DiD) analysis taking those households eligible for the subsidy as our treatment group. We test the robustness of the estimates with propensity score matching, controlling for heterogeneity between eligible and ineligible households. We use three indexes of energy poverty: the ability to keep your house warm, delays in electricity bills, and the presence of damp walls, leaking roofs and rotting windows. Most of the literature on energy poverty has focused on measurement, rather than on policy evaluation as we do here. There are few papers on the BSE, and the majority focused on identifying who is a potential beneficiary (Rodriguez et al, 2016). This reflects the broader literature on energy poverty, which is focused on measuring its extent rather than the impact of policies to reduce energy poverty. This paper fills this gap in the literature and provides a more in-depth understanding of an important topic in Spain. The BSE was established in 2009. Therefore, we focus on the period from 2008 to 2011. However, the subsidy is still in place, albeit the changed requirements, so that our results inform future reforms of the BSE or alternative policies to alleviate energy poverty.

The paper is structured as follows. Section 2 discusses the origins and details of the BSE. Section 3 reviews the literature regarding energy poverty and the *Bono Social de Electricidad*. In Section 4, we present the data and its limitations. Section 5 details the empirical strategy. Section 6 presents the results. Section 7 concludes.

2. The *Bono Social de Electricidad*

Concerns about energy poverty emerged in the UK after the energy crisis of 1973 (Sanchez-Guevara, 2015). Three root causes were identified: low income, low energy efficiency housing and the price of energy. The UK was also the first European country, in 1997, to implement policies to alleviate energy poverty, such as Winter Fuel Payments. Spain lagged behind.

The European Union (EU) urged its Members to act on energy poverty in 2009 (European Commission, 2009), protecting “vulnerable consumers”, but the approach is left to the national governments to decide. They later recommended that Member States use Structural and Cohesion Funds for mitigating energy-poverty (European Union, 2012). Due to the pressure from the EU and the high level of energy poverty in Spain after the financial crisis, the social democratic government created a subsidy that would benefit the most vulnerable households in Spain. Initially widely supported, the policy became controversial over the question about who is going to bear its cost. We instead focus on effectiveness.

How does the BSE work? Those eligible to apply are: households where all the members are unemployed, retirees receiving the minimum pension, and large families who did not contract more than 3 kWh. At the same time, the “Tarifa del Ultimo Recurso” (TUR) was also implemented. This was a policy that allowed the Government to regulate the electricity price after market liberalization. Consumer using less than 5,000 kW per year could benefit from it. BSE recipients get a 25% discount on the electricity price set by the TUR.[2]

In June 2010, 2,913,759 households received the BSE (CNE, 2010). This fell to 2,299,553 in 2018, but Spain is still among the countries with the highest incidences of energy poverty (EU Energy Poverty Observatory, 2019). There were 17,121,500 households in Spain in 2010 (INE, 2010); 13.4% of households in Spain received the BSE during its first year. According to our calculations, 23.5% of households suffer energy poverty (according to at least one of our three indexes). Therefore, it is unlikely that the subsidy reached all vulnerable households.

3. Literature Review

Since the 2008 Financial Crisis, the literature on energy poverty in the European Union (EU) member states has grown considerably. Higher electricity prices, greater unemployment and falling wages have led to a rise of energy poverty. There is no internationally agreed definition of what energy poverty means. Bouzarovski et al., (2012) define energy poverty as "a household experienc[ing] an inadequate level of energy services in their home". The United Kingdom used to use an expenditure-based measure, whether a household spends more than 10% of their income on energy. This measurement is analyzed in several studies as a complement to subjective variables (Aristondo and Onaindia, 2018; Papada and Kaliampakos, 2016). Roberts et al. (2015) and Aristondo and Onaindia (2018) argue for the multidimensional nature of energy poverty. Objective measurement is more reliable than subjective variables. However, it does not provide enough information, ignoring coping mechanisms, the struggle to pay, and adequate warmth during the winter.

Three indexes dominate the literature, due to their explanatory value and availability on living standard household surveys: ability to keep your house adequately warm, presence of damp walls or rotten windows, and delays in electricity bills. In order to avoid arbitrary weighting, it is common to consider households that are deprived in one dimension to be energy poor (Nussbaumer et al, 2012). We present our results separately for each index.

Subjective measures allow the researcher to identify not only the incidence but also intensity of energy poverty. For example, a household might be deprived in one dimension in period one and in two or three dimensions in period two. According to Papada and Kalianpakos (2016), the number of households in energy poverty is higher with subjective methods. This might be because some of the energy poverty conditions might not be that strictly linked to

[2] In 2014, the BSE was modified for “severely vulnerable consumers” who now receive a 40% to 50% discount on the electricity price. It also changed the calculation of the TUR and was substituted by the Precio Voluntario del Pequeño Consumidor, which effectively had no impact on the BSE discount. The last reform took place in 2017, when income criteria were added to the requirements and several households lost the right to apply for it. The criteria are now mixed: if there are children in the household and the household income is less than 1.5 times the IPREM (the amount of income to be eligible for certain subsidies; in 2010, it was set at €7,455.14) that household is eligible for the BSE. Depending on the number of children, whether it is a single parent household and other criteria, the income requirement changes.

income and there might be other variables to take into consideration: age, housing, geographical location, etc. This difference indicates that "the broader nature of the subjective energy poverty measures suggests that policy more focused on reducing energy costs might not be as efficient" (Roberts et al., 2015).

Subjective indicators have also some limitations, but most of them apply to all survey data (Bouzarovski and Herrero, 2017). Answers may be subject to error, but benefits are not based on the answers. Hence, households do not have economic incentives to not tell the truth. Sanchez-Guevara (2015) argues for urgent rehabilitation of the buildings in Spain and determines the priority by dividing the households into categories according to the building efficiency, the regional characteristics and household income.

Several problems have been identified regarding the BSE. First of all, the price discount is not automatically applied to vulnerable consumers. The most vulnerable are unlikely to know how to apply, or that this discount exists. Gabiola et al. (2016) find that only 65% of the households knew about the BSE and 71% had no intention to apply before the interview. The reasons varied from not having time to do it to not knowing how to apply. Rural and Southern Spain are still the most affected regions and the levels of energy poverty were worse in 2015 than in 2004 (Aristondo and Onaindia, 2018), which shows that the effect of the crisis and austerity dominated social policies like the BSE. There are many reasons to believe in the inefficacy of the BSE, as it used to exclude income levels for eligibility. This means that wealthy families with many children could avail of the price discount, but single-parent households with just one child cannot (Gonzalez Rios, 2013).

4. Data and Descriptive Statistics

4.1 Data Sources

Data on household and individual characteristics, including energy poverty subjective variables, is taken from the Living Standards Household Surveys, which are harmonized across different European Union member states. The “Encuesta de Condiciones de Vida” (ECV) is published every year by the National Institute of Statistics (INE). Each household participates for four years in the survey, in a rotating panel.

We analyze those households who participated before and after the BSE was implemented in 2009. There are 2,715 such households, for a total of 10,860 observations. The survey contains information about the three subjective energy poverty indexes and several control variables: household size, income, type of building, etc. Other variables like employment status and number of household members allow us to construct the sample of households that are eligible for the BSE. However, we cannot infer whether a household benefited from the BSE.

4.2 Limitations of the available data

The ECV, in contrast with other household surveys, does not contain information about the amount that households spend on electricity. There is “expenditure in the household”, but this includes all expenses. Therefore, we use the subjective indicators for this analysis. Another limitation is that the 2015-2018 data are unavailable. Those data would be used to analyze if the latest reform had any effect on the subjective energy poverty indexes. Moreover, we imputed retirees with a minimum pension. It is likely that there is some error. These surveys are self-reported; meaning that some households may not have told the truth.

4.3 Key variables

The outcome variables are the three subjective measures of energy poverty: presence of leaking roofs, damp walls and rotting windows; delays in electricity bills; and ability to keep the house adequately warm. These indexes are presented as dummy variables and we analyze the impact of the policy on them. Delays in electricity bills are an indicator of inability to pay electricity costs, which can lead to cut-offs. The ability to keep your house adequately warm is linked to health issues. If someone cannot afford heating, they may try alternative and potentially dangerous methods, such as candles. This index is highly related to the majority of “winter excess deaths”, which are mostly caused by alternative methods to heat the house. Lastly, the presence of damp walls, rotting windows and leaking roofs refer to the state of the building. These variables are related to poor housing energy efficiency and can be the root cause of several illnesses such as infectious and respiratory diseases. Overall, the three indexes together cover the majority of the problems that arise from energy poverty.

Our main independent variable will be the interaction term between the treatment and the time after the reform was implemented. Those households that meet the requirements are the treated and we take 2009 as the last year before the reform, as it was implemented during the last months of the year. We include also several controls that are available in the survey. Variables like household size, type of building, region and number of rooms are likely to have an impact on the energy needs and consumption of a household. If they live in a flat, it is less likely to be very cold during the winter due to their neighbors. We expect the impact of income to be of key relevance for every index of energy poverty. Households with a low budget will have to make decisions on how they are going to allocate their income to cover basic necessities. In a similar way, the number of rooms in a house is likely to have an impact, since it accounts for the size of the house. Lastly, we account for the possibility of “transfers to other households” having an impact on our outcome variables.

4.4 Descriptive Statistics

Figure 2 show that the number of households experiencing one of these three deprivation indexes has not varied substantially from 2008 to 2011, except for an increase in the delays in electricity bills in 2009 and 2010. The percentage of households that were able to keep their house warm fell by 2.5%, delays in electricity bills increased by 2.2% and the percentage of households experiencing leaking roofs, damp walls or rotting windows increased by 5.2% during these two years. This can be attributed to the impact of the financial crisis and subsequent loss of employment, decreasing salaries and increasing electricity prices. The highest index among Spanish households is the presence of damp walls, rotting windows and leaking roofs. This might suggest that housing quality is another key aspect to consider besides income when analyzing Spain.

Energy poverty has a strong regional component. Figure 3 shows the incidence of any type of energy-poverty by Comunidad Autónoma. Energy poverty is highly concentrated in the South of Spain, the Canary Islands, Cantabria, and Galicia. The richer regions in the North and the financial and economic centers Madrid and Cataluña show an incidence of less than 20%, with Aragon reporting the lowest at 0.06% of households.

We create the dummy variable "energypoor" for households affected by the at least one of the three indexes. The share of households identified as energy poor is 23.55%. We compare the incidence of energy poverty against the criteria for the BSE. Only one of the requirements is correlated with energy poverty: retirees with the minimum pension. For the other two requirements (unemployment and family size), the difference in energy poverty is not significant. Retirees with minimum pensions are 11.2% more likely to report delays in electricity bills. These statistics suggest that the requirements to apply for the BSE are questionable.

In Greece, 90% of the energy-poor are also income-poor (Papada and Kaliampakos, 2016). However, in Spain, according to our data, 37% of income-poor households[3] are also energy-poor in contrast to 21% of the non-income-poor households (Figure 3)

Other contemporaneous events may have affected the increase of energy poverty in the last decade. Prices increased every quarter in 2009 and 3 out of the 4 quarters in 2010. Over 2009 and 2010, the electricity price rose by 29.8%, more than offsetting the 25% discount of the BSE. Temperatures were low in 2010, which was the first year after the implementation of the BSE. 2010 was the coldest year since 1996, with abnormally cold temperatures during the months of November and February (AEMET, 2010). This is likely to have an impact on the variable "ability to keep your house adequately warm".

5. Empirical Strategy

In order to analyze the impact of the BSE on energy poverty, we use a linear difference-in-differences model (DiD) and propensity score matching (PSM).

5.1 Difference-in-Differences

We employ DID as one of the most effective methods for policy evaluation since it allows to isolate the causal effect of the BSE on the potential beneficiaries of the policy. We have a "control group" in non-eligible households and a "treatment group" in those who are eligible. We thus estimate the intention to treat. As the policy was implemented in late 2009, we consider 2008 and 2009 pre-treatment and 2010 and 2011 as post-treatment. Ideally, whether a household is in the treatment or control group should be randomized. However, in this case, it is given by certain requirements that the households have to meet, which indicates that both groups are not homogenous. This potentially biases our estimates. Moreover, the control

[3] The estimate for income poverty has been calculated from the "relative monetary poverty" definition, which categorizes a household as poor when the income is below 60% of the median of that country, as established by the European Union (European Parliamentary Research Service, 2019). In 2009, this was 8,877 euros per year for a household in Spain.

group may be contaminated by eligible households that did not apply for the BSE; we analyze eligibility to treatment and not actual treatment.

Our outcome variables are dummy variables that indicate the ability to keep the house warm, presence of damp walls, leaking roofs and rotting windows or delays in electricity bills. Our variable of interest is the "DiD" variable, which is the interaction term between those treated and the period after the subsidy was implemented. We interpret the coefficient for the DiD variable as the impact of the subsidy. We expect that the BSE has a negative impact on the presence of leaking roofs and in delays in electricity bills, and a positive impact on the ability to keep your house warm.

Our regression includes regional dummies for each "Comunidad Autónoma" (region) in Spain. We expect the region to play an important role due to differences in the temperatures, rainy days, different welfare policies, etc. As we have seen in the descriptive statistics, regional characteristics are likely to play a major role. The selection of the other covariates is explained in Section 4.

5.2 Propensity Score Matching

We expect a high degree of heterogeneity between the control and treatment groups in our data. Therefore, we check the robustness of our DiD model by the use of matching estimators. Propensity Score Matching is an effective method when the treatment is not randomized as it focuses on the common support: those households in either group that share similar propensity to be treated. In order to conduct PSM, we match the households accounting for the covariates that predict treatment (Rubin, 1997). The households in the common support are then randomized. We match on the variable "treated" to test for the variables that affect the probability of being treated. For this purpose, we run a logistic regression on the treated variables with all the covariates that were previously presented.

We test for bias reduction and common support to ensure the quality of the matching. The common support assumption states that there is enough overlap in the relevant characteristics of both the treated and untreated households to find the adequate matches (Rosenbaum and Rubin, 1983). We exclude those observations that lie outside our common support and focus on the matched ones, since we aim to analyze those households with a similar propensity of being treated. We find that 144 households are not part of the common support.

We consider Rubin's recommendations to measure the success and robustness of our matching (Rubin, 1997; Rubin and Waterman, 2006). First, we check if our standardized bias has reduced to 5% or less, and use Rubin's R and Rubin's B to test for the success of the matching. Rubin's B is the standardized difference between the means of the propensity scores in treatment and control groups and Rubin's R is the ratio of variances of propensity scores for both groups. The lower these values, the better the matching. As a rule of thumb, we aim for values below 25% and 2% respectively.

Table 2 shows that the bias reduction was indeed successful. None of our matched variables show a bias higher than 5%. Rubin's B and Rubin's R equal 6.8 and 1.1, respectively, which suggests that the matching has been conducted successfully. The mean standardized bias was reduced from 14.5 to 1.1 by matching. The average bias reduction across all the variables is 92.4%.

6. Results

6.1 Difference-in-Differences

Table 3 shows regression results for each outcome variable with and without controls. Without control variables, the BSE only has a statistically significant impact on delays in electricity bills. On average and ceteris paribus, being eligible for the BSE *increases* by 1.7 percentage points the probability of suffering from delays in electricity bills. For the other two outcome variables, the results show no significant effect of the subsidy on the ability to keep your house warm and the presence of leaking roofs, damp walls and rotting windows. The impact on the delays in electricity bills is counter-intuitive: the subsidy makes eligible households worse off.

These results do not change when we add control variables. Income, the number of rooms, the level of education and several regional dummies are significant determinants for all measures of energy poverty. Living in a flat reduces by 11.7 percentage points the probability of suffering from damp walls, leaking roofs or rotting windows. It also increases by 1.4 percentage points the probability of being able to keep your house adequately warm. This is due to the impact of the neighbors (heating is an externality).

There are some plausible explanations for the BSE delaying electricity bills. Households could have delayed paying while waiting for the BSE grant. We test for this by analyzing whether this effect continues in 2011. (Households do not need to apply again.) We find no statistically significant impact in 2011 (results not shown).

6.2 Propensity Score Matching Model

Table 4 shows the results of the PSM model for every index. The number of observations decreases from 10,860 to 10,716 since we have dropped the households that are not in the common support. The covariates are the same as in the linear difference-in-differences model.

For the standard PSM, the impact of the BSE on damp walls, rotting windows and leaking roofs is still statistically insignificant. As above, we find a positive and statistically significant impact on delays in electricity bills. The odds ratio of experiencing delays in electricity bills increases by 2.7%, on average and ceteris paribus.

The BSE statistically significantly *reduces* the ability to keep your house warm. The odds ratio increases by 0.011, on average and ceteris paribus. The rise of electricity prices, which was larger than the discount of the BSE, may have played an important role. Also, the cold winter of 2010 may also explain this result. Again, we compare these results to the impact of the BSE for the next year. The coefficient for keeping your house adequately warm is statistically insignificant (-1.78) for 2011. On the other hand, the impact on the delays in electricity bills persists.

Since the difference in incidence between vulnerable and non-vulnerable regions is considerable (see Figure 2), we conduct the matching dropping the observations of households in the less vulnerable regions (below country average). We can see the results in column 2 of Table 4, and we refer to it as *vulnerable sample*. The new matching retrieves 92 households outside common support and a slightly higher standardized bias of 1.7. Still, the bias lies below 5% and the Rubin's B and Rubin's R are also within the recommended values. We find that the effect on delays in electricity bills persists, although the t-statistic drops to 3.95. The coefficient for the ability to keep your house at an adequately temperature becomes statistically insignificant, with a t-statistic of -1.65. That is, we find that the eligible households are only better off in terms of ability to keep their houses warm, but it can be attributed to the fact that the regions that we dropped are the colder ones in the north of Spain, whereas in the Southern Regions the temperature does not fall as much during the winter.

We include transfers to test if this alters the previous results. We consider transfers to other households (presumably related or befriended) as a factor that might explain why eligible households have more difficulty to keeping their house warm. Retirees financially supporting their extended family were a very common phenomenon during the financial crisis in Spain (El Economista, 2014). Pension payments became the only reliable source of income for certain families. We do find that retirees are more likely to transfer income to other households (results not shown).

Adding the transfer variable does not affect the results as we can observe in Table 5. These results indicate that transfers to other households do not have a significant impact when it comes to the subjective indexes of energy poverty. The impact of the BSE on the three indexes is not affected and it retrieves the same coefficients and ATT in comparison to our original PSM model.

Our findings could be problematic if barely anybody applied for the BSE since we would have a small sample of actually treated households. 13.4% of households received the subsidy (see above), but in our sample, 36% of the households are eligible. This shows that, even if not all of the households apply, the impact on almost 3 million households should have been reflected in our results.

7. Concluding Remarks

We analyze the impact of the *Bono Social de Electricidad* on energy poverty in Spain between 2008 and 2011. Using a household survey data, we employ a difference-in-differences approach to test for the impact of its implementation on three different indexes of energy poverty, viz. ability to keep your house adequately warm, delays in electricity bills, and presence of damp walls, rotting windows and leaking roofs. We use matching estimators to test the robustness of our results.

The descriptive statistics support some of the most common findings in the energy poverty literature. Energy poverty is higher among income poor households. Second, there are regional differences in energy poverty. The southern, poorer regions experience higher degrees of energy poverty than the northern, richer regions. Retirees with the minimum pension report higher incidence on every index, with the largest difference in delays in electricity bills (11.2%). Large families report a higher incidence of delays in electricity bills, by only 2.4%, and less than 1.0% difference in the other indexes. Households with all members unemployed also do not present relevant differences, with the exception of less incidence in delays in electricity bills by 9.0%.

Regardless of the model or choice of covariates, we find no positive and statistically significant effect of the BSE implementation on energy poverty reduction. Our difference-in-differences estimators show that for two of the three indexes the interaction term coefficient is statistically insignificant. For delays in electricity bills, the effect is positive and statistically significant. Households eligible for the BSE are more likely to experience delays in electricity bills. The PSM model shows that eligible households experience difficulties in keeping their house at an adequate temperature. Transfers to other households do not explain the struggle to keep houses adequately warm. The cold of 2010 could explain these findings.

These results are subject to certain limitations. First, we impute eligibility of households for the BSE. Hence, this is an estimate of the potential beneficiaries. Second, not everyone applied. We thus estimate the impact of the intention to treat. Third, we have subjective indexes of energy poverty but no expenditure measure. Fourth, we have no data on home insulation or the type or efficiency of heating systems. Fifth, data for the 2015-2018 rotating panel are not yet available, so that we cannot study the impact of the 2017 BSE reforms.

A reform of the subsidy is needed. It is not clear that the change in the criteria in 2017 is enough to correct an ineffective policy, despite that it means better targeting of the vulnerable consumers. Structural problems such as energy-inefficient buildings are not likely to be tackled by an income transfer. 23.55% of Spanish households suffer energy poverty. A country with high average temperatures is not prepared for the cold weather. Some vulnerable groups of the society are likely to suffer from the lack of equipment and low energy efficiency when faced with low temperatures. New complementary policies to the BSE, such a project to renew the least energy efficient buildings, are likely to improve the situation. An easier application process suitable for people who are not familiar with online applications is one step to improve the BSE, as are support with applications and promotion the awareness of the policy. Like the caveats discussed above, these policy reforms should be tested in future research.

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Data Availability

Living Standards Survey (INE):
https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176807&menu=resultados&secc=1254736195153&idp=1254735976608

Boletín de Indicadores Energéticos (CNE/CNMC):
https://www.cnmc.es/listado/sucesos_energia_mercado_electrico_boletines_de_indicadores_electricos/block/250

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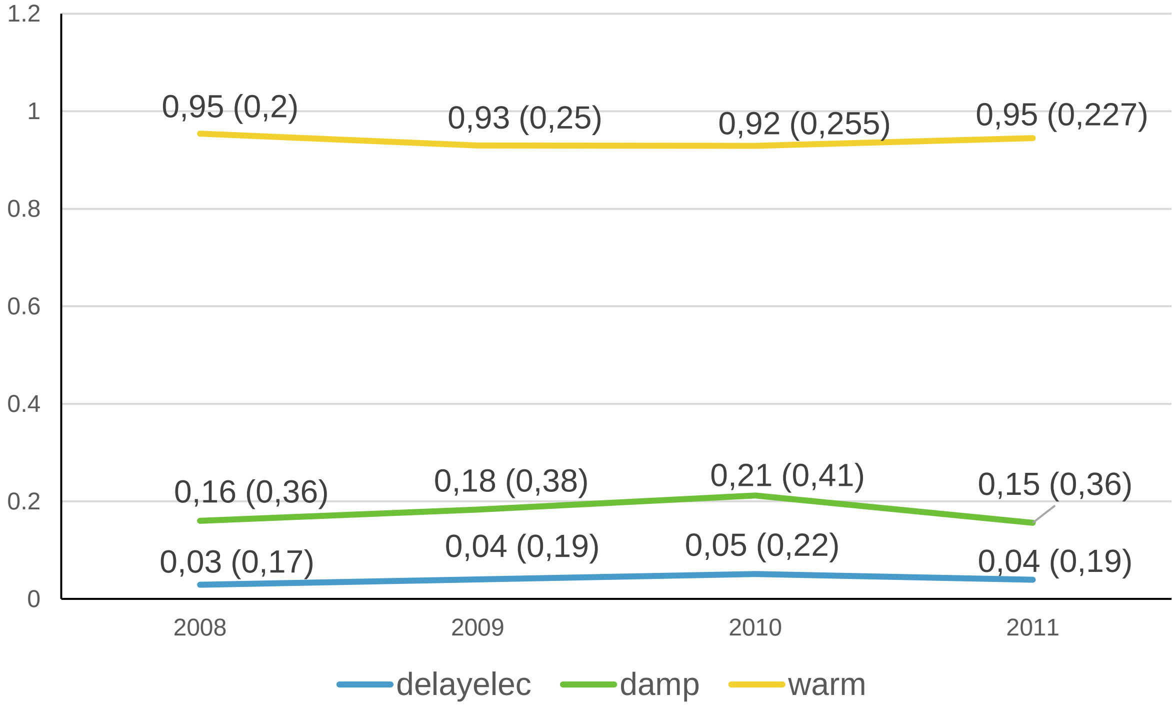
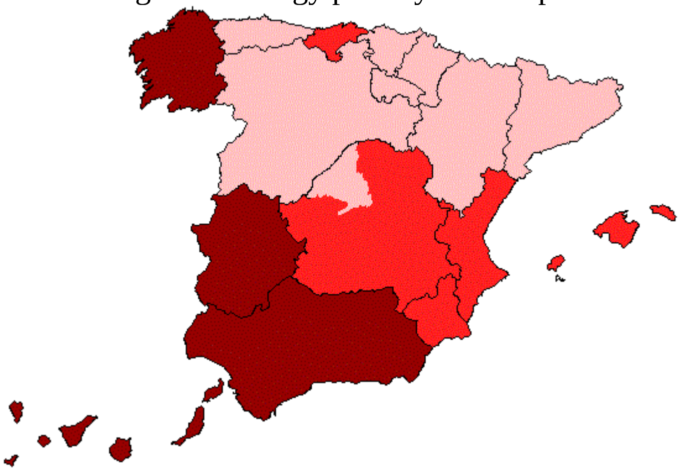
Figure 1. Mean of energy-poverty indexes by year



Note: Standard deviations in parentheses.

Figure 2. Energy poverty across space



Note: The map does not include Ceuta and Melilla which are located in the north of the African continent and show 32.3% and 16.07% of households in energy poverty, respectively. The darkest highlighted regions is where energy poverty affects more than 30% of the households. The medium intensity is for regions where the incidence is between 20% and 30%. In the rest of the regions, the percentage of households affected is less than 20%. A household is considered to be energy poor if it suffers from at least one of the subjective indexes.

Figure 3. Incidence of energy poverty by income poverty

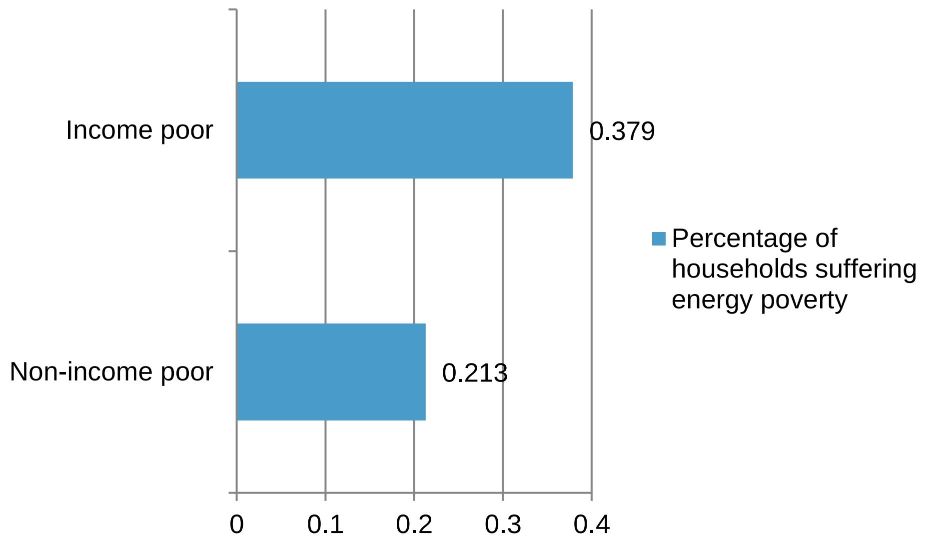


Table 1. Key variables

Name	Label
year	Year of the survey
hhid	Household Identification Number
pid	Personal Identification Number
delayelec	Dummy variable that indicates if the household experienced delays in electricity bills
nrooms	Number of Rooms
damp	Dummy variable that indicates the presence of leaking roofs, damp walls or rotting windows
warm	Dummy variable that indicates the ability to keep the house adequately warm
flat	Dummy variable that takes the value 1 if the household lives in a flat
detached	Dummy variable that takes the value 1 if the household lives in a detached house
urb	Dummy variable that takes the value 1 if the household lives in an urban area
rural	Dummy variable that takes the value 1 if the household lives in a rural area
largefam	Dummy variable that takes the value 1 if there are 4 or more members in the household
minret	Retiree receiving a minimum pension
region	Indicates the region where the household lives
lninc	Log of household income in Euros

Note: Region is divided in 18 dummy variables that represent each region of Spain. All variables are dummy variables except for log of household income, year, household and personal identification number and the number of rooms.

Table 2. Bias reduction after the matching

Pre and Post Matching Analysis					
	Mean Bias	Median Bias	Rubin's R	Rubin's B	Avg. bias reduction
Unmatched	14.5	7.7	95.3	0.92	
Matched	1.1	1.1	**6.8**	1.08	92.4%

Table 3. Difference-in-differences results

VARIABLES	(1) delayelec	(2) delayelec	(3) damp	(4) damp	(5) warm	(6) warm
DiD	0.017***	0.018***	0.000	0.006	-0.004	-0.006
	(0.006)	(0.006)	(0.012)	(0.012)	(0.008)	(0.008)
Treated	0.019***	0.019***	0.007	0.005	-0.004	-0.011*
	(0.005)	(0.005)	(0.009)	(0.009)	(0.006)	(0.006)
Treatment time	0.002	-0.002	0.012	0.006	-0.002	-0.000
	(0.004)	(0.004)	(0.010)	(0.010)	(0.006)	(0.006)
Log of income	1111	-0.021***		-0.026***		0.027***
		(0.004)		(0.005)		(0.004)
Primary education		0.010**		0.003		-0.010*
		(0.004)		(0.008)		(0.005)
Secondary education		0.016***		0.026***		-0.017***
		(0.004)		(0.008)		(0.005)
Tv ownership		0.065***		0.035		0.106
		(0.011)		(0.070)		(0.073)
Car ownership		-0.021***		-0.058***		0.028***
		(0.007)		(0.011)		(0.008)
Washing machine ownership		0.013		-0.043		0.021
		(0.019)		(0.050)		(0.039)
Computer ownership		0.008		0.005		0.020***
		(0.006)		(0.009)		(0.006)
Number of rooms		-0.013***		-0.023***		0.007**
		(0.002)		(0.004)		(0.003)
Retiree		0.015***		0.012		-0.004
		(0.005)		(0.008)		(0.005)
Flat		0.003		-0.117***		0.014**
		(0.005)		(0.011)		(0.007)
Detached House		-0.010*		-0.017		-0.003
		(0.006)		(0.014)		(0.009)
Rural		-0.000		0.005		-0.002
		(0.005)		(0.009)		(0.006)
Constant	0.028***	0.241***	0.169***	0.780***	0.943***	0.468***
	(0.003)	(0.037)	(0.006)	(0.095)	(0.004)	(0.085)

Note: Columns 1, 3 and 5 do not control variables. The regional dummy variables have been excluded from this table, but they were included as control variables in the regression. Standard errors in parentheses.

Table 4. Results of the PSM model by index

	Original PSM (1)			**Vulnerable Sample PSM (2)**		
	Damp walls	Adequate Temperature	Delays in Electricity Bills	Damp Walls	Adequate Tempreature	Delays in Electricity Bills
Treated Mean	0.184	0.938	0.055	0.222	0.917	0.064
Control Mean	0.176	0.949	0.028	0.223	0.932	0.035
ATT	0.008	-0.011	0.027	-0.001	0.015	0.029
t-statistic	0.84	**-2.03**	**5.36**	-0.14	-1.65	**3.95**
Standardized Bias Mean	1.1			1.7		
Rubin's R	1.08			1.04		
Rubin's B	6.8			8.05		
Sample Size						
On Common Support	10,716			5,603		
Off Common Support	144			92		
Total	10,860			5,695		

Note: Column 2 excludes the regions that are below the mean of energy poverty, in order to focus on the most vulnerable regions. This is due to the large regional differences in energy poverty incidence. The regions excluded are Madrid, Cataluña, Melilla, Castilla La Mancha, La Rioja, País Vasco, Asturias and Aragón.

Table 5. PSM results with transfers included

PSM with Transfers			
	Damp walls	Adequate Temperature	Delays in Electricity Bills
Treated Mean	0.184	0.938	0.055
Control Mean	0.176	0.949	0.028
ATT	0.008	-0.011	0.027
t-statistic	0.84	-2.03	5.36