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ORIGINAL PAPER

Economic Hardship, Housing Cost Burden and Tenure Status: Evidence from EU-SILC

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Abstract The primary goal of this study is to contribute on the literature on poverty by looking at household economic hardship in relation to the housing cost burden. Being one of the most significant outlays in a household balance, housing costs may indeed cause households to reduce non-housing expenditure such as health care, education, food, and clothing, thus creating serious household economic hardship. Using microdata from the European Union Statistics on Income and Living Conditions dataset (EU-SILC) regarding five European countries (Italy, Germany, UK, Spain, and France) we have examined the predictive power of housing costs in explaining family economic hardship. Furthermore, we have jointly estimated the effect of the housing cost burden upon economic hardship for renters versus home-owners paying mortgages. Results showed that housing costs represent a non negligible burden in all the five European countries. Moreover, home ownership was found to significantly reduce household hardship status.

Keywords Financial distress · Household finance · Housing cost burden · Tenure status

JEL Classification D12 · D14 · C24

Introduction

Although it has been often asserted that housing costs are one of the key determinants of household poverty status (Mimura 2008; Kutty 2005), in practice they have been rarely considered in relation to household economic hardship, and the focus has been on the role played by income or other socio-economic determinants of poverty. However, housing costs are among the most significant expense in a household balance (Stone 2006). Indeed, high housing costs may cause households to reduce non-housing expenditures such as health care, education, food, and clothing (Stone 2006; Kutty 2005). The gap between housing expenditures and income in some cases has increased to the point that many households ask for payday loans to pay for utilities (Melzer 2011) or risk foreclosure (Bostic and Lee 2008). Ignoring the housing cost burden may thus prevent a sound analysis of household poverty.

Within this context, tenure status is a crucial determinant of the housing cost burden. Monthly housing costs may be significantly higher for mortgage payers than renters, thus representing a significantly higher burden in the short term. However, home ownership represents a long term investment that may act as a form of private social insurance against future income uncertainty. Therefore, it may exert its effects beyond the short term. This may hold true especially in countries with low levels of social insurance protection (Conley and Gifford 2006) or poor pension provision. In this regard, home ownership may help prevent poverty, especially among older generations (Venti and Wise 2004; Yates and Bradbury 2010).

In this paper, we used three different measurements of hardship in order to take into account the particular phenomenon which is experienced by households. The first one is a composite measure indicating severe material hardship combined with low work intensity and poverty risk. The second refers to financial hardship, or financial distress, defined as the self-reported difficulty of paying mortgage or rent payments, utility bills and other loans on time. Last but not least, the third measure is a self-reported

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measure regarding the ability to make ends meet. Using a self-reported measure of hardship, rather than conventional measures of material or financial destitution, helps to overcome any problem related to households' unobserved preferences, and at the same time, to consider the role of comparison income effects on subjective well-being (Labeaga et al. 2007S).

Specifically, this study contributes to the literature on poverty by looking at families' economic hardship in relation to their housing cost burden. We deviated from previous literature in several ways. First of all, we went beyond the usage of traditional country-level measures of economic hardship based upon income thresholds. As observed by Bárcena-Martín et al. (2013), income is only one of the determinants of poverty.[1] Factors such as poor accumulated resources, employment status, educational level, and housing status, among others, may indeed affect living standards more than just income would do. Within this line of research, several proposals have appeared in the literature, which analyse household deprivation as a multidimensional phenomenon (Atkinson et al. 2002; Ayala et al. 2011; Nolan and Whelan 2010, 2011). Furthermore, using solely income-based measures of hardship does not allow several forms of non-monetary benefits to be taken into account which could impact on household poverty. Since housing represents one of the largest expenditure items in a household balance, living mortgage-free, or with reduced rent, may significantly reduce households' economic burdens. In this regard, looking at the impact of housing costs upon the probability of suffering from economic hardship would provide some useful insights and thus help develop a more comprehensive measure of hardship. This is in line with the definition of housing-induced poverty as a situation that arises when the burden of housing costs (rent, mortgage repayment) makes non housing goods unaffordable (Kutty 2005).

Secondly, we provided a re-examination of family economic hardship in relation to tenure status. Housing tenure choice represents one of the most crucial choices for individuals, involving consumption as well as investment choices (Banks et al. 2003). On one hand, housing services absorb a large fraction of the household budget, in terms of mortgage repayment or rent. On the other hand, housing represents a significant long term investment for households, which makes up a large fraction of households' portfolio in most countries.[2] Further, tenure choices depend on household-level factors as well as country-level ones, so that a relatively poor household may encounter some difficulties in finding an accommodation that fits its budget requirements (Van Dam et al. 2003; Bosch 1998).

Beside the fact that renting may be relatively cheaper than paying a mortgage in the short term, ownership represents a long term investment[3] that may act as a form of private social insurance against future income uncertainty in countries with low levels of social insurance protection (Conley and Gifford 2006) or poor pension provision, thus preventing poverty, especially among older generations (Venti and Wise 2004; Yates and Bradbury 2010). Last but not least, the debate regarding housing versus renting has gone far beyond mere housing market issues, involving broader social, economic and demographic problems. In particular, homeownership issues should be taken into account when considering a broader concept of poverty that involves also non income-related determinants (Watson and Webb 2009).

In order to avoid the inclusion of a heterogeneous set of situations in the analysis, we focused on working households. Traditionally, hardship has been associated with disadvantaged categories such as the unemployed, homeless, or people with disabilities. However, households today may be in a working status and nevertheless remain under the poverty threshold. According to the Eurofund Seminar Report on Working Poverty in the EU (EUROFUND 2010), 18 % of the self-employed and 6 % of the employed in the EU15 can be classified as poor. From this perspective, the phenomenon of the so-called "working poor" has become a great concern for both economists and policy makers.[4]

Using micro data on five European countries taken from the European Union Statistics on Income and Living Conditions (EU-SILC henceforth), we performed a cross country investigation on the mechanism of individual deprivation by relating several measures of material and financial deprivation to socio-economic variables at individual level, considering, at the same time, country characteristics such as the institutional environment and political interventions as the main candidates to explain variations in observed levels of household deprivation.[5]

[1] Mammen et al. (2014) highlighted the extent to which poverty status as well as its trajectory is determined by more than just income or employability. Albeit focusing on poverty and well being in rural areas, the authors emphasized that not only poverty, but also the process to exit or enter into poverty has a multidimensional nature.

[2] See, among others, Alessie et al. (2002) for the Netherlands, Banks et al. (2003) for the United Kingdom, Kessler and Wolff (1991) for France and the United States, and Wolff (1994) for the United States.

[3] In this regard, expectations for a high capital gain represent an incentive to become a home-owner (Goodman 1990).

[4] According to the Eurofund Seminar Report on Working Poverty "workers living in a household where at least one member works and where the overall income of the household (including social transfers and after taxation) remain below the poverty line (60 % of median equivalized income) are defined as working poor".

[5] On this regard, this study allows to consider jointly institutional country-level factors and micro-level mechanisms.

We used two measures of housing costs in our dataset. The first one is simply the ratio between household-related costs and household income, while the second is a self-reported measure of the financial burden represented by housing costs. While the first represents the actual cost borne by households, the second is a subjective measure. Indeed, the first measure includes factors such as the cost of living and conditions related to the job market, while the second is more closely related to household perception of the housing burden, and thus is more affected by subjective factors such as comparisons with the reference group.

On the methodological side, we jointly estimated the probability of facing some kind of hardship and the probability of being a home owner by using an endogenous switching regression approach according to the procedure of (Miranda and Rabe-Hesketh 2006). This approach allows dealing with the endogeneity of an explanatory variable when it is a binary variable. Actually, the main challenge when estimating the causal effect of tenure status on economic hardship is that being an owner rather than a renter may be endogenous, since the allocation of households among home owners and renters is based on outcomes that have been endogenously chosen by households. Households' choices regarding tenure status depend on several factors that can also affect the likelihood of facing hardship. Family background, for example, is likely to affect both the probability of being in hardship and the probability of being a home owner. Households might receive help from parents or friends in order to alleviate a situation of poverty, and, at the same time, wealthier relatives might help households with a down payment to obtain a mortgage. Similarly, someone expecting to be fired/have irregular contracts will probably not be a homeowner; at the same time, these households are more likely to experience some form of hardship. Thus, neglecting the potential endogeneity of the tenure status may result in biased and inconsistent estimators.

To our knowledge, our study is among the first to explicitly consider the extent to which effective and perceived housing costs affect economic hardship from a cross-country perspective. Moreover, we contributed to the existing research by simultaneously considering the effect of housing costs and tenure status upon household poverty.

The paper is structured as follows. A brief literature review on the measurement of household hardship as well as the description of some of the main studies about ownership status is first presented. The following section describes the data used and the variables introduced in the study. Next, the method of analysis is described, as well as the results of our analysis. The final section reports concluding remarks, policy implications and avenues for future research.

Literature Review

This paper relates to two strands of literature. First, the contributions which have attempted, from an empirical perspective, to shed light on the determinants of household economic hardship. In particular, recent improvements in the poverty literature, place into question the consistency of measures of deprivation based on mere income-based criteria (Layte et al. 2001; Nolan and Whelan 2011; Figari 2012; Fusco 2012).[6]

Georgarakos et al. (2010) estimated a random effects probit regressions using ECHP household survey data from 1994 to 2001 for twelve European countries. They analysed the extent to which debt burdens affect households' reported financial distress. Financial distress in this case was defined as housing costs being a financial burden for the household. Their cross-country analysis highlighted that households' reported distress tended to be higher in countries with a more expanded credit market. In line with Townsend (1979), household perceptions of their debt burden needed to be compared with the average of the reference group. Thus, households' assessment of their debt burden tended to be lower in countries with a relatively low number of mortgage holders.

Brandolini et al. (2013) defined financial hardship as a self reported perception of housing cost burden. They used EU SILC data over a five year time-span to perform a comparative analysis, shedding light on objective and subjective motives affecting household financial distress. In particular, they examined the micro and macroeconomic determinants of the self reported measure of housing cost burden.

Ayala et al. (2011), using Spanish data from EU-SILC, disaggregated at regional level, questioned the existence of country-level association between personal income and the probability of facing some kind of hardship. First of all, the authors used a latent class model in order to construct a synthetic deprivation index. Second, they analyzed the linkage between economic hardship and income-based poverty at regional level, in order to avoid intra-regional heterogeneity. The authors eventually found that poverty-level income did not seem to have a high explanatory power even at regional level, supporting the idea that peculiarities at regional levels may affect household deprivation more than income.

Bárcena-Martín et al. (2013) joined in the debate on whether household hardship should be considered as a

[6] Boarini and d'Ercole (2006) found that the probability of experiencing material deprivation is twice as large among those in the lower quartile of the income distribution than for those in the middle quartile, although these differences vary greatly across countries.

mere microeconomic phenomenon, explained by individual drivers, or rather a macroeconomic phenomenon, driven by country-level aggregate factors. Using data from the 2007 wave of EU-SILC, the authors estimated a multilevel model of deprivation,[7] considering the phenomenon of multidimensional deprivation at both individual and aggregate level. The authors eventually found that institutional factors affected cross-country differences among households more than individual-level variables.

Several papers analyzed the determinants of household hardship in the US as in Europe. Mayer and Jencks (1989) measured hardship as the inability to afford food, housing, and medical care. Using two surveys regarding Chicago residents in 1983 and 1985, they explored the determinants of hardship, claiming that traditional measures of hardship based on income to need ratio might not be totally effective in describing hardship. Melzer (2011) considered the effects of payday loans on economic hardship. Using data from the National Survey of America's Families (NSAF) over 3 years, the author used several measures of hardship: the delay or postponement of some kind of care of any household component; difficulty in paying bills, mortgage, or rent; moving out of one's home or apartment due to financial difficulties; reducing or skipping meals due to lack of money; going without telephone service for at least 1 month. Melzer (2011) eventually found that, rather than improving households' ability to afford certain expenses, increased access to credit increased the probability that households had difficulties in paying mortgage and utility bills, and delayed expenditures related to medical and dental care.

Mimura (2008) analysed whether the burden of housing costs rather than poverty thresholds helped explain family economic hardship among low income US households. She used a definition of economic hardship which was calculated as a factor score on the basis of nine economic hardship items including food insufficiency, household crowding, difficulty paying bills, medical need, and automobile ownership. Using cross sectional data from the National Survey of America's Families, the author estimated the effect of housing cost and poverty status upon household reported hardship using a general linear model, focusing on the analysis of differential effects according to race and ethnicity. The author eventually found that poverty status had a higher explanatory power than housing cost burden in explaining the economic hardship of low-income White, Black, and Hispanic households. Further, when considering families with children, poverty status, rather than housing cost burden, was found to have a differential explanatory power among ethnic groups.

Sullivan et al. (2008), using panel data from the Women's Employment Study, estimated OLS and fixed effect models to analyse the role played by income and other factors in determining household hardship. The authors defined household hardship using several dimensions: whether a respondent experienced food insufficiency, whether her utilities were shut off, whether she had been evicted, and whether she had been homeless.

Heflin et al. (2009) used data from the 2001 and 2004 panels of the Survey of Income and Program Participation (SIPP), and estimated several models of hardship using factor analysis. The authors argued that a model of hardship which separates different dimensions—health, food, bill-paying, and housing hardship—fit the data better than any other model tested.

In the above context, several studies emphasized the role of tenure status in preventing household hardship. Watson and Webb (2009) using data from the European Community Household panel survey from 2004 to 2006, showed the necessity of controlling for homeownership when performing poverty analyses. Regressing household hardship—defined as insufficient resources to make ends meet—on homeownership (besides various socio-economic characteristics) using a logit model, the authors eventually found that home-owners were less likely to report subjective poverty. In addition, a cross country analysis pointed out that the relative poverty level tended to increase in countries with a relatively higher owner-occupancy rate, thus supporting the idea that homeownership is used as a form of private insurance in countries that have greater income inequalities.

Yates and Bradbury (2010) focused on the role of homeownership for the elderly. Renting households are indeed more likely to experience higher poverty rates than homeowners, due to lower non-housing wealth, lower disposable incomes and higher housing costs in retirement. Similarly, Venti and Wise (2004)using several data sources regarding elderly US households, supported the idea that housing represents a sort of buffer in case of an unexpected event. Albeit the authors did not consider housing equity as a part of saving made by households to keep the same standard of living of the pre-retirement period, they considered the non-negligible role played by housing in preventing potential hardship situations. Conley and Gifford (2006) also highlighted the role of home-ownership as a substitute of social insurance, especially in countries with low level of social spending.

Our analysis was motivated by the literature examining the determinants of economic hardship, as well as the contributions which analyse the determinants of tenure

[7] Bárcena-Martín et al. (2013) consider deprivation as the inability to afford at least four out of nine items: to pay utility bills; to keep their home adequately warm; to pay unexpected expenses; to eat meat, fish, or a protein equivalent every second day; to enjoy a week's holiday away from home; to have a car; to have a washing machine; to have a colour TV; and to have a telephone.

status. After examining the extent to which effective and self-reported housing costs influence reported material and financial hardship, we have gone one step further by explicitly considering household tenure status. Our focus tended to be broader than an assessment of the determinants of household economic hardship. On one hand, we considered the incidence of actual and self-reported housing costs upon several measures of hardship, thus controlling for the robustness of this linkage. On the other hand, given that housing related choices represent one of the most important choices in households' lifecycle, we reckoned these need to be properly considered to provide a sound analysis of household hardship.

Data and Descriptive Evidence

We used data from the European Union Statistics on Income and Living Conditions (EU-SILC henceforth), an international database coordinated by Eurostat that consists of harmonized data on income and living conditions in 27 EU member states. EU-SILC contains a cross sectional component and a longitudinal one. We worked with data at cross sectional level for the year 2010.

The initial sample contained 476,705 observations with information on demographic and socio-economic characteristics at the household and individual levels from 27 different countries.[8] Given that household members share the same standard of living (Cantillon and Nolan 1998), we considered households as our unit of analysis. Particularly, we considered the household reference person as the person responsible for the accommodation.[9]

As in Brandolini et al. (2013), we restricted our analysis to five countries: Italy, UK, France, Germany, and Spain. Furthermore, given the nature of our research question, we restricted our analysis to households whose heads were aged 18–59.[10] Furthermore, we excluded from our sample those households declaring to be unemployed/not working in the reference period. Unlike similar papers that focused on the phenomenon of material and financial deprivation for traditionally disadvantaged categories such as the unemployed, disabled people, or households belonging to minorities, we decided to analyse households which were working but still had a non-negligible risk of facing hardship. Indeed, households may not be able to consume minimal levels of very basic goods and services such as food, housing, and medical care even if they have a relatively stable source of income. In-work poverty has been analyzed empirically at national level as well as with some comparative studies (Marx and Verbist 1998; Peña-Casas and Latta 2004). Bardone and Guio (2005) observed that almost 7 % of the employed population was below the poverty line, thus indicating the need to tackle this problem through appropriate policy measures (EC 2005). After excluding the unemployed and oldest households from our dataset, removing observations with missing values in the variables of interest and taking only five countries into account, we ended up with a sample of 14,104 observations.

The strength of EU-SILC is that it provides us with data on income, poverty, social exclusion and living conditions in the EU, as well as information regarding household hardship. Specifically, in the empirical analysis we used three measures of household economic hardship. The first one, *H1*, is a variable assuming value 1 if the household experienced at least one of the following situations: risk of poverty, severe material deprivation, and/or low work intensity.[11] The second indicator of hardship, *H2*, refers to financial hardship, that means that the household declared that in the last 12 months an inability to pay on time due to financial difficulties for at least one of the following items: utility bills (heating, electricity, gas, water, etc.) for the main dwelling; mortgage or rent payments; and/or hire purchase instalments or other loans. The third indicator that we used in the empirical analysis, *H3*, uses information regarding the self-reported level of income a household would require to make ends meet.[12] In particular, households in each of the participant countries were asked to reply to the following question: "A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total income, is your household able to make ends meet, namely, to pay for its usual necessary expenses?" A household replying "with great difficulty" or "with difficulty" to the above question was considered to face hardship. Using a self reported measure of hardship, rather than conventional measures of material or financial hardship may help to overcome those problems related to households' unobserved preferences.

[8] Information as social exclusion and housing-condition is collected at household level, while labour, education and health information come at personal level.

[9] EU-SILC documentation states that "the person responsible for the accommodation is the one owning or renting the accommodation. If the accommodation is provided at no cost, the person to whom the accommodation is provided is the responsible person. If two persons share responsibility for the accommodation, the oldest person is considered to be responsible".

[10] Indeed, the work intensity indicator that is used in order to calculate one of the indicators of hardship only refers to the population in the age range 18–59.

[11] See appendix for a detailed definition of material deprivation, low work intensity and risk of poverty according to EUROSTAT.

[12] A similar measure of poverty has been used by Watson and Webb (2009)

The material deprivation, considered by indicator *H2,* takes a pre-defined set of items into account, but households may consider themselves to be deprived if they suffer from not having items that are not in the list defined by EUROSTAT (2002). In this regard, using a subjective measure of hardship allowed taking the role of the income comparison effect on subjective well-being into proper account. Indeed, according to a relatively well developed strand of literature,[13] individuals, other things being equal, evaluate their own level of welfare by comparing their level of income to that of the reference group. On this regard, Ferrer-i-Carbonell (2005) using German panel data stressed the importance of household's own income in comparison to the income of the reference group. From this perspective, individuals consider hardship less burdensome if they reckon their level of welfare to be similar (or higher) to those of their peers.[14] Furthermore, Christelis et al. (2009) noticed that households' self reported inability to make ends meet was correlated with households' inability to borrow in order to support consumption, and thus in financial distress.

Finally, objective measures of distress (such as income) may show less variability than subjective ones (Valentino et al. 2014). The latter may indeed be able to capture unobservable individual characteristics (optimism, locus of control) that may cause households to perceive, ceteris paribus, less financial strain (Prawitz et al. 2013).

We used two measures of housing cost burden.[15] The first one, *HC*, is the actual cost borne by households. In the case of homeowners, housing costs would include the mortgage payment (principal and interest), property taxes, insurance, utilities, and maintenance costs. For renters these costs include utilities and monthly rent. Thus, we defined the actual cost burden as the ratio between household-related costs and household income. This is in line with official statistics, which often used income thresholds to define cost burdened households (Mimura 2008; Stone 2006). The second measure, *HBU*, is a self-reported measure of the financial burden represented by housing costs. Specifically, this measure is a binary variable, taking value 1 if the household reports total housing cost to be a heavy burden. While the first measure encompasses factors such as the cost of living and conditions related to the job market, the second is more related to household perception of the burden related to housing, and thus is more affected by subjective factors such as comparison with the reference group.[16]

Table 1 Descriptive statistics, economic hardship

	Total	DE	ES	FR	IT	UK
H1						
0	88.73	89.91	86.8	89.46	85.03	93.64
1	11.27	10.09	13.2	10.54	14.97	6.36
H2						
0	80.03	90.93	70.39	84.44	28.19	91.48
1	19.97	9.07	29.61	15.56	71.81	8.52
TARG						
0	89.41	84.26	55.42	70.03	65.46	92
1	10.59	15.74	44.58	29.97	34.54	8

Table 1 presents some descriptive statistics regarding the measures of economic hardship and measures of housing costs used in the empirical analysis. Overall, almost 11.27 % of the households reported facing hardship according to the definition *H1*. This percentage is higher when considering *H2* and *TARG,* (19.97 and 10.59 %, respectively). This is in line with the possibility that *H3*, being a subjective measure, is able to capture household-specific situations where economic hardship may arise. In this regard, *H1*, by encompassing standard situations of material hardship, may not be able to properly capture household heterogeneity.

Looking at cross-country statistics, we noticed that UK showed the lowest percentage of households reporting hardship (it is always lower than 10 %), while the highest percentage was found in Spain and Italy.[17] When looking at Italy, we noticed that 71 % of households reported having experienced financial distress. This is in line with the relatively thin mortgage market and high levels of down payment requirements (Chiuri and Jappelli 2003).

Looking at cross-country distribution of measures of housing costs, Table 2 shows that there was not a great deal of cross-country variability in the average level of housing cost over total income. In total, households reported paying almost 40 % out of their total income for housing related expenses. When looking at the second indicator, we

[13] Peer group effects have been studied with reference to consumption (Charles et al. 2007; Childers and Rao 1992) and stock market participation (Hong et al. 2004).

[14] The usage of such a self-reported measure of hardship may capture households who experience a lower level of welfare than their peers, but who may not face hardship in absolute sense. From this perspective, the usage of alternative hardship measures allows to check for the robustness of results to different measurement of households' hardship status.

[15] For example, the US Department of Housing and Urban Development, Office of Policy Development and Research (2007) considers households paying more than 30 % of gross income for housing as cost burdened, while those paying 50 % or more are considered severely cost burdened.

[16] Brandolini et al. (2013), analysing the determinants of perceived housing cost burden, found indeed this measure to be strongly correlated to the effective housing cost sustained by households.

[17] According to Boeri and Brandolini (2005), subjective factors such as disappointed expectations, high income mobility and high income inequality are good candidates to explain Italian households poverty perception.

Table 2 Descriptive statistics, housing cost burden

Housing cost (mean value)	Total (%)	DE (%)	ES (%)	FR (%)	IT (%)	UK (%)
Housing cost/ income	37.81	37.09	38.41	38.19	24.39	40.90
Perceived housing cost burden	36.45	18.04	49.12	27.44	67.87	23.63

noticed instead that it ranged from 20.97 % in Germany to 81.90 % in Italy. Again, high imperfections in credit markets may be considered as responsible for households' perceived burden.

Empirical Estimation

Following Mimura (2008), the linkage between housing hardship and housing cost was estimated to determine the extent to which the burden represented by housing costs explained the likelihood of facing some kind of hardship. However, we went one step further by using measures of household hardship beyond material hardship, as well as two measures of housing cost burden.

In addition to HC and HBU, several demographic and socio-economic variables were included in the estimation. The set of demographic indicators included age, education, sex, a dummy indicating household being married, two dummies indicating household composition, an indicator of tertiary education attainment, and a dummy indicating household reporting good health. Further, it included a set of variables regarding the job of the reference person: sectoral dummies, a dummy indicating whether the household head had a permanent contract, and a dummy indicating change of job with respect to the previous year. Income quartile dummies and interaction terms between income quartile and levels of education were included as well in order to control for permanent income effects. Finally, country dummies were included in order to consider institutional country specific factors such as financial market level of regulation, and subsidies and tax policy towards homeowner/renters .[18] This analysis allowed for a number of inferences about households' perceived hardship.

Tables 3 and 4 show the results of a probit equation, where the dependent variables are H1 (Model (1)), H2 (Model (2)) and TARG (Model (3)), and the main explanatory variables are HBU and HC, respectively.[19]

Table 3 Determinants of household economic hardship, probit regression using HBU

Variables	(1) H1	(2) H2	(3) TARG
HBU	**0.0338*** **	**0.120*** **	**0.237*** **
	(0.00531)	**(0.0124)**	**(0.00977)**
II income quart*educ	−0.0127†	0.0202	−0.0191
	(0.00674)	(0.0224)	(0.0126)
III income quart*educ	−0.0107	0.0151	−0.00139
	(0.00923)	(0.0231)	(0.0133)
IV income quart*educ	−0.0292*	−0.00205	−0.0356*
	(0.0133)	(0.0289)	(0.0165)
Education	−0.00713	−0.0535**	−0.0179
	(0.00480)	(0.0182)	(0.0109)
Good health	0.00346	−0.0545†	−0.0562*
	(0.00701)	(0.0310)	(0.0231)
Permanent contract	−0.0212***	−0.0326†	−0.0196†
	(0.00620)	(0.0179)	(0.0106)
Change of job since last year	0.0150*	0.0582**	0.0218*
	(0.00663)	(0.0217)	(0.0111)
I income quartile	0.113	0.181†	0.0631
	(0.0898)	(0.109)	(0.0521)
II income quartile	0.0129	0.0247	0.0558
	(0.0396)	(0.0723)	(0.0491)
III income quartile	−0.0301	−0.0174	−0.0357
	(0.0240)	(0.0650)	(0.0342)
Age	−0.000263	−0.00211***	0.000975**
	(0.000171)	(0.000531)	(0.000326)
Household composition			
No children	−0.00528	−0.0189†	−0.0121†
	(0.00369)	(0.0103)	(0.00652)
Household composition			
Single parent with children	0.0345***	−0.00168	0.0223†
	(0.00889)	(0.0170)	(0.0120)
Married	0.0271***	0.00957	0.0186**
	(0.00385)	(0.0105)	(0.00643)
Male	0.00319	0.0103	−0.0166*
	(0.00354)	(0.0108)	(0.00726)
Observations	14,104	6,636	14,104

Country dummies and sector dummies are also included

The coefficient associated to HBU is highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Results indicated that, overall, having relatively high housing costs increased the probability of facing economic hardship. The same held when the subjective measure of housing cost burden was considered. When looking at the impact that several demographic and economic variables had upon households' likelihood of perceiving hardship,

[18] In this regard, MacLennan et al. (1998) noticed how different levels of financial market regulation affect differently housing market in different countries.

[19] When looking at results by country (Tables 14, 15 in the Appendix) results are confirmed.

Table 4 Determinants of household economic hardship, probit regression using HC

Variables	(1) H1	(2) H2	(3) TARG
HC	**0.0391*** **	**0.0350*** **	**0.0486*** **
	(0.00362)	**(0.0102)**	**(0.00671)**
II income quart*educ	−0.0125†	0.0203	−0.0244†
	(0.00686)	(0.0229)	(0.0142)
III income quart*educ	−0.0126	0.00937	−0.0120
	(0.00904)	(0.0232)	(0.0151)
IV income quart*educ	−0.0360*	−0.0155	−0.0622***
	(0.0141)	(0.0292)	(0.0184)
Education	−0.00725	−0.0534**	−0.0167
	(0.00460)	(0.0186)	(0.0122)
Good health	0.000990	−0.0817*	−0.107***
	(0.00728)	(0.0336)	(0.0266)
Permanent contract	−0.0169**	−0.0326†	−0.0242*
	(0.00574)	(0.0180)	(0.0116)
Change of job since last year	0.0133*	0.0588**	0.0290*
	(0.00639)	(0.0222)	(0.0128)
I income quartile	0.0158	0.111	−0.0162
	(0.0446)	(0.0959)	(0.0415)
II income quartile	−0.0182	−0.0139	−0.00170
	(0.0271)	(0.0655)	(0.0446)
III income quartile	−0.0422†	−0.0400	−0.0685†
	(0.0220)	(0.0613)	(0.0352)
Age	−7.41e-05	−0.00164**	0.00191***
	(0.000164)	(0.000535)	(0.000356)
Household composition			
No children	−0.00433	−0.0247*	−0.0215**
	(0.00363)	(0.0105)	(0.00698)
Household composition			
Single parent with children	0.0227**	−0.000659	0.0445**
	(0.00776)	(0.0179)	(0.0146)
Married	0.0210***	0.0119	0.0310***
	(0.00357)	(0.0107)	(0.00704)
Male	0.00342	0.00375	−0.0233**
	(0.00338)	(0.0111)	(0.00775)
Observations	14,104	6,636	14,104

Country dummies and sector dummies are also included

The coefficient associated to HC is highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

we noticed that conditions related to the job market strongly affected the probability that households could face some kinds of hardship. Households with a permanent contract were indeed less likely to suffer from some kind of deprivation; similarly, the fact that households had changed jobs within the last year positively affected households' probability of facing hardship. In this regard, job market conditions that enhanced job insecurity were found to be strongly related to hardship. Household composition affected hardship as well. Single parents and married couples had a higher probability of perceiving hardship. Overall, it seemed that socioeconomic variables were able to explain the complex phenomenon of household hardship better than income only.

Although the housing cost burden was found to be strongly correlated with several measures of hardship, the previous probit regression might be plagued by an endogeneity problem. First, the housing cost burden may be correlated with unobserved factors, possibly related to household needs and thus house characteristics, which also affect household hardship. Intuitively, households with relatively bigger families would probably need bigger houses. Further, households with children would probably choose houses close to the city centre in order to have easier access to basic services (schools, hospitals etc.). Second, the perception of burdens related to housing costs may depend on households' material or financial hardship. In this sense, a reverse causality problem may arise, raising the need to use IV techniques to correct possible endogeneity. We assumed the housing cost burden to be correlated with the size of the house, and with its location. Indeed, we used a dummy indicating whether the number of rooms was smaller than four (*DHSIZE*) and an interaction term between urban location and the presence of noise (*URBNOISE*) in the area as instruments of HC and HBU. Intuitively, a bigger house would cost more than a smaller one. On the other hand, households may decide to live in relatively noisy areas, if this results in substantial savings in the housing costs. Results of the IV regression are presented in Table 5.

In most cases, the overidentification test did not reject the model specification and the chosen instruments, thus suggesting that *DHSIZE* and *URBNOISE* had no direct effect upon household hardship. However, overidentification restriction was rejected in the final model (Column VI), thus suggesting that the housing size and the presence of noise in the neighbourhood may have a direct effect upon the probability of facing hardship, when TARG was used as dependent variable and HC was used as a measure of housing cost burden. However, the Hausman test rejected the null hypothesis of exogeneity, thus indicating that probit regression provided better estimates than instrumental variable probit.

Results seem to suggest that exogenous factors (banking sector conditions, which set the housing price and the monthly rent) were the main determinants of the household cost burden. Exogeneity of housing cost burden can be explained by the fact that households may not have complete freedom in housing choices. First of all, imperfections in the housing market may cause households to have

Table 5 Instrumental variable probit regression

Variables	(1) H1	(2) H2	(3) TARG	(4) H1	(5) H2	(6) TARG
HBU	**1.401***	**1.287***	**1.448*****			
	(0.557)	**(0.603)**	**(0.435)**			
HC				**0.580***	**0.287**	**0.129**
				(0.229)	**(0.242)**	**(0.172)**
II income quart*educ	−0.128	−0.0177	−0.0898	−0.189*	−0.0599	−0.150*
	(0.0934)	(0.103)	(0.0733)	(0.0868)	(0.0982)	(0.0655)
III income quart*educ	−0.0391	0.0295	0.0794	−0.114	−0.0442	−0.000993
	(0.132)	(0.114)	(0.0771)	(0.126)	(0.107)	(0.0697)
IV income quart*educ	−0.281†	−0.0672	−0.183*	−0.433**	−0.174	−0.277***
	(0.158)	(0.131)	(0.0932)	(0.150)	(0.123)	(0.0824)
Education	−0.125†	−0.189*	−0.179**	−0.133*	−0.174*	−0.155**
	(0.0668)	(0.0912)	(0.0617)	(0.0657)	(0.0881)	(0.0581)
Good health	0.119	−0.196	−0.319**	−0.0708	−0.389***	−0.510***
	(0.140)	(0.154)	(0.111)	(0.104)	(0.117)	(0.0816)
Permanent contract	−0.314***	−0.141*	−0.153**	−0.287***	−0.122†	−0.145**
	(0.0549)	(0.0706)	(0.0490)	(0.0544)	(0.0692)	(0.0465)
Change of job since last year	0.0253	0.249***	0.0495	0.0460	0.253***	0.0905†
	(0.0639)	(0.0748)	(0.0540)	(0.0620)	(0.0729)	(0.0499)
I income quartile	1.248***	0.487	0.467*	0.607	0.181	0.261
	(0.358)	(0.303)	(0.210)	(0.411)	(0.378)	(0.255)
II income quartile	0.329	0.189	0.348	0.00639	0.0286	0.286
	(0.382)	(0.307)	(0.217)	(0.388)	(0.324)	(0.218)
III income quartile	−0.486	−0.126	−0.337	−0.727†	−0.224	−0.357†
	(0.433)	(0.316)	(0.222)	(0.424)	(0.313)	(0.208)
Age	−0.00307	−0.0104***	0.00536**	0.00175	−0.00584*	0.00855***
	(0.00234)	(0.00280)	(0.00192)	(0.00236)	(0.00269)	(0.00181)
Household composition						
No children	−0.109†	−0.0733	−0.0855*	−0.127*	−0.114*	−0.135***
	(0.0564)	(0.0591)	(0.0413)	(0.0530)	(0.0538)	(0.0367)
Household composition						
Single parent with children	0.176†	−0.0885	0.0849	0.239**	−0.0231	0.230***
	(0.0963)	(0.107)	(0.0798)	(0.0754)	(0.0958)	(0.0619)
Married	0.326***	−0.0265	0.0924†	0.366***	0.0279	0.196***
	(0.0660)	(0.0643)	(0.0495)	(0.0522)	(0.0574)	(0.0369)
Male	0.0404	0.0743	−0.0684†	0.0404	0.00634	−0.0869*
	(0.0483)	(0.0606)	(0.0369)	(0.0472)	(0.0509)	(0.0339)
Constant	−2.197***	−1.062*	−1.558***	−0.984†	0.0246	−0.716*
	(0.495)	(0.516)	(0.331)	(0.512)	(0.494)	(0.336)
Instruments: n. rooms <4; urb*noise						
Wald test of exogeneity (p value)	0.0886	0.2382	0.545	0.9363	0.7182	0.3453
Test of overidentifying restrictions (p value)	0.3998	0.469	0.1281	0.3181	0.105	0.0003
Observations	14,104	6,632	14,104	14,104	6,632	14,104

Country dummies and sector dummies are also included

The coefficients associated to HBU and HC are highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

incomplete information on the price/quality relationship, so that it is not always the case that a higher rent/price reflects a better housing quality. Moreover, in case that an unexpected event (i.e., drop in income) occurs, it is not always possible for a household to move to a cheaper house in the short term (Van Dam et al. 2003). This indeed is in line with the idea that factors related to imperfections in the housing market may in fact prevent households from choosing accommodations whose quality/price profile are adequate with respect to their income levels.

Household Hardship and Tenure Status

So far we have addressed the linkage between household economic hardship and housing cost burden without taking tenure status into account. However, home ownership needs to be explicitly taken into consideration, given the role that it may exert upon households' well being, explaining cross country differences in social inclusion and social inequality (Kurz and Blossfeld 2004; Watson and Webb 2009). On one hand, since housing is a long-term investment, it would increase household wealth over time, eventually helping to alleviate poverty in old age, providing a "buffer stock wealth" in case of unexpected contingencies. However, in situations of volatile current housing environment, low and moderate income homeowners are likely to be at risk of distress and foreclosure (Bostic and Lee 2008). On the other hand, even if renting may be a preferable choice for some categories of people (i.e., those people whose careers require flexibility), it represents a mere consumption good, exerting its utility in one period time. Thus, it does not act as a buffer in case of unexpected drops in household income.

Table 6 provides figures on the tenure structure in the five European countries, distinguishing by homeowners, renters and those who benefit from some form of social renting,[20] while the rate of renters versus owners paying mortgage as appears in EU SILC is shown in the bottom part of the Table.[21] The Table shows that the incidence of home ownership is quite dissimilar among European countries.

In particular, France and the UK appear to be the countries with the highest rate of social rent (17 and 18 %, respectively), while Germany has the lowest rate of home ownership (42 %), followed by France and UK (57 and 66.4 %, respectively). This is in line with the idea that home ownership, as a long term investment, does not offer enough flexibility. Thus, where rent at reduced rates is available, one would expect that household would prefer renting to owning. Further, in the bottom part of the Table one can notice that Germany and Italy have the lowest rates of ownership (41.59 and 59.65 %, respectively).[22]

Table 6 Ownership rates

	Owner occupied (%)	Private rent (%)	Social rent (%)
France	57	22	17
Germany	42	53	5
Italy	68.50	13.60	5.30
Spain	85	11	2
United Kingdom	66.40	15.60	18

Source: CECODHAS Housing Europe's Observatory (2011)

Tenure choice	Total	DE	ES	FR	IT	UK
Rates						
Renter	37.73	58.41	18.26	35.4	40.35	20.67
Owner	62.27	41.59	81.74	64.6	59.65	79.33

Source: EU SILC

In order to take home ownership into account, we estimated the equation previously estimated in Tables 3 and 4 including the variable *owner* into our estimation. The variable takes value 1 if the household is a home owner paying mortgage, while it takes value 0 if the household is a renter (Table 7). In our analysis only private renters were considered, while we did not take into account any form of social housing.[23]

When household hardship was re-estimated taking tenure status into proper account, previous results were confirmed. Further, the negative coefficient associated with homeownership indicated that home owners, ceteris paribus, were less likely to report poverty than renters.[24] This can be explained by thinking about the role of housing as a "buffer," i.e., an asset they would draw on in case an

[20] The definition of social renting differs in the five countries taken into account (Pittini and Laino 2011).

[21] The fact that home ownership rate in Italy is the lowest with respect to other countries is not surprising. Indeed, descriptive statistics only refer to households with outstanding mortgage, while in Italy the majority of households count on parental help. This is in line with statistics provided by Georgarakos et al. (2010) using HCHP.

[22] We are only considering houses which are mortgage-burdened, and in Italy only a minority of households have mortgages (Georgarakos et al. 2010). This may explain a level of home ownership that is not as high as expected.

[23] Including social renters into the analysis would allow for a substantial degree of heterogeneity across countries. Social renting in EU countries differs indeed in terms of tenures, providers, beneficiaries and funding arrangements (Housing Europe Review 2012).

[24] This is in line with Brandolini et al. (2013), who eventually found that home-ownership, as well as living in a rent-free accommodation, affected negatively the subjective measure of housing cost burden. Furthermore, households with mortgages in Italy and Spain were more likely to declare heavy housing cost burdens.

Table 7 Probit regression including tenure status

Variables	(1) H1	(2) H2	(3) TARG	(1) H1	(2) H2	(3) TARG
HBU	**0.0346*** **	**0.125*** **	**0.240*** **			
	(0.00536)	**(0.0125)**	**(0.00987)**			
HC				**0.0428*** **	**0.0440*** **	**0.0537*** **
				(0.00395)	**(0.0111)**	**(0.00710)**
Owner	**−0.0162*** **	**−0.0641*** **	**−0.0368*** **	**−0.0236*** **	**−0.0647*** **	**−0.0380*** **
	(0.00376)	**(0.0117)**	**(0.00679)**	**(0.00416)**	**(0.0123)**	**(0.00757)**
II income quart*educ	−0.0127†	0.0222	−0.0179	−0.0125†	0.0226	−0.0230
	(0.00660)	(0.0218)	(0.0126)	(0.00671)	(0.0224)	(0.0142)
III income quart*educ	−0.0101	0.0186	3.73e-05	−0.0114	0.0124	−0.0108
	(0.00902)	(0.0227)	(0.0133)	(0.00875)	(0.0228)	(0.0152)
IV income quart*educ	−0.0282*	0.000985	−0.0343*	−0.0350*	−0.0136	−0.0616***
	(0.0131)	(0.0284)	(0.0164)	(0.0139)	(0.0288)	(0.0184)
Education	−0.00713	−0.0530**	−0.0186††	−0.00737	−0.0536**	−0.0173
	(0.00476)	(0.0179)	(0.0110)	(0.00460)	(0.0183)	(0.0123)
Good health	0.00385	−0.0496††	−0.0537*	0.00164	−0.0766*	−0.105***
	(0.00695)	(0.0300)	(0.0231)	(0.00722)	(0.0327)	(0.0267)
Permanent contract	−0.0193**	−0.0256	−0.0157	−0.0141**	−0.0250	−0.0200†
	(0.00601)	(0.0171)	(0.0104)	(0.00546)	(0.0172)	(0.0114)
Change of job since last year	0.0146*	0.0543**	0.0214†	0.0125*	0.0545*	0.0280*
	(0.00648)	(0.0208)	(0.0110)	(0.00619)	(0.0214)	(0.0127)
I income quartile	0.103	0.160	0.0502	0.00447	0.0792	−0.0310
	(0.0844)	(0.104)	(0.0494)	(0.0371)	(0.0885)	(0.0386)
II income quartile	0.0110	0.0162	0.0478	−0.0217	−0.0278	−0.0125
	(0.0381)	(0.0694)	(0.0476)	(0.0254)	(0.0615)	(0.0429)
III income quartile	−0.0306	−0.0212	−0.0378	−0.0441*	−0.0466	−0.0721*
	(0.0233)	(0.0630)	(0.0336)	(0.0214)	(0.0590)	(0.0346)
Age	−0.000177	−0.00173***	0.00112***	5.10e-05	−0.00122*	0.00209***
	(0.000168)	(0.000520)	(0.000323)	(0.000162)	(0.000527)	(0.000355)
Household composition						
No children	−0.00599†	−0.0226*	−0.0141*	−0.00515	−0.0281**	−0.0235***
	(0.00364)	(0.0101)	(0.00644)	(0.00359)	(0.0103)	(0.00695)
Household composition						
Single parent with children	0.0352***	−0.000529	0.0235†	0.0224**	−0.00206	0.0444**
	(0.00899)	(0.0168)	(0.0120)	(0.00780)	(0.0175)	(0.0146)
Married	0.0297***	0.0216*	0.0238***	0.0243***	0.0230*	0.0361***
	(0.00396)	(0.0103)	(0.00649)	(0.00370)	(0.0105)	(0.00711)
Male	0.00320	0.0103	−0.0168*	0.00355	0.00383	−0.0235**
	(0.00352)	(0.0107)	(0.00723)	(0.00338)	(0.0110)	(0.00774)
Observations	14,104	6,636	14,104	14,104	6,636	14,104

Country dummies and sector dummies are also included

The coefficients associated to HBU, HC and Owner are highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

emergency occurs (Benito 2007).[25] In this regard, home ownership can be regarded as a form of "informal insurance" against future unexpected events or poor pension provision.

[25] Households who are not homeowners would probably allocate money in private pension plans, saving accounts, or private insurance, thus limiting their spending capacity.

Switching Regression Estimation

The main challenge in estimating the causal effect of tenure status on economic hardship is that the owner versus renter status may be endogenous: Unobservables in the hardship equation may be correlated with unobservables in the tenure status equation. For example, family background

is likely to affect both the probability of being in hardship and the probability of being a home owner. Households with relatively wealthy relatives will probably be less likely to face hardship, and simultaneously will be able to pay the down payment required for a mortgage.

Neglecting the potential endogeneity of the tenure status may therefore result in biased and inconsistent estimators. Thus, we need to consider a model where hardship is observed for two categories of households: home-owners paying mortgages, and renters. Moreover, there may be a self selection problem, so that households who apply for mortgages are those with relatively greater wealth, and who may be less burdened by housing costs.

In order to cope with this problem in the empirical estimation we relied on a switching regression framework to differentiate households' responses to housing cost burdens among renters and home owners.[26] The model allowed taking into account unobservable individual characteristics, influencing at the same time households' hardship, housing cost burden, and the probability of being a home owner.

In particular, we relied on the procedure developed by Miranda and Rabe-Hesketh (2006), which allowed estimating jointly household hardship and tenure status by a maximum likelihood approach. In this way it was possible to model a switching regression, taking explicitly into account the fact that the outcome variable is binary and needs to be modelled with a nonlinear model.[27]

Considering two different groups of households (renters and home-owners paying mortgages), we needed to specify two equations. The first one was an equation where the response variable, $Hardship_i$ is a binary variable assuming value 1 if the household is experiencing some form of hardship according to the hardship criteria previously defined (H1, H2, TARG). We assumed $Hardship_i$ to depend on tenure status, and on a vector of explanatory variables, which we assumed to be the demographic and financial variables previously defined. In the second equation, the dependent variable, $Owner_i$ is a dummy variable assuming value 1 if the household is a owner paying mortgage, and 0 otherwise. It depends upon a set of explanatory variables: determinants of household permanent income (the product of household wage income and series of age dummy variables and education dummy variables for the household head), and a series of demographic variables (race, gender, household size, marital status).

The model can be formulated as a system of equations for two unobserved responses, as follows:

$$y_i = x_i'\beta + \delta Owner_i + u_i \tag{1}$$

y_i^* is a latent continuous variable, such that:

$$\begin{aligned} Hardship_i &= 1 \text{ if } y_i^* > 0 \\ Hardship_i &= 0 \text{ otherwise} \end{aligned} \tag{2}$$

u_i is a residual term, and x_i' is a matrix of explanatory variables. $Owner_i$ is a switching dummy, and it can be modelled as well as a latent response model:

$$S_i^* = z_i'\gamma + v_i \tag{3}$$

S_i^* is a latent continuous variable, such that:

$$\begin{aligned} Owner_i &= 1 \; if \; S_i^* > 0 \\ Owner_i &= 0 \text{ otherwise} \end{aligned} \tag{4}$$

where z is a matrix of explanatory variables in the switching equation, and v_i is an error term. Error terms in Eqs. (1) and (3) are assumed to be correlated.[28] However, this assumption should be tested, by looking at the ρ coefficient, estimated in the switching equation.

Tables 8, 9, 10, 11, 12, 13 show switching regression results when *HC* and *HBU* were used, respectively, as main explanatory variables and H1, H2 and TARG were used as dependent variables.

In the tenure status equation, a set of variables which were not included in the main equation were included. Miranda and Rabe-Hesketh (2006) noticed that explanatory variables of the main equation may be the same as those of the selection equation. However, since it would be of use to a proper estimation, we specified exclusion restrictions. Specifically, we included a dummy taking value 1 if the household reported that the area where they lived was characterized by pollution, grime, or other environmental problems (*pollution*), country level dummy indicating the average change in property value[29] (*pval*), and an interaction term between property value and a dummy indicating whether the household lives in a urban area (*urbval*). Country-level property value indicators represent indeed an important factor into an individual decision of whether to buy (EUROSTAT 2013). Furthermore, they include the property evaluation in households' portfolio, thus providing useful insights regarding the value of households' real wealth.

Looking at the relation between housing costs and tenure status, we noticed that as housing costs (or the housing cost

[26] Maddala (1996) called it switching regression model with endogenous switching. Amemiya (1978) suggested bivariate probit models to correct endogeneity in the case of binary models.

[27] Two stage procedures such as Heckman (1979) are approximate, since they do not allow making distributional assumptions regarding estimators.

[28] Miranda and Rabe-Hesketh (2006) noticed that their method differed from bivariate probit for the parametrization of the variance-covariance matrix, where the variances of the errors were set to be 1.

[29] Particularly, it is an indicator regarding price changes of residential properties purchased by households (flats, detached houses, terraced houses, etc.), both newly-built and existing ones, independently of their final use and independently of their previous owners. Data come from ECB statistical warehouse.

Table 8 Switching regression, H1, HC

H1	Coef.	Switching equation	
HC	**0.6820*** **	HC	0.5524***
	(0.0436)		(0.0253)
Owner	**−0.7538*** **	Permanent contract	0.2940***
	(0.1494)		(0.0410)
I income quart*education	−0.1756*	Change of job since last year	0.0052
	(0.0850)		(0.0431)
II income quart*education	−0.0881	Income	0.0000***
	(0.1222)		(0.000001)
III income quart*education	−0.4035**	Age*income quart.	0.0052***
	(0.1476)		(0.0008)
Permanent contract	−0.2042***	Education*income quart.	0.0509***
	(0.0561)		(0.0143)
Change of job since last year	0.0437	Male	−0.0553*
	(0.0601)		(0.0281)
I income quartile	0.3081	urbval	−0.0034***
	(0.3502)		(0.0002)
II income quartile	−0.1738	pval	0.0234***
	(0.3653)		(0.0043)
III income quartile	−0.8075†	Pollution	−0.2923***
	(0.4117)		0.0319265
Household composition			
No children	−0.1758**	_cons	−2.3479***
	(0.0506)		(0.4682)
Household composition			
Single parent with children	0.2298**		
	(0.0661)		
_cons	−0.3797	ρ	0.2561**
	(0.4545)		(0.0907)
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), Household composition (no children; single parent with children) sex

The coefficients associated to HC and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 9 Switching regression, H2, HC

H2	Coef.	Switching equation	
HC	**0.2890*** **	HC	0.5195***
	(0.0512)		(0.0357)
Owner	**−0.6018** **	Permanent contract	0.2870***
	(0.2164)		(0.0620)
I income quart*education	−0.03561	Change of job since last year	−0.0780
	(0.0968)		(0.0629)
II income quart*education	−0.00941	Income	0.0000
	(0.1054)		(0.000001)
III income quart*education	−0.1377	Age*income quart.	0.0037**
	(0.1214)		(0.0012)
Permanent contract	−0.0604	Education*income quart.	0.0780***
	(0.0721)		(0.0216594
Change of job since last year	0.2392***	Male	−0.0835*
	(0.0718)		(0.0413)
I income quartile	0.076866	urbval	−0.0030***
	(0.3014)		(0.0003)
II income quartile	−0.06452	pval	−0.0060***
	(0.2982)		(0.0061)
III income quartile	−0.26907	Pollution	−0.2865***
	(0.3029)		(0.0465)
Household composition			
No children	−0.1549**	_cons	−0.0797***
	(0.0516)		(0.6619)
Household composition			
Single parent with children	−0.01515		
	(0.0847)		
_cons	0.254756	ρ	0.249664†
	(0.4162)		(0.1296)
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), Household composition (no children; single parent with children) sex

The coefficients associated to HC and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

burden) increased, the probability of being a renter decreased. Households reckon that high housing costs (rent versus mortgage) are worth paying only in the perspective of becoming home-owner. In this regard, a higher housing cost burden is valuable only if the burden represented by housing costs exerts its utility for more than one period of time, thus confirming the idea of housing as an investment good.

Last but not least, ρ was significantly different from zero in all the specifications, thus justifying the usage of a switching regression approach rather than estimating an ordinary probit regression.[30] In this regard, it is a good practice to assume that unobservables in the hardship equation are also correlated with unobservables in the tenure status equation. Households with strong family ties, for example, may have a lower than average propensity to

[30] Furthermore, there is evidence that ignoring endogeneity of tenure status leads to biased coefficients. In the specification with H2 and HBU, when endogeneity is not considered being a home owner reduces the probability to face material hardship (H2) of 18 %. This probability is almost 60 % when endogeneity is taken into account. Similar results hold when other specifications are considered.

Table 10 Switching regression, TARG, HC

TARG	Coef.	switching equation	
HC	**0.3783*** **	HC	0.5520***
	(0.0352)		(0.0253)
Owner	**−0.6168*** **	Permanent contract	0.2937***
	(0.1386)		(0.0410)
I income quart*education	−0.1319*	Change of job since last year	0.0039
	(0.0645)		(0.0431)
II income quart*education	0.0184	Income	0.00001***
	(0.0685)		(0.000001)
III income quart*education	−0.2639***	Age*income quart.	0.0051***
	(0.0816)		(0.0008)
Permanent contract	−0.0651	Education*income quart.	0.0549***
	(0.0476)		(0.0143)
Change of job since last year	0.0878**	Male	−0.0555
	(0.0484)		(0.0280)
I income quartile	−0.1528	urbval	−0.0034***
	(0.2022)		(0.0002)
II income quartile	0.0181	pval	0.0231***
	(0.2012)		(0.0043)
III income quartile	−0.4937*	Pollution	−0.2986***
	(0.2019)		(0.032)
Household composition			
No children	−0.1602***	_cons	−2.3243***
	(0.0350)		(0.4672)
Household composition			
Single parent with children	0.1914		
	(0.0558)		
_cons	−0.0249	ρ	0.2432**
	(0.2917)		(0.0840)
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), Household composition (no children; single parent with children) sex

The coefficients associated to HC and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 11 Switching regression, H1, HBU

H1	Coef.	Switching equation	
HBU	**0.5049*** **	HBU	0.2763***
	(0.042)		(0.0257)
Owner	**−0.6725*** **	Permanent contract	0.2595***
	(0.1771)		(0.0408)
I income quart*education	−0.1677*	Change of job since last year	0.0233
	(0.0846)		(0.0429)
II income quart*education	−0.0600	Income	0.0000***
	(0.1246)		(0.000001)
III income quart*education	−0.3052*	Age*income quart.	0.0033***
	(0.1502)		(0.0008)
Permanent contract	−0.2655***	Education*income quart.	0.0549***
	(0.0561)		(0.0143)
Change of job since last year	0.0562	Male	−0.0544†
	(0.0594)		(0.0278)
I income quartile	1.0820	urbval	−0.0032***
	(0.3561)		(0.0002)
II income quartile	0.3050	pval	0.0048
	(0.3717)		(0.0043)
III income quartile	−0.5122†	Pollution	−0.3092***
	(0.4219)		(0.0316)
Household composition			
No children	−0.199***	_cons	−1.0362*
	(0.0511)		(0.4656)
Household composition			
Single parent with children	0.2933**		
	(0.0648)		
_cons	−1.4538	ρ	0.2604*
	(0.4552)		(0.1071)
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), household composition (no children; single parent with children) sex

The coefficients associated to HBU and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

face material or financial hardship and, at the same time, a higher than average propensity to satisfy down payment requirements and thus being a mortgage payer.

Conclusions

In this study we have explored the linkage between household hardship and housing costs. We estimated the extent to which housing costs affect household poverty, using several measures of hardship and two measures of housing cost burden indicating to what extent costs related to the main dwelling are onerous for households. We first estimated a model of household hardship, where the housing cost burden was found to have a high predictive power in explaining household well-being. Furthermore, we used a switching regression approach in order to control for housing related choices, explicitly controlling for the endogeneity of tenure status with respect to hardship. The results showed that the inclusion of the homeownership variable was crucial in the explanation of subjective

Table 12 Switching regression, H2, HBU

H2	Coef.	Switching equation	
HBU	**0.6222*** **	HBU	0.2372***
	(0.0452)		(0.0377)
Owner	**−0.6518** **	Permanent contract	0.2640***
	(0.2346)		(0.0618)
I income quart*education	−0.0132	Change of job since last year	−0.0569
	(0.0977)		(0.0625)
II income quart*education	0.0339	Income	0.0000**
	(0.1068)		(0.000001)
III income quart*education	−0.0664**	Age*income quart.	0.0019
	(0.1239)		(0.0012)
Permanent contract	−0.07616	Education*income quart.	0.084972***
	(0.0733)		(0.0214)
Change of job since last year	0.244521***	Male	−0.08045†
	(0.0727)		(0.0410)
I income quartile	0.392035	urbval	−0.00287***
	(0.3004)		(0.0003)
II income quartile	0.126357	pval	−0.0213***
	(0.3004)		(0.0061)
III income quartile	−0.15053	Pollution	−0.29469***
	(0.3077)		(0.0460)
Household composition			
No children	−0.1465**	_cons	0.931727
	(0.0527)		(0.6606)
Household composition			
Single parent with children	−0.0090**		
	(0.0851)		
_cons	−0.5082	ρ	0.2763*
	(0.4115)		(0.1405)
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), Household composition (no children; single parent with children) sex

The coefficients associated to HBU and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

poverty. In line with the idea that poverty analysis should control for home ownership, those owning their houses were less likely to report subjective poverty.

As this study showed, a proper analysis of household economic hardship needs to go beyond traditional poverty measures based solely on income threshold. Hardship is indeed a more complex phenomenon, encompassing socio-economic variables other than income. Among the determinants of hardship, the role of housing cost is crucial, and needs to be taken into proper account both from the academic community and from the policy makers. On one hand, they represent a large part of household budget: Housing costs may significantly reduce households' willingness to spend, affecting households' disposable income and lowering their standard of living. On the other hand, housing costs can be to some extent mitigated if households are owners rather than renters. Given that the main house is an asset which exerts its utility for more than one period, a long-term perspective is required when poverty—and, in a broader perspective, hardship—issues are analysed and when looking for proper policy measures. Indeed, even if owners paying mortgages may face higher costs than renters in the short term, home-ownership may provide the household with a long term investment that may act as a form of private social insurance against future contingencies. On this regard, the role of households' financial decisions (i.e., the choice of investing in assets with a certain liquidity-risk profile) needs to be considered jointly with households' probability of facing hardship.[31]

[31] In this regard, expanding households' access to financial products and enhancing their functioning plays a non negligible role in helping households to reduce hardship. See, for example, Huang et al (2014) who examined the correlation between the probability of experiencing hardship (defined as self-reported inability to meet basic needs) correlated with financial capability in a sample of older Asian immigrants. A related study (Leonard and Di 2014) as well

Table 13 Switching regression, TARG, HBU

TARG	Coef.	Switching equation	
HBU	**1.2165*** **	HBU	0.2792***
	(0.0319)		(0.0258)
Owner	**−0.5325*** **	Permanent contract	0.2603***
	(0.1622)		(0.0408)
I income quart*education	−0.0896	Change of job since last year	0.0224
	(0.0689)		(0.0429)
II income quart*education	0.0890	Income	0.000006***
	(0.0742)		(0.000001)
III income quart*education	−0.1809*	Age*income quart.	0.0033***
	(0.0892)		(0.0008)
Permanent contract	−0.1021*	Education*income quart.	0.0589***
	(0.0505)		(0.0142)
Change of job since last year	0.0653	Male	−0.0553*
	(0.0519)		(0.0278)
I income quartile	0.3219	urbval	−0.0032***
	(0.2141)		(0.0002)
II income quartile	0.2696	pval	0.0044
	(0.2159)		(0.0043)
III income quartile	−0.3863**	Pollution	−0.3101***
	(0.2207)		(0.0317)
Household composition			
No children	−0.1311***	_cons	−0.9904*
	(0.0386)		(0.4649)
Household composition			
Single parent with children	0.1192*		
	(0.0592)		
_cons	−1.1403***	ρ	0.1696†
	(0.3041)		0.098192
Demographic controls	Yes	Demographic controls	Yes
Country dummies	Yes	Sectoral dummies	Yes
Sectoral dummies	Yes		

Demographic controls include tertiary education (yes); good health (yes); age; married (yes), Household composition (no children; single parent with children) sex

The coefficients associated to HBU and Owner in the main equation are highlighted in bold

$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

As far as policy implications are concerned, the usage of appropriate indicators to measure and monitor poverty becomes of primary importance. Reducing poverty for at least 20 million people who are below the poverty threshold and promoting social inclusion is indeed included in the targets of the EU 2020 strategy for smart, sustainable and inclusive growth. On the other hand, when explicitly considering tenure status in the relation between housing cost burden and economic hardship, a policy maker should take into consideration that policies aimed at mitigating household hardship should not be disentangled from those directed towards alleviating the financial burden related to housing costs. In this regard, the role of tenure status needs to be taken into account in a long-term perspective, given that home-ownership may exert positive effects in the long-run, thus increasing overall household well being. Furthermore, when analysing policies towards more affordable housing, macro-level effects should be considered in addition to the consequences to individual well being. From this perspective, housing policies trends have changed dramatically since 2007, when the global financial crisis led to the subprime crisis, enhancing housing unaffordability. While in the pre-crisis period housing policies were directed towards supporting private home-ownership and construction of new housing, in the post-crisis period housing policies have shifted towards the construction of social housing (Pittini and Laino 2011).

Footnote 31 continued
highlighted the role played by financial behaviour. Focused on asset poverty (defined as having a net worth to sustain income for 3 months above the federal income poverty level, or net worth equal to 25 % of the annual income poverty level), they stated that financial behaviour directed towards debt minimization and inclusion of productive assets may reduce the likelihood of asset poverty re-entry.

Our findings and evaluations must be placed in the context of some limitations of this study. First, the data used are cross-sectional. Even if this does not cast doubts regarding the linkage between the burden represented by high housing costs and economic hardship, the EU SILC data do not allow the recovery of much of the information used in the analysis, and analyse the phenomenon in a dynamic perspective. In this regard, comparable household-level data for a long time span would allow the analysis of the process of entry and exit from ownership. Rather than analysing the effect of being a home owner rather than a renter, a dynamic perspective would shed light on the effect of housing cost burden upon economic hardship when transition into ownership (renting) is observed.

Secondly, albeit representing a valuable source of data as far as household well being is concerned, EU SILC does not provide any information regarding household wealth composition. Other things being equal, portfolio composition, in terms of risk and liquidity may not be neutral to the probability of facing hardship. From this perspective, the linkage existing between household likelihood of facing hardship and portfolio choices needs to be investigated in greater detail.

The presence of missing values can be also considered a limitation of the current study. However, it is likely that individuals not responding to job related questions might be disadvantaged individuals, employed with an informal-black market agreement. For these individuals, it may be difficult to answer whether their (presumably irregular) contract is permanent or not. From this perspective, dropping observations without information on the type of contract or the sector of activity is functional to meet the criteria regarding the inclusion of only the "working poor" in the analysis. Given that we were interested in estimating the effect of housing cost burden upon economic hardship in the sample of the "working poor," we only needed to consider households with complete information regarding their job status. Similarly, individuals not responding to questions related to housing costs may be low-educated or low-skilled households; these individuals might be more likely to face poverty, material deprivation and low work intensity or might report having difficulty in making ends meet because they do not have high ability in managing their monthly income. In other terms, individual not responding to certain questions might differ regarding unobservable factors from others. With this perspective, dropping observations with missing values mitigated unobservable heterogeneity in the sample under analysis. Unfortunately, EU SILC, as with many household surveys, does not adopt a process of imputation of missing values, and listwise deletion is a common approach that has been used by research papers using this source of data. One of the possible problems that may arise when information is missing not at random is that estimates are biased. However, two different approaches (mean imputation and multiple imputation)[32] to fill missing values have been used in order to deal with this issue, and the positive and significant effect of housing cost (measured as housing cost burden and effective housing cost) upon economic hardship is still positive and significant.[33]

Further analysis is needed to better understand the determinants of home ownership versus renting, in order to implement adequate policy interventions. For example, rather than only the level of income, income uncertainty needs to be properly investigated in determining the choice between ownership and renting. Finding a negative correlation between ownership rates and unstable income flows would point to policy interventions that reduce job insecurity.

Appendix

Variables Definition

Housing Cost (HC)

Monthly housing costs sustained by owners include the following components: mortgage principal repayment, mortgage interest payments (net of any tax relief), gross of housing benefits, (i.e., housing benefits should not be deducted from the total housing cost), structural insurance, mandatory services and charges (sewage removal, refuse removal, etc.), regular maintenance and repairs, taxes, and the cost of utilities (water, electricity, gas and heating).

Monthly housing costs sustained by renters include the following components: rent payments, gross of housing benefits (i.e., housing benefits should not be deducted from the total housing cost), structural insurance (if paid by the tenants), services and charges (sewage removal, refuse

[32] On this regard, we can assume that the ignorability hypothesis holds for our data. First of all, ignorability implies distinctness of parameters of the data model and the missing data mechanism. Second, the missing at random (MAR) hypothesis is also assumed, implying that the probability that an observation is missing may depend on observed values but not on missing ones. On this regard, we are including a set of controls (i.e. income, household size and composition) that can predict the probability of not reporting missing information. Further, it is often difficult to establish a clear border line between the MAR and Missing not at random (MNAR) assumption. However, as pointed out by Schafer and Graham (2002), multiple imputation can still be unbiased with NMAR data even if we assume data is MAR. Moreover, multiple imputation does not require that nonresponse is ignorable (Schafer 1999), so that inferences created under any kind of assumptions for the missing-data mechanism will be valid.

[33] As shown in the tables that have been inserted in the appendix, the coefficient associated to housing cost is slightly higher when missing values are imputed using both methods of imputation. Therefore, when the observations with missing values in the key variables are deleted from the sample, a downward bias in the coefficient associated to housing cost is present.

removal, etc.) (if paid by the tenants), taxes on dwelling (if applicable), regular maintenance and repairs and the cost of utilities (water, electricity, gas and heating).

Housing Cost Financial Burden (HBU)

Households were asked the following question: "Please think of your total housing costs including mortgage repayment (instalment and interest) or rent, insurance and service charges (sewage removal, refuse removal, regular maintenance, repairs and other charges). To what extent are these costs a financial burden to you?". Households are considered to perceive high financial burden if they declare housing costs to be a heavy burden.

Material Deprivation (H2)

Material deprivation refers to households' inability to afford at least three of the following items:

- to pay rent, mortgage or utility bills;
- to keep the home adequately warm;
- to face unexpected expenses;
- to eat meat or proteins regularly;
- to go on holiday;
- to own a television set;
- to own a washing machine;
- to own a car;
- to own a telephone.

When the household cannot afford at least four of the above items it comes to be severe material deprivation. Material deprivation does not refer to the case when the household does not own the item for reason different from their affordability (i.e., the household does not need the good).

Work Intensity

Eurostat defines work intensity as the ratio of the total number of months that all working-age household members have worked during the income reference year and the total number of months the same household members theoretically could have worked in the same period. A working-age person is a person aged 18–59 years, with the exclusion of students in the age group between 18 and 24 years.

Risk of Poverty

A householder is at risk of poverty if her income is relatively low compared with other residents in the country where she lives. In particular, risk of poverty refers to having an equivalised disposable income below the risk of poverty threshold, set at 60 % of the national median equivalised disposable income after social transfers.

Probit Regression, by Country

See Tables 14 and 15

Table 14 HBU used as main explanatory variable

H1 Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
HBU	**0.0327*** **	**0.00612** **	**0.0474*** **	**0.0656*** **	**0.000514**
	(0.00888)	**(0.00212)**	**(0.0107)**	**(0.0103)**	**(0.000479)**
Education	0.00672	−0.00395†	−0.0138	−0.0303*	−0.000925
	(0.00720)	(0.00209)	(0.0105)	(0.0152)	(0.000567)
Good health	−0.0143	−0.0224	0.0184*	0.00206	0.000378
	(0.0172)	(0.0171)	(0.00862)	(0.0213)	(0.000514)
Permanent contract	−0.0163†	−0.00870*	−0.0176	−0.0648***	−0.000423
	(0.00879)	(0.00350)	(0.0119)	(0.0178)	(0.00142)
Change of job since last year	0.0188†	−0.00151	0.0104	−0.00358	−3.03e-05
	(0.0106)	(0.00158)	(0.0141)	(0.0117)	(0.000401)
Age	−0.000575*	−8.73e-05	−0.000167	0.00105*	1.26e-05
	(0.000237)	(8.70e-05)	(0.000335)	(0.000533)	(1.50e-05)
Household composition					
No children	−0.0128*	−0.00386**	−0.00978	−0.00506	0.00110†
	(0.00520)	(0.00133)	(0.00702)	(0.0104)	(0.000638)
Household composition					

Table 14 continued

H1 Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
Single parent with children	0.0382**	0.00458	0.0307†	0.0388	−4.69e-05
	(0.0132)	(0.00436)	(0.0162)	(0.0254)	(0.000416)
Married	0.0122*	0.00731***	0.0284***	0.0492***	0.000617†
	(0.00594)	(0.00191)	(0.00725)	(0.00956)	(0.000349)
Male	0.00505	−0.00221	0.000831	0.00673	0.000446
	(0.00515)	(0.00174)	(0.00738)	(0.0105)	(0.000309)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	Yes	Yes	Yes
Sectoral dummies	Yes	Yes	Yes	Yes	Yes
Observations	4,314	2,574	2,875	2,569	1,673
H2 Variables	**(1) DE**	**(2) ES**	**(3) FR**	**(4) IT**	**(5) UK**
HBU	**0.0782*** **	**0.152*** **	**0.118*** **	**0.398*** **	**0.0996*** **
	(0.0169)	**(0.0284)**	**(0.0198)**	**(0.0588)**	**(0.0206)**
Education	−0.0379†	−0.0394	−0.0807*	0.0425	0.0254
	(0.0229)	(0.0495)	(0.0325)	(0.0913)	(0.0306)
Good health	−0.0419	−0.135	−0.0498	−0.197***	0.00965
	(0.0345)	(0.127)	(0.0498)	(0.0533)	(0.0534)
Permanent contract	−0.0127	−0.0840†	−0.0533	−3.52e-06	0.0256
	(0.0198)	(0.0441)	(0.0327)	(0.0515)	(0.0341)
Change of job since last year	0.0250	0.0490	0.00851	0.153***	0.0649*
	(0.0236)	(0.0512)	(0.0346)	(0.0426)	(0.0282)
Age	−0.00303***	0.00362*	−0.00138	−0.00405	−0.000710
	(0.000571)	(0.00179)	(0.000919)	(0.00249)	(0.000736)
Household composition					
No children	−0.0239*	−0.0396	−0.0102	−0.0138	−0.00592
	(0.0107)	(0.0322)	(0.0194)	(0.0488)	(0.0147)
Household composition					
Single parent with children	−0.00691	−0.0720	−0.00554	0.110†	−0.00833
	(0.0181)	(0.0544)	(0.0318)	(0.0623)	(0.0202)
Married	−0.00471	−0.0965**	−0.00959	0.222***	0.0150
	(0.0125)	(0.0354)	(0.0172)	(0.0464)	(0.0147)
Male	0.00778	−0.0335	0.0510**	−0.00593	−0.0112
	(0.0120)	(0.0366)	(0.0170)	(0.0500)	(0.0150)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,116	1,032	1,754	585	1,149
TARG Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
HBU	**0.0982*** **	**0.349*** **	**0.286*** **	**0.443*** **	**0.270*** **
	(0.0122)	**(0.0163)**	**(0.0193)**	**(0.0171)**	**(0.0251)**
Education	−0.0102	−0.0731**	−0.0708**	−0.102†	0.0322
	(0.00931)	(0.0280)	(0.0271)	(0.0531)	(0.0250)
Good health	−0.0293	−0.189*	−0.0842†	−0.149*	−0.0334
	(0.0202)	(0.0925)	(0.0454)	(0.0606)	(0.0827)

Table 14 continued

TARG Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
Permanent contract	−0.00755	−0.0679*	−0.00131	−0.0673†	0.0247
	(0.00929)	(0.0267)	(0.0228)	(0.0370)	(0.0244)
Change of job since last year	0.0122	0.0262	0.0187	−0.0255	0.0217
	(0.0115)	(0.0294)	(0.0320)	(0.0335)	(0.0187)
Age	0.000579*	0.00246*	0.000774	0.00114	0.000279
	(0.000268)	(0.00102)	(0.000761)	(0.00136)	(0.000633)
Household composition					
No children	−0.00491	−0.0275	−0.0321*	−0.0151	−0.0160
	(0.00565)	(0.0186)	(0.0156)	(0.0263)	(0.0126)
Household composition					
Single parent with children	0.00408	0.0715†	0.0109	0.0719	0.0263
	(0.00890)	(0.0419)	(0.0260)	(0.0514)	(0.0245)
Married	0.0118†	−0.00731	0.0123	0.0886***	0.0245†
	(0.00631)	(0.0185)	(0.0148)	(0.0249)	(0.0134)
Male	−0.00874	−0.0514*	−0.0159	0.0303	−0.0210
	(0.00646)	(0.0201)	(0.0168)	(0.0277)	(0.0145)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	4,314	2,665	2,875	2,569	1,673

Country dummies and sector dummies are also included

The coefficient associated to HBU is highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 15 HC used as main explanatory variable

H1 Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
HC	**0.0431*** **	**0.0114*** **	**0.0191** **	**0.0744*** **	**0.00117*** **
	(0.00516)	**(0.00286)**	**(0.00617)**	**(0.0128)**	**(0.000346)**
Education	0.00647	−0.00437*	−0.0112	−0.0441**	−0.000539
	(0.00691)	(0.00194)	(0.0115)	(0.0134)	(0.000383)
Good health	−0.0184	−0.0142	0.0148	0.00230	0.000321*
	(0.0181)	(0.0133)	(0.0120)	(0.0225)	(0.000148)
Permanent contract	−0.0137	−0.00631*	−0.0124	−0.0693***	7.14e-05
	(0.00847)	(0.00295)	(0.0119)	(0.0184)	(0.000452)
Change of job since last year	0.0135	−0.00262*	0.0138	−0.000767	0.000107
	(0.00984)	(0.00121)	(0.0163)	(0.0130)	(0.000295)
Age	−0.000504*	−8.72e-07	4.83e-05	0.00164**	1.26e-05
	(0.000229)	(7.49e-05)	(0.000359)	(0.000590)	(9.82e-06)
Household composition					
No children	−0.00981†	−0.00319*	−0.0110	−0.000159	0.000624
	(0.00523)	(0.00126)	(0.00768)	(0.0116)	(0.000431)
Household composition					
Single parent with children	0.0205†	0.00538	0.0349†	0.0439	−0.000289*
	(0.0107)	(0.00459)	(0.0180)	(0.0270)	(0.000140)

Table 15 continued

H1 Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
Married	−0.00133	0.00707***	0.0314***	0.0539***	0.000269
	(0.00606)	(0.00192)	(0.00783)	(0.0102)	(0.000232)
Male	0.00499	−0.00105	0.000576	0.0156	0.000220
	(0.00496)	(0.00154)	(0.00802)	(0.0108)	(0.000193)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	4,314	2,574	2,875	2,569	1,673
H2 Variables	**(1) DE**	**(2) ES**	**(3) FR**	**(4) IT**	**(5) UK**
HC	**0.0364****	**0.222*****	**−0.0157**	**0.151****	**0.0523****
	(0.0113)	**(0.0367)**	**(0.0134)**	**(0.0469)**	**(0.0181)**
Education	−0.0413†	−0.0519	−0.0792*	0.00546	0.0454
	(0.0237)	(0.0494)	(0.0335)	(0.0958)	(0.0337)
Good health	−0.0620	−0.0730	−0.0775	−0.168**	−0.00284
	(0.0389)	(0.137)	(0.0545)	(0.0638)	(0.0668)
Permanent contract	−0.0105	−0.0669	−0.0518	0.000325	0.0285
	(0.0202)	(0.0440)	(0.0336)	(0.0523)	(0.0379)
Change of job since last year	0.0225	0.0401	0.0136	0.135**	0.0645*
	(0.0243)	(0.0514)	(0.0364)	(0.0443)	(0.0291)
Age	−0.00286***	0.00458**	−0.00129	−0.00261	−0.000384
	(0.000585)	(0.00176)	(0.000929)	(0.00241)	(0.000785)
Household composition					
No children	−0.0246*	−0.0303	−0.0165	−0.0253	−0.0116
	(0.0112)	(0.0329)	(0.0194)	(0.0479)	(0.0149)
Household composition					
Single parent with children	−0.00991	−0.0609	0.0102	0.117†	−0.0186
	(0.0183)	(0.0570)	(0.0355)	(0.0632)	(0.0191)
Married	−0.00939	−0.0913*	0.000499	0.220***	0.0161
	(0.0130)	(0.0360)	(0.0174)	(0.0443)	(0.0155)
Male	0.00711	−0.0243	0.0490**	−0.0164	−0.0232
	(0.0123)	(0.0360)	(0.0176)	(0.0474)	(0.0160)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,116	1,032	1,754	585	1,149
TARG Variables	**(1) DE**	**(2) ES**	**(3) FR**	**(4) IT**	**(5) UK**
HC	**0.0271*****	**0.164*****	**0.0289***	**0.0864*****	**0.0971*****
	(0.00566)	**(0.0221)**	**(0.0125)**	**(0.0261)**	**(0.0184)**
Education	−0.0119	−0.0985***	−0.0585*	−0.106*	0.0526†
	(0.0105)	(0.0297)	(0.0295)	(0.0517)	(0.0302)
Good health	−0.0536*	−0.282**	−0.144**	−0.173**	−0.0202
	(0.0265)	(0.0982)	(0.0530)	(0.0586)	(0.0826)
Permanent contract	−0.00960	−0.0582*	0.00858	−0.0836*	0.0417
	(0.0105)	(0.0262)	(0.0237)	(0.0344)	(0.0318)
Change of job since last year	0.0136	0.00712	0.0283	0.00933	0.0328
	(0.0125)	(0.0297)	(0.0341)	(0.0332)	(0.0229)
Age	0.000927**	0.00383***	0.00168*	0.00221†	0.00143†
	(0.000299)	(0.00106)	(0.000808)	(0.00131)	(0.000759)

Table 15 continued

TARG Variables	(1) DE	(2) ES	(3) FR	(4) IT	(5) UK
Household composition					
No children	−0.00696	−0.0317	−0.0431**	−0.0334	−0.0214
	(0.00636)	(0.0196)	(0.0162)	(0.0250)	(0.0149)
Household composition					
Single parent with children	0.00858	0.128**	0.0479	0.0865†	0.0216
	(0.0111)	(0.0469)	(0.0306)	(0.0502)	(0.0287)
Married	0.0139*	0.0236	0.0328*	0.107***	0.0341*
	(0.00708)	(0.0193)	(0.0157)	(0.0237)	(0.0155)
Male	−0.0116	−0.0557**	−0.0188	0.0375	−0.0465**
	(0.00730)	(0.0208)	(0.0175)	(0.0262)	(0.0168)
Income quartile	Yes	Yes	Yes	Yes	Yes
Income quartile*education	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	4,314	2,665	2,875	2,569	1,673

Country dummies and sector dummies are also included

The coefficient associated to HC is highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Missing Values

See Tables 16, 17, 18, 19, 20.

Table 16 Descriptive statistics

	Sample selection (14,104 obs.)	Missing values (3,616 obs.)
Age	41.652	42.060
University degree	0.387	0.356
Good health	0.978	0.959
Income	35350.09	33665.04
Male	0.652	0.694
H1	0.095	0.280
TARG	0.196	0.238

Table 17 Determinants of household economic hardship, probit regression using H1 as dependent variable and HBU as main explanatory variable: comparison between original sample, mean substitution and multiple imputation

Dependent variable: H1 Variables	(I) Missing values	(II) Mean substitution	(III) Multiple imputation
HBU	**0.0338*** **	**0.0408*** **	**0.0390*** **
	(0.00531)	**(0.00557)**	**(0.00521)**

Table 17 continued

Dependent variable: H1 Variables	(I) Missing values	(II) Mean substitution	(III) Multiple imputation
II income quart*educ	−0.0127†	−0.00373	−0.00610
	(0.00674)	(0.00807)	(0.00815)
III income quart*educ	−0.0107	0.00645	−0.00663
	(0.00923)	(0.00989)	(0.0106)
IV income quart*educ	−0.0292*	−0.0171	−0.0242†
	(0.0133)	(0.0119)	(0.0127)
Education	−0.00713	−0.0101†	−0.00794
	(0.00480)	(0.00577)	(0.00566)
Good health	0.00346	−0.00688	−0.00627
	(0.00701)	(0.0114)	(0.0112)
Permanent contract	−0.0212***	−0.0313***	−0.0367***
	(0.00620)	(0.00548)	(0.00807)
Change of job since last year	0.0150*	0.00843	0.00986
	(0.00663)	(0.00624)	(0.00714)
I income quartile	0.113	0.389***	0.342***
	(0.0898)	(0.0922)	(0.0946)

Table 17 continued

Dependent variable: H1	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
II income quartile	0.0129	0.0619	0.0456
	(0.0396)	(0.0492)	(0.0422)
III income quartile	−0.0301	−0.0350	−0.0251
	(0.0240)	(0.0264)	(0.0289)
Age	−0.000263	−0.000173	−0.000184
	(0.000171)	(0.000206)	(0.000204)
Household composition			
No children	−0.00528	−0.00739	−0.00762
	(0.00369)	(0.00465)	(0.00461)
Household composition			
Single parent with children	0.0345***	0.0313***	0.0317**
	(0.00889)	(0.00914)	(0.00920)
Married	0.0271***	0.0375***	0.0360***
	(0.00385)	(0.00439)	(0.00420)
Male	0.00319	0.00952*	0.00942*
	(0.00354)	(0.00433)	(0.00433)
Country dummies	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes
Observations	14,104	17720	17720

Country dummies and sector dummies are also included

The coefficients associated to HBU are highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 18 Determinants of household economic hardship, probit regression using TARG as dependent variable and HBU as main explanatory variable: comparison between original sample, mean substitution and multiple imputation

Dependent variable: TARG	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
HBU	**0.237*** **	**0.256*** **	**0.280*** **
	(0.00977)	**(0.00886)**	**(0.00875)**
II income quart*educ	−0.0191	−0.00937	−0.0158
	(0.0126)	(0.0109)	(0.0129)
III income quart*educ	−0.00139	0.00147	−0.0102
	(0.0133)	(0.0115)	(0.0138)
IV income quart*educ	−0.0356*	−0.0430**	−0.0583***
	(0.0165)	(0.0140)	(0.0167)
Education	−0.0179	−0.0207*	−0.0208†
	(0.0109)	(0.0100)	(0.0113)
Good health	−0.0562*	−0.0867***	−0.0959***
	(0.0231)	(0.0215)	(0.0244)
Permanent contract	−0.0196†	−0.0266**	−0.0326*
	(0.0106)	(0.00919)	(0.0132)

Table 18 continued

Dependent variable: TARG	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
Change of job since last year	0.0218*	0.0260**	0.0284*
	(0.0111)	(0.00944)	(0.0135)
I income quartile	0.0631	0.0468	0.0417
	(0.0521)	(0.0395)	(0.0449)
II income quartile	0.0558	0.0150	0.0159
	(0.0491)	(0.0355)	(0.0434)
III income quartile	−0.0357	−0.0502†	−0.0500
	(0.0342)	(0.0281)	(0.0379)
Age	0.000975**	0.00117***	0.00133**
	(0.000326)	(0.000318)	(0.000391)
Household composition			
No children	−0.0121†	−0.0175**	−0.0222**
	(0.00652)	(0.00620)	(0.00765)
Household composition			
Single parent with children	0.0223†	0.0222*	0.0269†
	(0.0120)	(0.0113)	(0.0136)
Married	0.0186**	0.0139*	0.0153*
	(0.00643)	(0.00617)	(0.00751)
Male	−0.0166*	−0.0189**	−0.0227*
	(0.00726)	(0.00702)	(0.00859)
Country dummies	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes
Observations	14,104	17720	17720

Country dummies and sector dummies are also included

The coefficients associated to HBU are highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 19 Determinants of household economic hardship, probit regression using H1 as dependent variable and HC as main explanatory variable: comparison between original sample, mean substitution and multiple imputation

Dependent variable: H1	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
HC	**0.0391*** **	**0.0407*** **	**0.0568*** **
	(0.00362)	**(0.00369)**	**(0.00413)**
II income quart*educ	−0.0125†	−0.00540	−0.00237
	(0.00686)	(0.00807)	(0.00824)
III income quart*educ	−0.0126	0.00295	−0.00207
	(0.00904)	(0.00974)	(0.0108)
IV income quart*educ	−0.0360*	−0.0238*	−0.0215
	(0.0141)	(0.0120)	(0.0143)

Table 19 continued

Dependent variable: H1	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
Education	−0.00725	−0.0107†	−0.0137*
	(0.00460)	(0.00582)	(0.00546)
Good health	0.000990	−0.0119	−0.00862
	(0.00728)	(0.0120)	(0.0114)
Permanent contract	−0.0169**	−0.0291***	−0.0288***
	(0.00574)	(0.00548)	(0.00733)
Change of job since last year	0.0133*	0.00947	0.00942
	(0.00639)	(0.00626)	(0.00705)
I income quartile	0.0158	0.257**	0.212*
	(0.0446)	(0.0819)	(0.0918)
II income quartile	−0.0182	0.0253	0.0107
	(0.0271)	(0.0393)	(0.0373)
III income quartile	−0.0422†	−0.0457†	−0.0384
	(0.0220)	(0.0236)	(0.0279)
Age	−7.41e-05	6.84e-05	4.16e-05
	(0.000164)	(0.000204)	(0.000199)
Household composition			
No children	−0.00433	−0.00823†	−0.00749
	(0.00363)	(0.00466)	(0.00456)
Household composition			
Single parent with children	0.0227**	0.0264**	0.0202*
	(0.00776)	(0.00886)	(0.00828)
Married	0.0210***	0.0344***	0.0293***
	(0.00357)	(0.00431)	(0.00408)
Male	0.00342	0.00937*	0.00876*
	(0.00338)	(0.00431)	(0.00421)
Country dummies	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes
Observations	14,104	17720	17720

Country dummies and sector dummies are also included

The coefficients associated to HC are highlighted in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

Table 20 Determinants of household economic hardship, probit regression using TARG as dependent variable and HC as main explanatory variable: comparison between original sample, mean substitution and multiple imputation

Dependent variable: TARG	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
HC	**0.0486*** **	**0.0357*** **	**0.0522*** **
	(0.00671)	**(0.00604)**	**(0.00794)**
II income quart*educ	−0.0244†	−0.0191	−0.0229
	(0.0142)	(0.0124)	(0.0148)

Table 20 continued

Dependent variable: TARG	(I)	(II)	(III)
Variables	Missing values	Mean substitution	Multiple imputation
III income quart*educ	−0.0120	−0.00859	−0.0169
	(0.0151)	(0.0128)	(0.0153)
IV income quart*educ	−0.0622***	−0.0664***	−0.0757***
	(0.0184)	(0.0146)	(0.0180)
Education	−0.0167	−0.0192†	−0.0237†
	(0.0122)	(0.0111)	(0.0126)
Good health	−0.107***	−0.139***	−0.153***
	(0.0,266)	(0.0238)	(0.0264)
Permanent contract	−0.0242*	−0.0312**	−0.0351*
	(0.0116)	(0.00994)	(0.0145)
Change of job since last year	0.0290*	0.0362***	0.0395*
	(0.0128)	(0.0105)	(0.0148)
I income quartile	−0.0162	−0.00309	−0.0108
	(0.0415)	(0.0349)	(0.0422)
II income quartile	−0.00170	−0.00970	−0.00,921
	(0.0446)	(0.0348)	(0.0434)
III income quartile	−0.0685†	−0.0716*	−0.0708†
	(0.0352)	(0.0281)	(0.0397)
Age	0.00191***	0.00209***	0.00242***
	(0.000356)	(0.000345)	(0.000417)
Household composition			
No children	−0.0215**	−0.0284***	−0.0341***
	(0.00698)	(0.00665)	(0.00807)
Household composition			
Single parent with children	0.0445**	0.0477***	0.0532**
	(0.0146)	(0.0137)	(0.0158)
Married	0.0310***	0.0269***	0.0286***
	(0.00704)	(0.00675)	(0.00799)
Male	−0.0233**	−0.0265***	−0.0319***
	(0.00775)	(0.00745)	(0.00892)
Country dummies	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes
Observations	14,104	17720	17720

Country dummies and sector dummies are also included

The coefficients associated to HC are highlighed in bold

Robust standard errors in parenthesis

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$

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