Journal of Economic Behavior and Organization 204 (2022) 490–508

Contents lists available at ScienceDirect

Journal of Economic Behavior and Organization

journal homepage: www.elsevier.com/locate/jebo

Health shocks and housing downsizing: How persistent is 'ageing in place'?

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ARTICLE INFO

Article history:
Received 28 January 2022
Revised 9 October 2022
Accepted 27 October 2022

JEL classification:
I18
G51
J61
R31

Keywords:
Ageing in place
Housing downsizing
Health shocks at old age
Europe
Residential mobility
Mental disorder
Degenerative illness

ABSTRACT

Individual preferences for 'ageing in place' (AIP) in old age are not well understood. One way to test the strength of AIP preference is to investigate the effect of health shocks on residential mobility to smaller size or value dwellings, which we refer to as 'housing downsizing'. This paper exploits more than a decade worth of longitudinal data to study older people's housing decisions across a wide range of European countries. We estimate the effect of health shocks on different proxies for housing downsizing (residential mobility, differences in home value, home value to wealth ratio), to examine the persistence of AIP preferences. Our findings suggest that consistently with the AIP hypothesis, after every decade of life, the likelihood of downsizing decreases by two percentage points (pp). However, the experience of a health shock partially reverts such culturally embedded preference for AIP by a non-negligible magnitude We estimate a 9pp increase in the probability of residential mobility after the onset of a degenerative illness), a 0.6 a fewer rooms after the onset of a degenerative illness. Such estimates are larger in northern and central European countries.

1. Introduction

In many western countries, individuals exhibit a preference for ageing in their own homes which is known as 'ageing in place' (AIP) (Wiles et al., 2012; Costa-Font et al., 2009). That is, individuals expect to remain in their homes (or their spouse's/partner's) unless personal circumstances require other arrangements (Quinn et al., 2009). However, AIP's viability is dependent on the presence of local support networks, adequate housing, and access to informal and community care (Luanaigh and Lawlor, 2008). However, we still know little about how individual preferences change in response to unexpected events afecting the suitability of ones housing, such as health shocks.

Behavioural explanations for preference for AIP point to the role of *status quo bias* giving rise to state dependant preferences (Samuelson and Zeckhauser, 1988). That is, individuals' judgements on the suitability of their dwelling at old age tends to be anchored on an independent living scenario which is taken as the baseline (status quo) and, might ignore other features that become relevant only at older age. Hence moving away from such baseline is perceived as a loss,

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https://doi.org/10.1016/j.jebo.2022.10.039
0167-2681/

which gives rise to ''inertial preferences for not changing residence'. Similarly, a preference for AIP might suggest that individuals are *present biased* with regards to their housing needs. Accordingly, housing decisions get postponed until adverse health or care needs arise, such as health shocks. However, whether health shocks cause people to adjust peoples living needs to the most suitable dwelling (Beach, 2016), remains an empirical question. This paper contributes to this question.

In most countries, housing assets are the primary source of wealth, so AIP has a significant financial impact on household finances (Venti and Wise, 2004). Indeed, AIP allows families to keep most of their housing wealth in the event of needing care, preventing such assets from depletion following admission to nursing home (Chappell et al., 2004). Furthermore, AIP is at odds with housing downsizing interventions, which encourage older people to live in smaller dwellings (Kneale et al., 2013). Governments encourage housing downsizing becuase it frees up assets for other uses and frequently allows people to adapt their homes to their specific needs as they age, preventing accidental falls and other environmental hazards (Banks et al., 2007; Bradbury, 2010; Luborsky et al., 2011).

This paper investigates whether people downsize to smaller homes after a health shock, including whether such a move encompasses a reduction in people's housing assets, freeing up wealth for other purposes such as paying for elderly care. In making housing choices, economic theory conceptualises individuals' homes are instrumentally perceived either as an investment, or an instrument to consume housing services 2022, but home hasin addition an emotional and symbolic value providing individuals with feelings of comfort, security, belonging and even personal achievement (Faulkner and Bennet, 2002).[1] Some studies find that the preference for AIP prevails even when individuals exhibit a deteriorating health and need personal care (Judd et al., 2010). However, what are the main drivers of the persistence of such a preference AIP?

We study the effect of health shocks on housing downsizing to determine the persistence of a preference for AIP. Todate we still know little about what explains residential mobility at old age and downsizing after a health shock (Beer et al., 2006; Painter and Lee 2009; Bonnet et al., 2010; Calvo et al., 2009; Angelini et al., 2011). Pannell et al. (2016) identify several 'push' and 'pull' factors underpinning residential mobility decisions[2,3]. One of such factors refers to indvididuals health. Indeed, Ostrovsky (2002) documents that people with health problems limitations are more likely to move, even though health status does not explain mobility. Consistently, Clark and Duerloo (2006) show that older households tend to keep extra living space for as long as possible, only giving it up when forced to, primarily for health reasons, and Painter and Lee (2009) find that having a disability increases the likelihood for a household to exit homeownership. This paper makes three distinct contributions to the literature:

First, we study the effect of a health shock to oneself or the spouse on three measures of housing downsizing, namely residential mobility, the value of a new residence (the home value of the new dwelling and the home value to wealth ratio) and the indviduals home size considering the potential endogeneity of h health shocks, as well as residential mobility.

Second, we use longitudinal data from the five waves of SHARE (the Survey of Health, Ageing, and Retirement in Europe) for a group of nine countries for about a decade. The availability of panel data from 2004 to 2015 allows us to account for both time variant and invariant unobserved individual heterogeneity. To the best of our knowledge, this is the first paper to use this empirical approach to investigate the effect of a health shock on downsizing decisions in a sample of European countries.

Finally, unlike previous research, we distinguish four types of health shocks (degenerative mental illness, other mental disorders, non-mental illness and basic activities of daily living). The effect of different health shocks allows us to evaluate the hypothesis that the effect of every type of health shock on the decision to downsize is not equivalent.[4]

We find the following results. First, although consistently with the AIP hypothesis, age reduces probability of residential mobility (by 2 percentual points (pp) for every decade of life) we find that such probability reduction reverts after a health shock. The probability of residential mobility increases between 4.8pp and 9pp depending on the type of health shock. These results suggest that *AIP is contingent on the absence of a health shock* in the household, and such effect is also observed for the spouse or partner. However, residential change is less likely to take place when individuals live in a house where home adaptations have already taken place. In examining residential mobility, we find that the home value to wealth ratio falls by 8.9 percentage points after the onset of a degenerative mental disorder and 4.2 percentage points after a non-mental illness. In these cases, the new home has 0.6 and 1.2 fewer rooms, respectively. Finally, we document significant country heterogeneity, individuals in Nordic countries meet all of the downsizing definitions examined, whereas those in Southern European countries tend to move to smaller, but higher-value, residences.

[1] Some evidence even suggests that individuals are willing to pay to reduce the likelihood of being institutionalised (Costa-Font, 2017), and enjoy such features even under a middle health shock.

[2] *Pull factors* include energy bills, difficulties with steps or stairs and the need for care or support. Access to local shops and services, as well as the desire to be closer to other family members alongside cognitive or emotional attachment to an individual's home are all *pull factors*.

[3] Other important behavioural divers include the emotional attachment to the current home, the desire to maintain social networks within the immediate community (particularly with neighbours), as well as the disruption and costs associated with moving, alongside the fear that an unfamiliar future home will not live up to the current home in terms of convenience or comfort (Ball and Nanda, 2013).

[4] We also investigate whether living in a dwelling that has been modified to improve its habitability reduces the likelihood of changing residence in the event of a health shock, whether there are significant differences between countries, and whether a gradient (Northern-Southern European countries) can be identified.

The rest of the article is structured in the following sections. Section 2 provides a review of the literature. Section 3 explains the econometric strategy. Section 4 presents the data and descriptive statistics. Section 5 presents the results, and finally, in Section 6, we report the conclusions.

2. Related literature

2.1. Financial and physical housing downsizing

There is no common definition of housing downsizing. Whilst some authors define downsizing as moving to smaller quarters (Ekerdt and Sergeant, 2006; Luborsky et al., 2011), others define it as cashing in housing equity (Bradbury, 2010; Jefferson et al., 2017; French et al., 2018), or combineboth criteria (Banks et al., 2007; Nguyen et al., 2021). Hence, one can consider two perspectives, namely physical, and financial downsizing. Physical downsizing denotes a change to a dwelling with a lower number of rooms, whereas financial downsizing refers to the change to a dwelling of lower value to free equity for other purposes. Consistently, Angelini et al. (2011) observe that Europeans downsize late in life by selling an expensive home and buying a cheaper one. Whelan et al. (2019) report that, amongst the older Australian population, 40% of older Australians moving home experience financial downsizing. Some older people may move to smaller houses that nevertheless have the same value as their old house (e.g., in a better location).[5] However, this would not involve physical housing downsizing. Therefore, by considering both physical and financial downsizing we capture a better picture of the phenomenon under study.

2.2. Motivations for housing downsizing

Housing mobility decisions typically are explained by the so-called the housing balance model and/or the life-cycle model, addition to other explanations. According to the *housing balance model*, older households tend to be in '*disequilibrium*', as they consume more housing than they need. Overconsumption of housing increases with age, especially in the 60–69 years 'empty nester' stage, almost all households in this age group overconsume their housing.[6] The proportion of households that overconsume their housing is higher amongst homeowners' singles and individuals in higher income categories (Clark and Duerloo, 2006). Housing overconsumption amongst over 60s can create a bottleneck in the housing market that limits younger households' access to more spacious housing.[7] Alternatively, *the life-cycle model* posits that older people expect to use accumulated assets to support themselves in old age.[8] Given that housing assets are the largest share of people's wealth, older people are likely to downsize or rent to release some wealth for other purposes (Beer et al., 2006).[9]

Other life cycle explanations include *bequest* (Feinstein and McFadden, 1989) and *empty nest* motives (Wulff et al., 2010). The former suggests that homeowners with children are expected to reveal higher savings trajectories. However, evidence from Hurd (1992), documents similar trajectories between homeowners with and without children. On the other hand, Venti and Wise (2004) found that, for older homeowners, housing equity decisions are found not to depend on the presence of children.Indeed, Wulff et al. (2010) suggests that the transition to 'empty nester' status increases mobility amongst mid-life empty-nester couples compared with couples that still had children at home.[10] Finally, a final set of reasons includes widowhood (Venti and Wise, 2004; Painter and Lee, 2009),[11] yet the effects are country specific. Banks et al. (2007) found that widowhood leads to a reduction in the number of rooms in older households in the United States but has a much smaller impact in the United Kingdom, where the overall residential mobility of older people is much lower. In contrast, Bonnet et al. (2010) documents that new widows are more likely to move into smaller dwellings, flats and the rental sector.

5 Existing studies that do examine preferences for housing attributes indicate that, as people age, preferences for lift access, housing without stairs or with an adapted bathroom increase (Abramsson and Anderson, 2016; De Jong et al., 2012; Fox et al., 2017; Anderson et al., 2019). In contrast, the preference for a garden and additional space in the home, e.g., for the family to stay, for social events and for hobbies, is observed to decrease with age (Anderson et al., 2019).

6 Clark and Duerloo (2006) in their study on housing in the Netherlands (2006) differentiate four categories: neutral housing (defined as one room more than the number of people living in the household), crowded (any living situation with less space than neutral housing), spacious (two rooms more than the number of people) and very spacious (three or more rooms than the number of people).

7 Painter and Lee (2009) suggest that the sharing of non-financial resources between children and their older parents explains why older people retain ownership of their family home. Older people may be reluctant to move and release housing because of the difficulties their younger children face in accessing housing, and they are also increasingly providing a home for their adult children in the housing crisis, often providing a home for much longer periods than was provided for them when they were young.

8 Consistently, the life-cycle theory considers precautionary planning and the performance of the housing market and attachment to the home as explanations for housing decisions (Ostrovsky, 2002).

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2.3. Housing effects of health shocks

Residential mobility is often unexpected, and is often triggered by the sudden deterioration of a family members' health. Other common life events underpinning downsizing are divorce, marriage, divorce, and deaths (Helderman, 2007). Calvo et al. (2009) found that there were very strong qualitative differences in residential mobility of older households that had experienced such shocks and those that had not.[12] Consistently, Clark and Duerloo (2006) and Painter and Lee (2009) document that older households tend to reduce their housing consumption following a sudden deterioration in a household member's health.[13] Documenting the effect of health shocks at older age in measures of housing downsizing is the main purpose of the rest of this paper.

3. The data

3.1. The sample

We use longitudinal data from SHARE (Survey of Health, Ageing and Retirement in Europe) corresponding to Wave 1 (2004), Wave 2 (2006/2007), Wave 4 (2011), Wave 5 (2013) and Wave 6 (2015).[14] SHARE is largest pan-European social science study for studying the effects of health, social, economic and environmental policies over the life-course of people aged 50 or older. The data contains 380,000 in-depth interviews.[15] Table 1 shows the initial composition of the sample considering only countries that have participated in all waves (160,388 observations for respondents). To construct the longitudinal sample, we have selected individuals participating in all the waves of the survey (33,535 observations for 6707 respondents).

3.2. Attrition

Given that the number of observations declines when we build the balanced panel data sample ued in this study, we examine the existence of attrition bias. To investigate this issue, we next estimate a series of attrition probits (Fitzgerald et al., 1998) and perform pooling tests for the equality of coefficients from the initial sample with and without attritors, using the Becketti-Gould-Lillard-Welch test (Becketti et al., 1988). To compute this test, first we regress the outcome variables from the first wave on household characteristics, an attrition dummy, and the attrition dummy interacted with the other explanatory variables. Next, we test for the joint significance of the interaction variables and the attrition dummy to determine whether the coefficients from the explanatory variables differ between households who attrit and those who remain in the panel. Results (on Table A.1) indicate that attrition is random and therefore, it is unlikely to bias our estimates.[16]

3.3. Trends in residential change and health shocks

According to Fig. A1, the probability of residential mobility between two consecutive waves is about 3%−4% for waves 1–2 and 2–4 but increases to 8% for waves 4–5 and 5–6. Considering that individuals are observed in all waves, this suggests that the probability of residential mobility increases with age.[17] Similarly, Fig. A2 displays the probability of a health shock between two consecutive waves for four types of health shocks, namely non-mental health shock, degenerative mental health shock, other mental health disorders shock and a disability shock affecting individuals' limitations in personal activities of daily living (ADL).

A *non-mental health shock* occurs when the respondent has been diagnosed of heart attack, stroke, cancer or lung disease between two consecutive waves. A degenerative *mental health shoc*k occurs when the respondent has been diagnosed of Alzheimer's disease or Parkinson's between two consecutive waves. Other mental health disorder related shock is a binary

[12] Consistently, the life-cycle theory considers precautionary planning and the performance of the housing market and attachment to the home as explanations for housing decisions (Ostrovsky, 2002).

[13] They found that those who moved after a shock experienced an average decrease in home value of about $26,000. In contrast, those who moved without a shock experienced an average increase of almost $33,000. The authors suggest that this means that *older people who have suffered a shock, such as illness or widowhood, may have chosen to downsize*, while those who have not are more likely to have planned to move to a more expensive home in an area with better amenities.

[14] However, some evidence finds that uncertainty about future medical expenses may prevent older people from downsizing, especially if housing is seen as an asset of last resort that will only be used to pay for nursing care or to support a surviving spouse (Ostrovsky, 2002).

[15] Unfortunately, wave 3 could not be included as it is not comparable with the other waves and wave 7 does not contain the question concerning change of household.

[16] The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782) and by DG Employment, Social Affairs & Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

[17] Additionally, the small pseudo-R-squared from the attrition probits, which can be interpreted as the proportion of the attrition that is not random, from the Becketti-Gould-Lillard-Welch test (Outes-Leon and Dercon, 2008), reinforces our previous diagnostic.

Table 1
Description of the sample by countries.

	Initial sample		Panel data sample		Change residence(%)	Baseline health status				Health shock between 2 waves			
	# obs.	# indiv.	# obs.	# indiv.		Non-mentalIllness(%)	Deg. mental(%)	Other mental disorders(%)	ADL(%)	Non-mentalIllness(%)	Deg. mental(%)	Other mental disorders(%)	ADL(%)
Austria	15,808	1274	1985	397	5.73	19.26	2.33	4.91	9.39	11.57	2.46	2.96	8.73
Belgium	23,824	3295	7020	1404	5.13	21.22	1.41	8.19	12.30	10.66	1.39	3.72	9.84
Denmark	14,502	1507	3230	646	9.53	21.77	1.08	5.42	7.58	11.07	0.93	2.55	6.76
France	20,416	2480	3680	736	4.84	22.33	0.95	9.04	11.19	11.31	0.82	4.35	9.97
Germany	17,410	3143	2870	574	5.52	23.46	0.91	3.88	9.75	12.80	1.35	2.18	9.93
Italy	19,197	3407	4740	948	6.96	21.18	1.21	6.12	11.33	12.38	1.66	4.35	10.02
Spain	20,815	2182	3710	742	4.05	18.41	2.32	9.94	11.07	10.32	2.66	6.03	9.69
Sweden	16,276	1658	4320	864	10.27	20.87	1.39	4.77	7.12	10.34	1.10	2.00	7.29
Switzerland	12,140	1046	1980	396	9.67	14.00	0.51	5.11	5.79	7.71	0.63	2.53	5.28
North	30,778	3165	7550	1510	10.01	21.18	1.26	5.05	7.29	10.60	1.03	2.24	7.10
Centre	89,598	11,238	17,535	3507	5.45	22.32	1.23	6.94	10.22	11.86	1.30	3.38	9.68
South	40,012	5589	8450	1690	5.65	19.93	1.70	7.80	11.24	11.47	2.10	5.09	9.88
All	160,388	19,992	33,535	6707	6.51	21.61	1.36	6.73	10.53	11.71	1.44	3.55	9.57

Note: Initial sample: all respondents at least one wave of SHARE (1, 2, 4, 5 and 6). Statistics for have been computed using sampling weights. Panel data: respondents who have answered the five waves of SHARE (1, 2, 4, 5 and 6).
Netherlands: did not participate on wave 6; Greece: did not participate on waves 4 and 5; Croatia, Czech Republic, Estonia, Ireland, Hungary, Luxembourg, Poland, Portugal, Slovenia did not participate on wave 1.
Group of countries: North (Denmark and Sweden), Centre (Austria, Belgium, France, Germany and Switzerland); South (Italy and Spain).
Baseline_(non-mental) illness: 1 if respondent has been diagnosed at baseline of one of the following pathologies (heart attack, stroke, cancer or lung disease); 0 otherwise.
Baseline_degenerative_mental: 1 if respondent has been diagnosed at baseline of Alzheimer's disease or Parkinson; 0 otherwise.
Baseline_other mental disorders: 1 if respondent has started to take drugs for anxiety or depression at baseline; 0 otherwise.
Baseline ADL: 1 if respondent reports a limitation for doing personal activities of daily living (dressing, including putting on shoes and socks, walking across a room, bathing or showering, eating, such as cutting up your food, getting in or out of bed and using the toilet, including getting up or down); 0 otherwise.
Shock (non-mental) illness: 1 if respondent has been diagnosed of heart attack, stroke, cancer or lung disease between two consecutive waves; 0 otherwise.
Shock_degenerative_mental: 1 if respondent has been diagnosed of Alzheimer's disease or Parkinson between two consecutive waves.
Shock_other mental disorders: 1 if respondent has started to take drugs for anxiety or depression between two consecutive waves; 0 otherwise.
Shock ADL: 1 if respondent has become limited for doing personal activities of daily living between two consecutive waves (dressing, including putting on shoes and socks, walking across a room, bathing or showering, eating, such as cutting up your food, getting in or out of bed and using the toilet, including getting up or down); 0 otherwise.
Residential mobility: 1 if respondent has changed of residence between two consecutive waves (0 otherwise).

Table 2
Comparison of home value with respect to wealth, home value (in real terms) before/after residential mobility and household size after residential mobility (%).

	Residential mobility (%)	Difference in number of rooms			Ratio home value/wealth (%)		Decrease home value after residential mobility (%)
		Upsize(%)	Same size(%)	Downsize(%)	Before change resid.	After change resid.	
No health shock							
Austria	5.24	14.81	23.39	61.79	73.23	75.51	8.00
Belgium	4.06	13.08	12.15	74.77	69.75	69.89	20.22
Denmark	8.61	11.31	21.49	67.21	62.32	60.38	35.52
France	4.06	10.05	15.55	74.40	72.41	71.42	7.08
Germany	4.70	9.19	32.97	57.84	71.96	70.66	10.86
Italy	7.38	9.55	13.87	76.58	81.45	85.12	2.10
Spain	3.43	14.20	16.98	68.83	75.89	75.35	2.20
Sweden	8.19	8.59	25.42	65.99	58.18	55.12	19.99
Switzerland	9.50	9.91	22.39	67.69	63.89	64.50	17.86
All	5.94	11.08	20.35	68.57	70.63	71.00	13.13
Health shock							
Austria	5.46	9.02	21.31	69.67	81.52	82.38	13.39
Belgium	4.97	11.18	12.35	76.47	71.91	71.82	38.31
Denmark	10.51	9.93	13.91	76.16	61.66	62.15	58.10
France	5.34	8.09	12.50	79.41	72.97	75.05	13.29
Germany	4.94	7.37	24.21	68.42	75.41	73.22	16.17
Italy	8.52	10.37	13.41	76.22	85.50	86.83	5.94
Spain	3.02	12.10	15.32	72.58	76.88	75.36	1.71
Sweden	8.51	7.80	19.15	73.05	63.87	59.27	38.81
Switzerland	6.48	7.37	24.21	68.42	62.67	64.34	26.93
All	6.22	9.43	16.61	73.96	74.15	74.75	23.23

Note: Own work using waves 1, 2, 4 5 and 6 from SHARE. Using sampling weights.
Decrease in home value: 1 if home value of new dwelling is smaller than home value of previous residence (both in PPP2012).

variable taking the value 1 if the respondent has started to take drugs for anxiety or depression between two consecutive waves. Finally, a shock on basic *activities of daily living (ADL) shock*[18] takes place when number of limitations for doing daily living activities increases between two consecutive waves. In the analysis, we report health shocks affecting both the respondent and spouse or partner.

As expected, the probability of experiencing a health shock increases with age from 5% for the youngest cohort (50–54 years) to approximately 30% for individuals aged 85 and over. We find that the probability is higher between waves 2 and 4, which can be explained by the effects of the economic downturn (Thomson et al., 2014). Table 1 reveals that when we distinguish between health shocks, we find that 11.7% have experienced a non-mental illness shock, 9.6% a ADL shock, 3.5% other mental disorders shock and 1.4% a degenerative mental shock.

3.4. Dependant variables

We use four outcome variables to measure different measures of downsizing. First, "*residential mobility*" which is a binary variable taking the value 1 when respondents change residence between two consecutive survey waves. Second, "*home value to wealth ratio*" which can only be calculated for homeowners, and is defined as the ratio of the value of an indviduals home (reported by the individual in the survey[19]) and its wealth (which includes bank accounts, bond, stock and mutual funds, savings for long-term investments, value of own business, value of home, value of cars and value of other real estate).[20] Third, we measure the difference in housing value (new - old) expressed in millions PPP (2012). Finally, we measure the difference in the number of household rooms between two consecutive waves (including bedrooms but excluding kitchen, bathrooms, and hallways). This variable is defined for all those who have changed residence.

Table 2 reports the descriptive statistics for the dependant variables per country, conditional on having suffered a health shock (non-mental illness, degenerative mental illness, other mental health disorders or ADL limitation).[21] The share of

[18] Considering the entire sample, we find that 6.5% of all respondents have changed their residence between two consecutive waves (Table 1), with a maximum value in Sweden (10.3%) and a minimum in Spain (4%).

[19] We follow Coile's (2004) intuition in considering ADL shocks (e.g., an increase in activities of daily living). Given that the severity of a health shock varies between individuals, indicators of health states related to illnesses may mask significant heterogeneity. This reasoning is also consistent with Jones et al (2020) shock-induced impairment shock approach.

[20] In relation to the reliability of home value statements, it has been found that families with short tenure and high-value homeowner provide unbiased estimates of home value (Kiel and Zabel, 1999).

[21] Some theoretical studies have examined on how the relationship between home value and household wealth influences households' asset allocation decisions (Flavin and Yamashita, 2002; Cocco, 2005). If there is a mortgage, a higher home value to wealth ratio exposes homeowners to a higher risk of

home value to wealth is 3 percentage points higher amongst households that have experienced a health shock (74% vs. 70%) and remains practically stable after the residential mobility.[22]

Next, we report four different event-studies for the four outcome variables conditional on residential mobility and health shock. Time 0 is identified as the time at which the health shock occurs, as displayed in Fig. A4, which suggests that the occurrence of a health shock leads to: (i) a significant increase in the probability of residential change, (ii) a decrease in the value of the new residence acquired, (iii) an increase in the probability that the new residence has fewer rooms, and (iv) a reduction in the home-value to wealth ratio.

3.5. Control variables

We include the following controls, namely socio-demographic characteristics (age, sex, marital status, level of education, relation with economic activity, adjusted household income (dividing total household income by the square root of household size), household size and size of municipality of residence. We also control for health status at baseline. See Table A2 for descriptive statistics. We define home adaptations as a binary variable, identifying whether the home has any of the following facilities (widened doors or corridors, ramps or street level entrances, handrails, automatic or easy open doors or gates, bathroom or toiled modifications, kitchen modification, stair glides, alerting devices).[23] Finally, country and regional (at NUTS-2 level) fixed effects are also included to capture the effect of different urbanisation policies and year fixed effects.

3.6. Instruments

In modelling residential mobility, we consider the potential endogeneity of the occurrence of a health shock. More specifically, we draw on six instruments for which the literature documents a relationship with the potentially endogenous variable, conditionally on the other covariates, and for which it is plausible to assume that they are not correlated with the error term of the outcome equation (residential mobility).[24] In addition, we study the variation in the home value to wealth ratio, alongside the difference in home value and in the number of rooms.[25] Definition and descriptive statistics for all variables are provided on Tables A3 and A4 of Appendix A.[26]

4. Empirical strategy

In this section we present three econometric specifications considering the different nature of our different dependant variables measuring housing downsizing. Indeed, in modelling downszising as residential change as a binary event, a dynamic probit is proposed. However, when we model downsizing as the home value to wealth ratio, a fractional model used instead. Finally, we measure downsizing by estimating the difference in home value and the difference in the number of rooms across an individuals age drawing on a generalised method of moments. However, all models consider the potential endogeneity of the health shock (of the individual and/or his/her spouse/partner) or of the residential mobility as discussed below.

4.1. Dynamic probit estimator for residential mobility

Given that individuals downsizing decisions are state dependence, namely past experience influence current behaviour, we model residential change decisions using a dynamic specification. According to the descriptive estimates in Table 1, only 6.5 percent of respondents have ever moved. However, 7.1 percent of those who have never experienced a health shock and

mortgage commitment, which will induce them to adjust the level of risk in other assets. Conversely, if there is no mortgage debt, a higher home value to wealth ratio indicates that more of homeowners' wealth is locked up in highly illiquid real estate. Therefore, the home value to wealth ratio may be considered as indicative of the fraction of assets that can be mobilised to defray long-term care expenses (associated with a health shock), with an inverse relationship between the two variables (Davidoff and Welke, 2007).

[22] Figure A3 summarises the behaviour of the above-mentioned dependent variables by country. The red areas have been used to reflect the percentage of households that have moved to a household with fewer rooms, which is above 70% in Belgium, France, Italy and Spain. The purple bricks denote the percentage of households that have moved to a dwelling that represents a smaller percentage of total wealth. For all countries it is above 40%, reaching values above 50% in Germany and Sweden. The maximum value corresponds to Switzerland (50.76%) and Sweden (47.28%), and the minimum to France (9.65%) and Italy (7.72%). The green circles represent the percentage of households that have moved to lower value housing, with the highest values in Denmark (45.77%) and Sweden (29.88%), and the lowest values in Spain (1.62%) and Italy (5.08%).

[23] In the case of a health shock, the percentage of new dwellings of lower value is higher (23.23% vs. 13.13%, respectively) as well as the percentage of new dwellings with a lower number of rooms (73.96% vs. 68.57%).

[24] The SHARE questionnaire does not provide the detail of how many of these adaptations have been made in the household. It is only known whether the household has any or all of the adaptations mentioned in the list.

[25] The proposed instruments are being a (1) smoker, (2) former smoker (Courtney-Long et a., 2014; Rissanen et al., 2019), (3) being obese, (4) overweight (Vidoni et al., 2011; Pozzobon et al., 2018; Zhang et al., 2019), (5) regular alcohol consumption (Salonsalmi et al., 2017; Ilic et al., 2018; Peng et al., 2020) and (6) sedentary lifestyle (Pozzobon et al., 2018; Onambele-Pearson et al., 2019; Narita et al., 2020).

[26] To instrument residential change, the following five instrumental variables are proposed: (i) cooling degree days: measure of the need of air-conditioning (at NUTS-2 level), (ii) heating degree days: measure of the need of heating (at NUTS-2 level), (iii) housing price index: price index of residential property (2004=100) (at NUTS-2 level), (iv) growth rate of housing price index: annual growth rate of residential property price (%) (at NUTS-2 level) and (v) number of daughters at home.

5.7 percent of those who have experienced a health shock, have moved more than once. Accordingly, we have specified the probability of changing residence as below:

$$C_{it}^{*} = \alpha_0 C_{it-1} + \sum_{j=1}^{j=3} \alpha_j SH_{it}^{R} + \sum_{j=4}^{j=6} \alpha_j SH_{it}^{P} + Z_{it}'\gamma + \eta_i + R_r + T_t + \varepsilon_{it}$$
$$i = 1, \ldots, N; t = 1, \ldots T \quad (1)$$

where C_{it}^{*} is the latent dependant variable, C_{it-1} represents the residential change decision in the previous period, Z_{it}' is a vector of explanatory variables (age, sex, previous health status, marital status, level of education, economic activity, adjusted household income, household size, home adaptations), η_i is a term capturing unobservable heterogeneity. R_r and T_t denote regional (at NUTS-2 level) and time fixed effects and ε_{it} is an error term following a normal distribution with mean zero and variance normalised to one. The subscripts i and t refer to cross-sectional units (individuals) and years (waves), respectively. We evalute the effect of four types of health shocks SH_{it}^{R} following previous definitions (non-mental, degenerative mental, other mental disorders, ADL shocks) and four analogous shocks experienced by the partner or spouse SH_{it}^{P}. The observed binary outcome variable (having residential mobility or not) is defined as:

$$C_{it} = 1\left[C_{it}^{*} \geq 0\right], \ t = 2, \ldots, T \quad (2)$$

The number of cross-sectional units (N) are assumed to be long, whilst the number of periods are small, implying that the asymptotic properties depend only on N. Modelling this relationship using a random effects probit would assume that conditional on Z_{it}', the unobservable heterogeneity is normally distributed with zero mean and variance σ_{η}^{2}, and independent of ε_{it} and Z_{it}'. Under these assumptions, the probability of residential mobility for individual i at time t, given η_i is:

$$Pr\left[C_{it}|Z_{it}, C_{it-1}, \eta_i\right] = \Phi\left[\left(\alpha C_{it-1} + \sum_{j=1}^{j=4} \alpha_j SH_{it}^{R} + \sum_{j=5}^{j=7} \alpha_j SH_{it}^{P} + Z_{it}'\gamma + \eta_i + R_r + T_t\right) (2C_{it} - 1)\right] \quad (3)$$

We incorporate the effects of unobservable heterogeneity following Wooldridge (2005) proposed conditional maximum likelihood estimator,[27] and we specify an approximation for the density of η_i conditional on the initial value C_{i1}:

$$\eta_i|C_{i1}, \ Z_{it} \sim N\left(\nu_0 + \nu_1 C_{i1} + \tilde{Z}_{it}'\varrho, \sigma_{\upsilon}^{2}\right)$$
$$\eta_i = \nu_0 + \nu_1 C_{i1} + \tilde{Z}_{it}'\varrho + \upsilon_i \quad (4)$$

For simplicity of notation, $\tilde{Z}_{it}'$ includes both Z_{it}' and the health shocks. This specification considers the correlation between $C_{i1}$and $\tilde{Z}_{it}'$ and gives rise to a new unobservable heteroeneity term (υ_i), unrelated to the decision in the initial period. Substituting in the probability of residential mobility:

$$Pr[C_{it}|C_{i1}, \upsilon_i] = \Phi\left[\left(\alpha C_{it-1} + Z_{it}'\gamma + \nu_0 + \nu_1 C_{i1} + \tilde{Z}_{it}'\varrho + \upsilon_i + R_r + T_t\right)\right] \quad (5)$$

Then, the likelihood function of individual i is given by:

$$L_i = \int \prod_{t=2}^{T} \Phi\left(\alpha C_{it-1} + Z_{it}'\gamma + \nu_0 + \nu_1 C_{i1} + Z_{it}'\varrho + \upsilon_i + R_r + T_t\right)(2C_{it} - 1) \ \phi d\phi \quad (6)$$

where ϕ denotes la normal probability density function of the new unobservable term. This estimator is the Wooldridge Conditional Maximum Likelihood Estimator. This estimator allows for the correlation between the unobserved heterogeneity and the explanatory variables, which is realistic in a random effect specification.

One potential concern is the endogeneity of health shocks. Such endogeneity might be the result of individuals susceptibility to expercience a health shocks (e.g., a fall) as resulting from exposure to poor quality housing, which makes individuals more likely to move after an adverse event.[28] Alternatively, some other respondents may still see their home as

[27] The reasons underlying the choice of these variables are the following. In relation to weather, Banks et al. (2012) observe an increase in the mobility of older Americans residing in colder areas, who seem to be more likely to move to warmer areas. Thus, one would expect to see an increase in mobility in regions with a higher number of heating days. There is a body of literature that has found that lower house prices lead to lower household mobility for two reasons. First, because risk-averse people do not want to sell their property for less than what they once paid (Engelhardt, 2003). Second, the reduction in the value of the house may limit the amount of the potential mortgage that could be obtained for the new house (Schulhofer-Wohl, 2012). Finally, several research studies support that the daughters are more likely to become caregivers for parents Ulmanen (2013), and that daughters or their elderly parents tend to move when parental care needs are high (Artamanova et al., 2020).

[28] To estimate the dynamic probit model, we make some assumptions regarding the initial value of the decision to change residence (C_{i1}) and its correlation with the unobservable heterogeneity term. If the initial decision is assumed to be exogenous, a random effects probit model could be used to estimate the model. However, this would lead to biased coefficient estimates since it is unrealistic to assume exogeneity, given that the initial decision of households is unobservable. This implies that the decision made in the previous period (C_{it-1}) is correlated with η_i. This problem is known as the "*initial conditions problem*".

'their safe space' consistently with the AIP hypothesis.[29] We therefore propose a dynamic correlated random effect model (Wooldridge, 2005).[30]

We specifically focus on the effect of two moderating effects: a structural moderating effect arising from the non-linearity of the model, and a secondary moderating effect arising from the inclusion of an interaction variable in the model.[31] Therefore, an analytically correct significant moderating effect may reflect only the inherent structural features of the non-linear model used, but not the effect arising from the inclusion of an interaction variable in the model. Conversely, the lack of significance of the analytically correct moderating effect may masque that the moderating hypothesis underlying the introduction of the interaction is valid. In this paper we use the test proposed by Bowen (2012), which extends the results of Ai and Norton (2003) for logit and probit models to a general class of non-linear models which tests for the significance of both the effects including and excluding the interaction variable. Table A7 provides the estimates of the test for all the estimates reported later in the results.

4.2. Fractional response model for ratio value of new home with respect to wealth

In examining whether residential mobility after a health shock affects the value of the new residence to which one moves, we use a fractional model (Papke and Wooldridge, 2008). The fractional model is appropriate since the two dependant variables are binary, so that estimation of a linear model for the conditional mean could obviate important non-linearities.[32] Papke and Wooldridge (2008) proposed a Quasi-Maximum Likelihood Estimator and extends the fractional response model to panel data. For each individual i, we have T observations $t = 1,2,\ldots,T$ and the response variable (HW_{it}) which denote the home value to wealth ratio is bounded: $0 \leq HW_{it} \leq 1$.

$$E[HW_{it}|X_{it},\eta_i] = \Phi\left(\lambda_0 C_{it} + \sum_{j=1}^{j=4}\lambda_j SH_{it}^R + \sum_{j=5}^{j=7}\lambda_j SH_{it}^P + X_{it}\beta + \eta_i + R_r + T_t\right),\ t = 1,2,\ldots,T \tag{7}$$

X_{it} refers to a vector of explanatory variables and Φ denotes the standard normal cumulative distribution function. We also include, as before, the exposure to health shocks of both the respondent (SH_{it}^R) and the partner/spouse (SH_{it}^P), having changed of residence between two waves (C_{it}). η_i corresponds to individual heterogeneity and R_r and T_t denote regional and time fixed effects. The estimation method of Papke and Wooldridge (2008) also makes it easy to obtain average partial effects. In the case of binary regressors, the partial effect is given by:

$$\Phi\left(X_{it,(1)}\beta + \eta\right) - \Phi\left(X_{it,(0)}\beta + \eta\right) \tag{8}$$

where $X_{it,(1)}$ and $X_{it,(0)}$ denote the discrete change in the explanatory variable. In the case of continuous regressors, the partial effect for regressor j is given by:

$$\frac{E[HW_{it}|X_{it}\ ,\ \eta]}{x_{it,j}} = \beta_j\phi(X_{it} + \eta) \tag{9}$$

However, the average partial effects are influenced by unobserved heterogeneity (η), so in order to identify such effects, two additional assumptions are required. Papke and Wooldridge (2008) propose to combine the Mudlak-Chamberlain approach with the control function method, which yields consistent parameter estimates. First, they assume that the regressors, conditional on unobservable heterogeneity, are strictly exogenous:

$$E[HW_{it}|X_{it},\eta_i] = E[HW_{it}|X_i,\eta_i],\ t = 1,\ldots,T \tag{10}$$

And second, they introduce the assumption of conditional normality (Chamberlein, 1980):

$$\eta_i|x_{i1},x_{i1},\ldots x_{i1} \sim N\left(\psi + \bar{x}_{i\xi},\sigma^2\right),\quad \bar{x}_i = \frac{\sum_{t=1}^T x_{it}}{T} \tag{11}$$

[29] Indeed, it likely that unobservable dimensions related to the individual's preferences for staying in his or her environment (e.g., proximity to medical centres and knowledge of the doctors who usually treat him or her) are correlated with the probability of changing residence not only in the current period, but also in future periods.

[30] Figure A5 shows that changes in housing mobility, computed at NUTS-2 level, are positively associated with the variation in the occurrence of health shocks, suggesting that the probability of a residential change declines after health shocks. The red line shows the non-parametric lowness plot and highlights non-linearities in the bivariate relationship. Although in the results section we will also report the estimations of a pure random effects model, we already anticipate that this model is unrealistic as it relies on the assumption of independence between unobservable heterogeneity, initial conditions and exogenous variables in the model.

[31] First, we use the Mundlak (1978) approach by estimating a regression for each health shock by pooled OLS (using current smoker, past smoker, current alcohol consumption, overweight, obese, and sedentary lifestyle as instruments). Residuals are then obtained and averaged for everyone. Then a probit model for the probability of residential mobility is estimated and includes the explanatory variables, the predicted residuals, and the average of the residuals per conditional MLE. Bootstrapping is used to retrieve the standard errors.

[32] Note that as Ai and Norton (2003) describe that the sign and significance of the coefficient is conditional on the explanatory variables, unlike the interaction effect in linear models. Therefore, the sign of the estimated coefficient does not necessarily indicate the sign of the interaction effect (Karanca-Mandic et al., 2012). The analytically correct moderating effect is the partial cross-derivative of the conditional expectation of the dependent variable of the model, first with respect to the focus variable and then with respect to the moderating variable.

No assumption on the serial dependence of the response function is required and, at the same time, the potential endogenous regressors are allowed to be correlated with unobservable shocks in other periods. To account for the potential endogeneity of residential mobility we use the following instruments for the decision to move: (i) the number of heating and cooling days, (ii) housing price index and its growth rate and (iii) number of daughters in the household, and a control function (CF) approach, the standard errors are adjusted by bootstrapping.

4.3. Generalized method of moments for the difference in home value and the difference in the number of household rooms

In this model we consider the difference in home value in million PPP (12,012) (DHV_{it}) and the difference in the number of rooms in the dwelling (DR_{it}) between two consecutive waves as the dependant variable. As in the previous models, we introduce as regressors having changed residence (C_{it}), health shocks of both the individual (SH^R_{it}) and of his/her spouse or partner (SH^P_{it}):

$$DR_{it} = \varpi_0 C_{it} + \sum_{j=1}^{j=4} \varpi_j SH^R_{it} + \sum_{j=5}^{j=7} \varpi_j SH^P_{it} + W'_{it}\gamma + \eta_i + R_r + T_t + \varepsilon_{it} \qquad (12)$$
$$i = 1, \dots, N; t = 1, \dots T$$

To address concerns on the exogeneity of the residential mobility, we use a two-stage GMM estimation using the same instruments for residential switching as in Section 4.2 (the number of heating and cooling days, housing price index and its growth rate and number of daughters in the household).

5. Results

5.1. Residential change

Table 3 displays the pure random effects and correlated random effect estimates. For each model, the results are shown considering both the exogeneity and endogeneity of the health shock (using control function (CF) strategy). Table A6 displays the results of the first stage estimation.[33] When we do not correct for the endogeneity of a health shock (left-hand side of the table) we observe a negative association between health shocks and the probability of residential change. Given the evidence shown in Fig. A5, we expect short-term variations in the residential mobility to be correlated with wave-to-wave changes in health shocks. The right part of the table reports pure random effects and correlated random effects considering the endogeneity of health shocks.[34] However, our instrumental variable estimates which control for simultaneity bias sugest that *health shocks are positively associated with switching to another residence.* The reduction in the value of the coefficient of the delayed residential mobility suggests upward bias given the evodence of unobservable heterogeneity in previous estimates.

The probability of residential change increases after the onset of a health shock (9pp for degenerative mental illness, 6.5pp for ADL, 6.1pp for mental disorders, and 4.8pp for non-mental health shock) but decreases 2pp for every 10 years of life. However, the interaction between age and health shock is positive and significant. The same pattern is observed for health shocks among spouses or partners.[35] As expected, having undertaken home adaptations decreases the probability of changing residence (−18.1pp). Indeed, if the homeowner undertook home adaptations and suffered from ADL shock or a degenerative mental illness, the probability of changing residence decreases by 19.6pp and 11pp, respectively. The same results are observed if the spouse/partner suffers a health shock.

[33] In this regard, Papke and Wooldrige (2008) point out that the main limitation of Papke's (2005) analysis is its use of a linear probability model with IV for a fractional dependent variable. Yet, considering the endogeneity of one of the regressors is much more important when considering the non-linearity of the underlying relationship (Papke and Wooldrige, 2008).

[34] Being a smoker increases the probability of non-mental shock by 3pp and of ADL shock by 1.1pp. Having been a smoker (not now) significantly increases the probability of non-mental shock (7pp). Having a sedentary lifestyle increases the probability of non-mental shock by 8.2pp, degenerative mental health shock by 3.6pp, other mental disorders by 3.3pp and of ADL limitations by 6.7pp. The effect of obesity is considerably higher than that of being overweight (5.5pp for non-mental shock and 6.7pp for ADL limitations). And drinking alcohol increases the probability of non-mental and other mental disorders shock by 3pp and 1.6pp, respectively. The test for endogeneity is not done using the traditional Hausman or Durbin-Wu-Hausman approaches, but instead uses a variation of the Durbin-Wu-Hausman test that is robust to heteroskedastic and clustered errors (Cameron and Trivedi (2010) discuss the robust test (page 190) as the "robustified" Durbin-Wu-Hausman test). The robustified Durbin-Wu-Hausman tests indicate that the exogeneity hypothesis cannot be rejected. Similarly, we use the Kleibergen Paap F-statistic to test for weak instruments, since we cannot formally test for weak instruments when errors are heterskedastic, serially correlated, or clustered (Pflueger and Wang, 2015). Given that F-statistics may be high even under weak instruments, setting the confidence level to 5%, we compare the effective F test to the critical values under different values of τ (e.g., fraction of a "worst case scenario" situation in which the instruments are completely uninformative and first- and second-stage errors are perfectly correlated). The Nagar bias is the approximate asymptotic bias under weak instruments. The Montiel-Pflueger F-statistics allow us to test whether the Nagar bias exceeds a certain fraction of the "worst case" benchmark (Olea and Pflueger, 2013; Pflueger and Wang, 2015). The test rejects the null for a weak instrument threshold of $\tau = 5\%$. These results show that the instrument is reasonably strong under all specifications.

[35] As expected, the lagged coefficient of residential mobility is significant and positive, indicating strong persistence in housing mobility, both in pure random effects and in correlated random effects.

Table 3
Results for the probability of residential mobility.

	Health shock treated as exogenous				Health shock treated as endogenous			
	Control function(pure RE)		Control function(correlated RE)		Control function(pure RE)		Control function(correlated RE)	
	Coef.	APE	Coef.	APE	Coef.	APE	Coef.	APE
Residential mobility (lag)	0.406***	0.064***	0.390***	0.067***	0.578***	0.048***	0.554***	0.044***
	(0.049)	(0.006)	(0.070)	(0.006)	(0.067)	(0.006)	(0.067)	(0.006)
Home adaptations	−0.043***	−0.044***	−0.064***	−0.066***	−0.110***	−0.112***	−0.181***	−0.181***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Shock: no mental	−0.387	−0.050	−0.390	−0.040	0.038***	0.039***	0.489***	0.048***
	(0.286)	(0.029)	(0.292)	(0.029)	(0.014)	(0.009)	(0.216)	(0.022)
Shock: degenerative mental	−0.150***	−0.138***	−0.134***	−0.122***	0.112***	0.097***	0.080***	0.090***
	(0.032)	(0.032)	(0.033)	(0.034)	(0.034)	(0.035)	(0.036)	(0.045)
Shock: other mental disorders	−0.045	−0.050	−0.058	−0.065	0.072**	0.079***	0.086***	0.061***
	(0.035)	(0.036)	(0.038)	(0.039)	(0.040)	(0.032)	(0.043)	(0.026)
Shock: ADL	−0.697***	−0.140***	−0.709***	−0.140***	0.240***	0.140***	0.833***	0.065***
	(0.302)	(0.055)	(0.308)	(0.050)	(0.031)	(0.046)	(0.163)	(0.010)
Home adaptations and								
Shock: no mental	−0.047***	−0.047***	−0.051***	−0.054***	−0.057***	−0.051***	−0.056***	−0.051***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Shock: degenerative mental	−0.085	−0.083	−0.087	−0.091	−0.129***	−0.110***	−0.105***	−0.110***
	(0.050)	(0.052)	(0.053)	(0.055)	(0.047)	(0.040)	(0.043)	(0.045)
Shock: other mental disorders	−0.006	−0.006	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005
	(0.014)	(0.014)	(0.015)	(0.016)	(0.017)	(0.018)	(0.019)	(0.020)
Shock: ADL	−0.206***	−0.204***	−0.202***	−0.201***	−0.200***	−0.199***	−0.197***	−0.196***
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Age	−0.006***	−0.001***	−0.006***	−0.001***	−0.010***	−0.001***	−0.011***	−0.002***
	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)	(0.000)	(0.003)	(0.000)
Age * Shock(no mental)	0.036***	0.036***	0.040***	0.041***	0.080***	0.089***	0.091***	0.092***
	(0.010)	(0.010)	(0.012)	(0.012)	(0.032)	(0.032)	(0.032)	(0.023)
Age * Shock (deg. mental)	0.126***	0.110***	0.105***	0.101***	0.194***	0.186***	0.218***	0.225***
	(0.041)	(0.042)	(0.043)	(0.043)	(0.044)	(0.035)	(0.039)	(0.042)
Age * Shock (other mental dis.)	0.093***	0.085***	0.091***	0.086***	0.086***	0.087***	0.079***	0.076***
	(0.031)	(0.032)	(0.033)	(0.035)	(0.036)	(0.038)	(0.030)	(0.030)
Age * Shock(ADL)	0.010**	0.001**	0.010**	0.001	0.420***	0.033***	0.387***	0.063***
	(0.005)	(0.001)	(0.005)	(0.001)	(0.146)	(0.006)	(0.142)	(0.006)
Age partner	−0.004**	−0.002**	−0.005***	−0.002***	−0.020***	−0.002***	−0.021***	−0.002***
	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)	(0.000)	(0.003)	(0.000)
Shock partner: no mental	0.079	0.011	0.080	0.011	0.072	0.012	0.384***	0.033***
	(0.071)	(0.009)	(0.072)	(0.009)	(0.100)	(0.010)	(0.108)	(0.010)
Shock partner: degen. mental	0.054***	0.037***	0.045***	0.047***	0.052***	0.057***	0.054***	0.053***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Shock partner: other mental dis.	0.024***	0.025***	0.026***	0.026***	0.027***	0.027***	0.027***	0.027***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Shock partner: ADL	0.178*	0.025*	0.181**	0.025***	0.216	0.026	0.267***	0.040***
	(0.092)	(0.012)	(0.094)	(0.012)	(0.137)	(0.014)	(0.080)	(0.016)
Home adaptations and								
Shock partner: no mental	−0.081***	−0.079***	−0.080***	−0.082***	−0.084***	−0.085***	−0.086***	−0.040***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
Shock partner: degen. mental	−0.049***	−0.051***	−0.055***	−0.060***	−0.165***	−0.171***	−0.177***	−0.184***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Shock partner: other mental dis.	−0.038	−0.033	−0.030	−0.026	−0.024	−0.020	−0.017	−0.015
	(0.045)	(0.048)	(0.050)	(0.053)	(0.055)	(0.059)	(0.063)	(0.067)
Shock partner: ADL	−0.035***	−0.036***	−0.038***	−0.039***	−0.242***	−0.245***	−02***	−0.251***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Age * Shock partner(no mental)	0.073***	0.071***	0.083***	0.081***	0.081***	0.087***	0.092***	0.092***
	(0.023)	(0.021)	(0.023)	(0.021)	(0.039)	(0.039)	(0.038)	(0.038)
Age * Shock partner(deg. mental)	0.075***	0.078***	0.086***	0.096***	0.107***	0.117***	0.124***	0.122***
	(0.030)	(0.031)	(0.031)	(0.032)	(0.033)	(0.035)	(0.036)	(0.038)
Age * Shock partner(other mental dis.)	0.042***	0.044***	0.048***	0.054***	0.061***	0.070***	0.082***	0.098***
	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)	(0.017)	(0.018)	(0.018)
Age * Shock partner(ADL)	0.012***	0.001***	0.012***	0.000	0.086***	0.031***	0.093***	0.039***
	(0.003)	(0.000)	(0.003)	(0.001)	(0.037)	(0.006)	(0.031)	(0.006)
Man	0.005	0.001	0.006	0.001	0.025	0.001	0.015	0.001
	(0.029)	(0.004)	(0.030)	(0.004)	(0.040)	(0.004)	(0.041)	(0.004)
Married	−0.197***	−0.030***	−0.202***	−0.029***	−0.197***	−0.030***	−0.202***	−0.029***
	(0.055)	(0.009)	(0.057)	(0.009)	(0.055)	(0.009)	(0.057)	(0.009)

(*continued on next page*)

Table 3 (*continued*)

	Health shock treated as exogenous				Health shock treated as endogenous			
	Control function(pure RE)		Control function(correlated RE)		Control function(pure RE)		Control function(correlated RE)	
	Coef.	APE	Coef.	APE	Coef.	APE	Coef.	APE
Separated/divorced	0.273*** (0.045)	0.046*** (0.008)	0.278*** (0.047)	0.046*** (0.008)	0.274*** (0.045)	0.047*** (0.008)	0.280*** (0.047)	0.045*** (0.008)
Widow	0.217*** (0.039)	0.033*** (0.006)	0.222*** (0.041)	0.033*** (0.006)	0.216*** (0.039)	0.033*** (0.006)	0.222*** (0.041)	0.032*** (0.006)
Initial condition				0.082*** (0.013)				0.409*** (0.115)
N	33,535		33,535		33,535		33,535	

Note: Interaction terms computed using Ai and Norton (2003). Significance of the interaction terms tested using Bowen (2012).All models include level of education, household adjusted income, household size, country and year fixed effects. Standard errors between parenthesis. APE after bootstrap with 500 replications. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

5.2. Home value to wealth ratio

Next, we turn to examine the effects of a health shock on the ratio of home value to wealth. The first three specifications model residential mobility as exogenous: (i) we use a pooled OLS fixed effects, so that it is comparable to quasi-maximum likelihood (QML) estimates in which the time averages of the explanatory variables; (ii) a pooled Bernouilly QML where the serial dependence is considered as a nuisance that is corrected with the standard errors; (iii) and a fractional probit[36] using generalised estimation equation (GEE; Liang and Zejer, 1986). In contrast in the fourth specification, the change in residence is allowed to be correlated with time-constant individual heterogeneity (although the change in residence is not allowed to respond to idiosyncratic shocks affecting the outcome variable).[37] To ensure that the proposed instruments are exogenous we estimate a pooled OLS regression (with fully robust variance matrix) for the change in residence and its interactions with health shocks. In the specification we consider as regressors the averages of the other explanatory variables, allowing them to be correlated with the individual unobserved effect.[38]

The fractional model is estimated drawing on a control function approach proposed by Papke and Wooldridge (2008). The reduced-form residuals are retrieved from a pooled fractional probit model together with controls and their time averages. It should be noted that the coefficients obtained are scaled and APEs are estimated to compare them with the results of the linear model. Table 4 reports the results of the four estimations considered. For all four specifications, the APEs for age, sex and marital status are very similar: lower for men, higher for widowers and for individuals aged 65–80. However, the coefficients and APEs resulting from the estimation of the fractional model controlling for the endogeneity of health shocks reveal important differences with respect to the other three specifications. Having changed of house is not significant neither in the OLS nor in the fractional model (without IV). However, it turns significant and positive in the fractional probit models (GEE and with IV), increasing the ratio home value to wealth by 22.1pp-25.1pp, respectively.

Concerning health status: (i) having been previously diagnosed with a degenerative mental illness increases the home value to wealth ratio by 19.1pp, by 14.3pp in case of other mental disorders, and by 3.1pp for ADL. However, (ii) new health shocks are associated with an increase in the home value to wealth ratio (degenerative mental illness (19.1pp), ADL (16.9pp), other mental disorders (14.3pp) and non-mental (6.3pp). (iii) The same positive effect is found for health shocks suffered by the spouse or partner. This may be due to an increase in health expenditure at the expense of household savings (money in current accounts, sale of shares or investment funds), thus increasing the share of housing in wealth. However, the interaction between residential mobility and a health shock exhibits a negative effect: −20.7pp for degenerative mental shock, −15.8 for non-mental shock, −10.7pp for other mental disorders and −8.5 for ADL.

5.3. Difference in home value

Results for the difference in home value (1000,000 PPP2012) are reported on columns 1 and 2 of Table 5 . Although when buying a new property, we estimate an increase in the value of the property compared to the old one (17,000 PPP2012), this effect becomes negative after some health shocks, especially after a degenerative mental illness diagnosis (−37,000

[36] The probability of moving increases when the spouse/partner has suffered a degenerative mental illness shock (5.3pp) or ADL shock (4pp), and although age has a negative effect on mobility, the interaction between age and health shock (of the spouse/partner) also has a positive and significant effect.

[37] The linear probability model is very appealing because of its ease of estimation, and it does a good job in estimating the average effects, but on the other hand, it does not guarantee the predictions of the outcome variables (change of residence and home value to wealth ratio). In this sense, Papke and Wooldrige (2008) highlight that the main drawback in Papke's (2005) analysis is the use of a linear probability model with IV for a fractional dependent variable. Finally, taking into account the non-linearity of the underlying relationship is much more crucial when considering the endogeneity of one of the regressors (Papke and Wooldrige, 2008).

[38] In choosing our instruments (heating and cooling days, housing price index, housing price growth rate and number of daughters at home), our identifying assumption is that the home/wealth ratio depends on unobservable heterogeneity in a "smooth fashion".

Table 4
Estimations for home value to wealth ratio.

	OLS. Fixed effects	Fractional probitQAMLE		Fractional probitGEE		Fractional probitPooled GMLE (with IV)	
	Coef	Coef	APE	Coef	APE	Coef	APE
Residential mobility	0.000	0.002	0.000	1.116***	0.221***	1.241***	0.251***
	(0.010)	(0.053)	(0.011)	(0.100)	(0.019)	(0.128)	(0.054)
Before: no mental	0.012***	0.051	0.011	0.053**	0.011**	0.040	0.015
	(0.005)	(0.031)	(0.006)	(0.027)	(0.005)	(0.031)	(0.006)
Before: degenerative mental	0.067***	0.096***	0.102***	0.163***	0.169***	0.238***	0.245***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Baseline: other mental disorders	0.045***	0.054***	0.060***	0.072***	0.086***	0.110***	0.142***
	(0.017)	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
Before: ADL	0.027***	0.131***	0.031***	0.140***	0.031***	0.089**	0.031**
	(0.007)	(0.048)	(0.009)	(0.042)	(0.008)	(0.048)	(0.009)
Shock: no mental	0.026	0.072	0.016	0.120	0.025	0.169***	0.063***
	(0.030)	(0.171)	(0.034)	(0.158)	(0.032)	(0.064)	(0.012)
Shock: degenerative mental	0.109***	0.119***	0.125***	0.143	0.154	0.169***	0.191***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Shock: other mental disorders	0.123***	0.126***	0.122***	0.174***	0.129***	0.206***	0.143***
	(0.039)	(0.039)	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)
Shock: ADL	0.015	0.107	0.024	0.066	0.014	0.212***	0.169***
	(0.014)	(0.073)	(0.015)	(0.067)	(0.013)	(0.071)	(0.069)
Change * Shock(no mental)	−0.014***	−0.051	−0.019	−0.017***	−0.014***	−0.167***	−0.158***
	(0.006)	(0.035)	(0.010)	(0.003)	(0.006)	(0.112)	(0.030)
Change * Shock (degen. mental)	−0.104***	−0.202***	−0.208***	−0.207***	−0.209***	−0.211***	−0197***
	(0.016)	(0.017)	(0.018)	(0.018)	(0.019)	(0.020)	(0.020)
Change * Shock (other mental dis.)	−0.020***	−0.109***	−0.024***	0.155***	−0.134***	−0.128***	−0.107***
	(0.008)	(0.046)	(0.009)	(0.044)	(0.009)	(0.031)	(0.023)
Change * Shock(ADL)	−0.062***	−0.037**	−0.072***	−0.063***	−0.062***	−0.087***	−0.085***
	(0.018)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)	(0.021)
Shock partner: no mental	0.008	0.037	0.008	0.025	0.005	0.148***	0.056***
	(0.009)	(0.049)	(0.010)	(0.045)	(0.009)	(0.060)	(0.010)
Shock partner degenerative mental	0.075***	0.077***	0.078	0.083***	0.084***	0.085***	0.086***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Shock partner: other mental disorders	0.020***	0.018***	0.017	0.017***	0.017***	0.017***	0.017***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Shock partner: ADL	0.020	0.098	0.021	0.114	0.025	0.148	0.078
	(0.031)	(0.192)	(0.039)	(0.180)	(0.036)	(0.083)	(0.036)
Change * Shock partner(no mental)	−0.011	−0.057***	−0.020***	−0.058***	−0.057***	−0.043***	−0.042***
	(0.006)	(0.014)	(0.010)	(0.011)	(0.006)	(0.009)	(0.010)
Change * Shock partner(degen. mental)	−0.051***	−0.059***	−0.064***	−0.070***	−0.076***	−0.082***	−0.089***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Change * Shock partner (other mental dis.)	−0.034***	−0.030***	−0.028***	−0.026***	−0.025***	−0.031***	−0.029***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Change * Shock partner(ADL)	−0.020***	−0.093***	−0.021***	0.093***	−0.022***	−0.104***	−0.037***
	(0.008)	(0.016)	(0.009)	(0.011)	(0.009)	(0.011)	(0.021)
Man	−0.021***	−0.094***	−0.022***	−0.094***	−0.022***	−0.096***	−0.023***
	(0.004)	(0.026)	(0.006)	(0.019)	(0.004)	(0.026)	(0.006)
Age: 55–59	0.000	−0.001	0.000	−0.004	−0.001	−0.013	−0.003
	(0.011)	(0.041)	(0.009)	(0.046)	(0.011)	(0.041)	(0.009)
Age: 60–64	0.007	0.026	0.006	0.036	0.008	0.027	0.006
	(0.010)	(0.045)	(0.010)	(0.044)	(0.010)	(0.044)	(0.010)
Age: 65–59	0.021**	0.080*	0.019	0.097***	0.024***	0.092**	0.022**
	(0.010)	(0.047)	(0.011)	(0.045)	(0.010)	(0.047)	(0.011)
Age: 70–74	0.039***	0.135***	0.039***	0.138***	0.041***	0.139***	0.041***
	(0.010)	(0.048)	(0.011)	(0.047)	(0.011)	(0.047)	(0.011)
Age: 75–79	0.045***	0.144***	0.046***	0.145***	0.047***	0.144***	0.045***
	(0.011)	(0.053)	(0.012)	(0.050)	(0.011)	(0.052)	(0.012)
Age: 80–84	0.041***	0.137***	0.041***	0.142***	0.043***	0.138***	0.041***
	(0.012)	(0.061)	(0.014)	(0.057)	(0.013)	(0.060)	(0.014)
Age: 85+	0.031***	0.106	0.027	0.136**	0.039**	0.123	0.033
	(0.015)	(0.078)	(0.019)	(0.071)	(0.016)	(0.078)	(0.018)
Married	−0.009	−0.047	−0.010	−0.035	−0.007	0.000	0.000
	(0.009)	(0.059)	(0.014)	(0.047)	(0.010)	(0.061)	(0.014)
Separated/divorced	0.025**	0.098	0.023	0.100	0.024	0.109	0.027
	(0.012)	(0.074)	(0.017)	(0.057)	(0.013)	(0.073)	(0.016)
Widow	0.037***	0.143***	0.043***	0.143***	0.042***	0.144***	0.044***
	(0.011)	(0.068)	(0.016)	(0.054)	(0.012)	(0.068)	(0.015)
N	24,732	24,732		24,732		24,732	

Note: Interaction terms computed using Ai and Norton (2003). Significance of the interaction terms tested using Bowen (2012).All models All models include level of education, household adjusted income, household size, country and year fixed effects. Standard errors between parenthesis. APE after bootstrap with 500 replications. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5
Results for the difference in the number of bedrooms.

	Difference in home value (1000,000; PPP2012)		Difference in the number of rooms	
	Panel OLS, FE	GMM (IV)	Panel OLS, FE	GMM (IV)
Purchased new house	0.005***	0.017***	−0.066	0.170**
	(0.002)	(0.003)	(0.070)	(0.074)
Before: no mental	0.001	−0.003	0.000	−0.002
	(0.005)	(0.005)	(0.015)	(0.015)
Before: degenerative mental	0.000	0.006	0.187	0.234
	(0.007)	(0.008)	(0.181)	(0.233)
Baseline: other mental disorders	0.006	0.003	−0.091	−0.070
	(0.007)	(0.008)	(0.065)	(0.071)
Before: ADL	−0.005	−0.012*	0.029	0.033
	(0.006)	(0.007)	(0.022)	(0.023)
Shock: no mental	−0.005	−0.013	0.018	−0.470
	(0.009)	(0.010)	(0.022)	(0.396)
Shock: degenerative mental	0.013*	0.016*	0.662***	0.673***
	(0.007)	(0.008)	(0.263)	(0.268)
Shock: other mental disorders	0.009	0.020	−0.014	−0.012
	(0.024)	(0.032)	(0.101)	(0.102)
Shock: ADL	−0.020	−0.021	0.015	0.046
	(0.037)	(0.054)	(0.026)	(0.082)
Purchased new house * Shock(no mental)	−0.013***	−0.019***	−0.056	−0.157***
	(0.003)	(0.02)	(0.059)	(0.064)
Purchased new house * Shock (degen. mental)	−0.032***	−0.037***	−0.510***	−0.626***
	(0.004)	(0.005)	(0.120)	(0.122)
Purchased new house * Shock (other mental dis.)	−0.008***	−0.010***	−0.318***	−0.319***
	(0.002)	(0.004)	(0.121)	(0.125)
Purchased new house * Shock(ADL)	−0.024***	−0.031***	−0.713***	−1.218***
	(0.009)	(0.010)	(0.122)	(0.084)
Shock partner: no mental	−0.017	−0.033	0.013	0.216
	(0.046)	(0.089)	(0.036)	(0.302)
Shock partner degenerative mental	−0.019	0.038	−0.017	−0.024
	(0.065)	(0.104)	(0.073)	(0.074)
Shock partner: other mental disorders	−0.025	0.035	−0.061	−0.049
	(0.057)	(0.075)	(0.048)	(0.053)
Shock partner: ADL	0.002	0.003	0.004	−0.170
	(0.004)	(0.004)	(0.053)	(0.481)
Purchased new house * Shock partner(no mental)	−0.010***	0.0012***	−0.064	−0.139***
	(0.002)	(0.003)	(0.061)	(0.067)
Purchased new house * Shock partner(degen. mental)	−0.027**	−0.035***	0.536***	0.658***
	(0.008)	(0.007)	(0.080)	(0.084)
Purchased new house * Shock partner (other mental dis.)	−0.010***	−0.014***	−0.190***	−0.198***
	(0.003)	(0.003)	(0.060)	(0.068)
Purchased new house * Shock partner(ADL)	−0.033***	−0.035***	−1.126***	−1.106***
	(0.008)	(0.008)	(0.125)	(0.125)
Man	−0.021**	−0.009	0.002	−0.002
	(0.009)	(0.009)	(0.013)	(0.013)
Age: 55–59	−0.019*	−0.023*	0.006	0.005
	(0.010)	(0.012)	(0.021)	(0.021)
Age: 60–64	−0.021	−0.002	−0.021	−0.022
	(0.013)	(0.022)	(0.021)	(0.021)
Age: 65–59	0.004	0.006	0.012	0.008
	(0.009)	(0.010)	(0.022)	(0.022)
Age: 70–74	0.008	0.018*	0.001	−0.001
	(0.010)	(0.010)	(0.024)	(0.024)
Age: 75–79	0.007	0.011	0.028	0.028
	(0.009)	(0.010)	(0.028)	(0.028)
Age: 80–84	−0.006***	−0.007***	−0.036	−0.037
	(0.001)	(0.001)	(0.035)	(0.035)
Age: 85+	−0.009***	−0.010***	0.035	0.038
	(0.030)	(0.003)	(0.051)	(0.051)
Married	−0.014	−0.021	0.044	0.054
	(0.028)	(0.030)	(0.024)	(0.025)

(*continued on next page*)

Table 5 (*continued*)

	Difference in home value (1000,000; PPP2012)		Difference in the number of rooms	
	Panel OLS, FE	GMM (IV)	Panel OLS, FE	GMM (IV)
Separated/divorced	−0.003	−0.003	−0.027	−0.026
	(0.008)	(0.009)	(0.029)	(0.029)
Widow	−0.008***	−0.010***	−0.067***	−0.067***
	(0.02)	(0.002)	(0.028)	(0.028)
N	24,732	24,732	2135	2135
J-Hansen test (p-value)		0.623		0.566
C-statistic (p-value)		15.127		14.804
IV redundancy test (p-value)		0.220		0.116

Note: Interaction terms computed using Ai and Norton (2003). Significance of the interaction terms tested using Bowen (2012).All models All models include level of education, household adjusted income, household size, country and year fixed effects. Standard errors between parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

PPP2012) and the reporting of an ADL (31,000 PPP2012). However, the worsening of ones health status at baseline is not significant. Finally, we estimate a significant and negative effect among older age cohorts e.g., 80–84, 85+ and for those who are widowed.

5.4. Difference in the number of rooms

Results for the difference between the number of rooms are reported on columns 3 and 4 Table 5. We find that neither the previous health status nor a health shock exert a significant effect. The variable 'having purchased a new residence turns out to be significant in the GMM estimation, although the coefficient is rather small (+0.17 rooms), and its not significant for any of the age cohorts. In contrast, being widowed leads to a reduction in the size of the dwelling (−0.07 rooms), which is of much smaller magnitude compared to the interaction effect of the health shock and the purchase of a new dwelling.

5.5. Predicted effects by type of shock and country

Next, we have computed the effects of health shocks on the different measures of downsizing by country and type of health shock (Table 6). The probability of residential mobility after any health shock is significantly higher in Germany and Sweden compared to the effect of residential mobility without health shocks, and especially for health shocks involving limitations in ADL's. For instance, we estimate that in Denmark, the probability of residential mobility increases by 14.8% after a degenerative mental shock. The situation in Spain is particularly noteworthy, although it exibits the lowest probability of residential mobility without a health shock (3.36%), the opposite is true after a health shock, and it exceeds 12% after a degenerative mental health shock and an ADL shock.

Turning to the effect of health shocks on home value to wealth ratio we find a slight increase after residential mobility and non-health shocks in all countries. In the absence of a health shock, we estimate a very slight increase in the number of rooms, while the opposite is true when a shock occurs. The predicted difference in housing value increases for all countries in the absence of a health shock. However, wafter a health shock, we observe a *very strong decrease i in Denmark and Sweden, and in contrast, an increase in Spain and Italy*. Finally, the largest reduction in the number of rooms corresponds to an ADL shock (−1.6 in Germany, −2.67in Denmark) and in Sweden after a mental shock (−2.9).

Hence, the picture that emerges is that Nordic countries (Denmark and Sweden) meet all definitions of downsizing. In contrast, the Southern European countries (Spain and Italy) do not always = increase their mobility associated after a health shock and exhibit a slight decrease in the size of the new dwelling, but such new dwelling tends to be of higher value, which may be related to the higher propensity to commute to urban centres (see Section 5.7).

5.6. Spatial heterogeneity

In this section we have estimated whether there is any relationship between the incidence of a health shock and moving to more populated municipalities by country and considering the same explanatory variables and specifications. Table B1 reports significant evidence of spatial heterogeneity. Indeed, in Southern countries we estimate an increase in household size after a non-mental illness shock and degenerative mental shock (1.5pp and 1.2pp). In contrast, we find a decrease the household size in Central countries after the onset of other mental disorders (2.9pp) and a non-mental health shock (1.8pp).[39] However, in Southern countries we find an increase in the probability of moving from small village/rural area to

[39] First-stage estimates for the probability of residential change are reported on Table A6. The probability of changing residence increases by 1.5pp. for each heating degree day and decreases by 5.6pp. for each cooling degree day. The effect of the housing price index is significant and positive, although smaller in magnitude. Living in an area where housing prices are increasing decreases the probability of changing residence and each co-resident daughter

Table 6
Predicted outcomes (by country) conditioned on the occurrence of health shocks.

	Predicted prob. change of residence (from Table 3)				
	No shock	Non mental	Degenerative mental illness	Other mental disorders	ADL
Austria	6.515	6.700	4.635	2.396	6.623
Belgium	4.018	3.680	4.387	2.349	3.362
Denmark	7.747	6.924	14.849	6.715	7.254
France	3.888	3.849	5.811	2.536	4.512
Germany	4.225	6.486	8.602	2.435	9.347
Italy	6.311	5.840	7.224	2.550	4.699
Spain	3.362	9.440	13.136	1.428	12.498
Sweden	6.359	6.866	10.682	2.072	9.089
Switzerland	7.050	5.458	8.797	2.409	5.379
	Predicted (difference in home *value to wealth)* · 100 *(from Table* 4) Conditioned on residential mobility				
	No shock	Non mental	Degenerative mental illness	Other mental disorders	ADL
Austria	2.746	−3.310	−11.022	−1.995	−6.551
Belgium	2.267	−6.016	−4.323	−2.482	−2.950
Denmark	1.659	0.880	−5.241	−0.408	−12.093
France	0.080	8.411	−3.763	−2.557	−1.166
Germany	1.100	1.079	−29.736	−29.552	−9.756
Italy	3.302	3.412	1.217	1.134	1.460
Spain	1.230	2.407	3.354	2.139	0.770
Sweden	0.110	−13.353	−19.618	−2.480	−19.290
Switzerland	3.164	3.631	−0.472	−0.461	−1.146
	Predicted difference in home value (PPP 2012)*(from Table* 5) Conditioned on residential mobility				
	No shock	Non mental	Degenerative mental illness	Other mental disorders	ADL
Austria	22.234	−1.458	−3.048	−304	−2.955
Belgium	5.233	−18.077	−18.114	−1.964	−19.203
Denmark	2.786	−119.308	−118.927	−9.098	−119.973
France	23.707	−1.067	−456	−70	−786
Germany	19.203	−2.872	−3.361	−386	−5.233
Italy	23.783	21.982	23.531	1.459	2.371
Spain	119.973	23.792	24.081	536	2.379
Sweden	2.955	−24.883	−23.305	−2.471	−22.234
Switzerland	10.627	−10.422	−10.305	−1.038	−10.627
	Predicted (difference number of rooms)(from Table 5) Conditioned on residential mobility				
	No shock	Non mental	Degenerative mental illness	Other mental disorders	ADL
Austria	0.030	−0.762	−1.124	−0.916	−0.200
Belgium	0.430	−0.120	−0.395	−0.366	−1.124
Denmark	0.650	−0.170	−0.341	−0.319	−2.772
France	0.200	−0.080	−1.000	−0.833	−0.302
Germany	0.310	−3.332	−1.446	−1.118	−1.652
Italy	0.160	−0.424	−0.820	−0.704	−0.050
Spain	0.300	−0.060	−0.364	−0.340	−0.372
Sweden	0.929	−0.506	−2.974	−1.826	−1.620
Switzerland	0.200	−1.471	−0.968	−0.916	−0.330

Source: Own work using waves 1, 2, 4 5 and 6 from SHARE. Using sampling weights.

large town (2.6pp for degenerative mental and 2.99 for ADL shock). In contrast, in Northern countries we find an increase in the probability of moving to a small town/rural area (2.7pp for degenerative mental and 1.8pp after an ADL shock.

5.7. Entry into nursing home

AIP can reduce the likelihood of admission into nursing home (Giles et al., 2007). Hence, as an extension, we have considered the extent to which moving to another residence and suffering a health shock affects the likelihood of entering

in the household decreases the probability of changing residence by 2.7pp. We have performed the same endogeneity test and tests for weak instruments as in previous first-stage estimation. See footnote 11.

a nursing home.[40] We estimate that only 1.27% of the respondents have been temporarily in a nursing home.[41] However, we find that whilst amongst those who have changed residence only 0.62% have been temporarily in a nursing home, such estimates rises to 1.31% amongst those who have not changed residence. Finally, we examine whether moving into a home with home adaptations affects the likelihood of entering a nursing home in the event of a health shock. Table B2 shows the results for the probability of nursing home entry following a similar specifications as before. Results show that: (i) home adaptations decrease the probability of nursing home entry by 1.6pp; (ii) having changed residence in a previous period is not significant, unless combined with having moved to a house with home adaptations, in which case the probability of entry into nursing home decreases by 1. 4pp. Finally, (iii) having suffered a shock increases the probability of nursing home entry (8.4pp for degenerative mental illness and 3.8pp for ADL shock), but the effect is negative when individuals have moved earlier to a dwelling with home adaptations.

6. Conclusion

In this paper we study the persistence of the preference for ageing in place (AIP) which is typically reflective of either inertial preferences, status quo bias or present biasness in making housing choices at old age. We have examined whether housing downsizing defined in different ways is influenced by exposure to different health shocks. Our findings suggest that whilst ageing decreases the probability of residential change, health shocks revertse such effects. More specifically, the onset of degenerative mental illnesses or new limitations in performing activities of daily living (ADL) increase the likelihood of residential mobility, an effect that is greater the older the individual is. This suggest that the magnitude of AIP preferences as a phenomenon depends on the presence o an individual's health or that of their = partners =. Furthemore, the effects are highly heterogeneous across European countries, which suggest that AIP might be more culturally embedded in some parts of Europe than others.

These results carry relevant policy implications, and suggest that in settings where individuals exhibit strong AIP preferences even after a health shock, policy interventions should strengthen the existing links with both physical and social environments that are supposed to promote older person's well-being, including the existing support networks developed throughout their lives. In contrast, when individual's hold a strong preference to 'downsize' after experiencing a health shock, policy interventions should focus on supporting such housing search, to avoid or delay entry into more costly forms of residential or hospital care, and to promote continued independence, and to better manage physical and mental decline. Another welfare effect of downsizing is that it offers wider economic benefits by 'freeing up' larger housing for younger families currently owned or rented by older households, thus creating a more dynamic housing market, and serving other urban policy goals.

Declaration of Competing Interest

None.

Acknowledgments

We are very grateful to the two referees for their insightful comments and to Silvana Robone Cinzia Di Novi, Marcello Montefiori, Rosella Levaggi, Joerg Baten, Rita Santos and the participants of the II APHEC Workshop 'Health and ageing: The Sustainability and Equity Trade off' University of Genova September 2021.We also thank Spain's Ministry of Science, Innovation and Universities (MICINN) and the ERDF for financial support: PID2020–114231RB-I00 and RTI2018–095256-BI00.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2022.10.039.

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[40] This finding may be related to the north-south gradient in care (Bolin et al., 2007, Brandt, 2013; Muir, 2017), which is usually interpreted as arising from supply-side factors, such as the capacity of public bodies, the character of the welfare state and the existence of different attitudes as regards who should bear the responsibility of care (the state or the family). Moreover, for the provision of home care and according to Genet et al. (2012) there seems to be not only a north to south gradient but also a west to east gradient. Countries in the north-west offer a dense network of home care, whereas countries on south-eastern rim of Europe exhibit the weakest care networks in the European Union and care of dependent people mainly relies on informal carers. Therefore, the decrease in household size is justified if another person in the family does not move in with the person who has suffered the health shock.

[41] Previous literature points out that nursing home admission is motivated by a deterioration of the older adult's health beyond the capacity of the family and others to provide sufficient care (McAuley and Usita, 1998; Gaugler et al., 2003).

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