Empirical Economics (2023) 64:33–75
https://doi.org/10.1007/s00181-022-02242-4

Labour supply, retirement, and consumption responses of older Europeans to inheritance receipt

Eduard Suari-Andreu[1,2]

Received: 28 June 2021 / Accepted: 31 March 2022 / Published online: 18 May 2022

Abstract
This study quantifies individuals' responses to inheritance receipt in terms of their retirement, labour supply, and consumption decisions. Doing so is relevant for apprais-ing the potential effects of tax and pension reforms, as well as for the assessment of how inheritances contribute to total wealth and to wealth inequality. I start out by developing a simple version of the life cycle model that explains how individuals trade-off between the different possible responses. I test the model using individual panel data from the Survey on Health, Aging, and Retirement in Europe. These data allow accounting for expectations about inheritances and retirement in the analysis. All estimated effects are not significantly different from zero and they indicate absence of large response in terms of labour supply and retirement.

Keywords Inheritance · Wealth · Retirement · Labour supply · Consumption

JEL Classification D11 · D12 · D14 · D14

1 Introduction

The present study analyses how individuals react to inheritance receipt in terms of their consumption, labour supply and retirement choices. Studying this issue is relevant for two main reasons. First, it has potential implications for any public policy that

The author would like to thank Rob Alessie, Viola Angelini, Stefania Basiglio, Jim Been, Courtney Coile, Marike Knoef, Max van Lent, and Raun van Ooijen as well as participants at the RAND Summer Institute 2018 in Santa Monica, United States, the Reform of Social Legislation Speaker Series 2018 in Leiden, The Netherlands, the NETSPAR Pension Day 2018 in Utrecht, The Netherlands, and the NETSPAR International Pension Workshop 2019 in Leiden, The Netherlands.

✉ Eduard Suari-Andreu
e.suari.andreu@law.leidenuniv.nl

1 Department of Economics, University of Leiden, Leiden, The Netherlands

2 Netspar, Tilburg, The Netherlands

induces changes in wealth such as pension and tax reforms. There is a large literature that exploits diverse sources of variation in wealth to assess the effect of such policy reforms (e.g. Imbens et al. 2001; Coile and Levine 2006; Cesarini et al. 2015). The case of inheritances is particularly interesting since taking into account how they affect labour supply and/or consumption can help optimally calibrate estate taxation. Second, it has implications for the literature estimating the contribution of inheritances to wealth accumulation and wealth inequality (e.g. Wolff 2002; Brown and Weisbenner 2004; Boserup et al. 2016). This literature largely assumes that individuals fully save inheritances and gifts. To the extent that inheritances are spent by increasing consumption and/or reducing work effort, ignoring these effects may bias both the estimate of their share of total wealth and of their effect on wealth inequality.

Most literature studying the effects of inheritance receipt has so far focused on labour supply responses (e.g. Joulfaian and Wilhelm 1994; Sila and Sousa 2014; Bø et al. 2019; Doorley and Pestel 2020). In the present study I employ an empirical strategy based on Brown et al. (2010) and Eder (2016) which I ground on a more holistic approach by focusing on how individuals trade-off between multiple possible responses to inheritance receipt. To that end, I start by constructing a formal life-cycle model based on Blundell and MaCurdy (1999) in which a representative individual makes decisions about consumption, leisure, and retirement. Following Joulfaian (2006) and Eder (2016), I introduce an inheritance as a transitory shock to lifetime income and study how the individual responds.[1] I show that if the inheritance is unexpected and large enough it will have an effect upon receipt. According to her preference for consumption *vis-à-vis* leisure and retirement, the individual will trade-off the different possible responses the model considers.

To test the implications of the model I follow Eder (2016) in employing data from the Survey on Health, Ageing and Retirement in Europe (SHARE). The SHARE is a panel survey following European individuals aged 50 plus over biennial waves since 2004. I exploit the panel structure of the survey by using waves one to six and I include only the ten countries that are present in all waves I use.[2] The SHARE contains information on a variety of aspects of household's behaviour. Most importantly, it contains information on inheritances and gifts received by respondents. The latter are asked whether they (or their spouse) have received an inheritance or gift of five thousand Euros or more in the past, from whom they received it, and when. Due to the formulation of the question it is not possible to distinguish between inheritances and gifts.[3] Furthermore, the SHARE provides information on labour market status, hours worked, and consumption, which allows generating the dependent variables of interest. Regarding consumption, the SHARE provides consistently over all waves only information on food consumption. Given this limitation, I follow Joulfaian and Wilhelm (1994) and assume that food expenditures provide a reasonable representation of the total level of consumption of

[1] Joulfaian (2006) considers a very simple framework assuming exogenous labour supply, while Eder (2016) constructs a model in which individuals can only react to inheritance receipt by changing their retirement age.

[2] The third wave is excluded since it focuses on people's life histories and does not contain information on most of the variables used in the analysis.

[3] A question on the monetary amount of the inheritances or gifts received is present in waves one and two but has been dropped since. For this reason, I do not use this information in this study.

non-durables of a household. By using consumption, labour supply, and retirement as outcome variables for waves one to six of the SHARE I expand the previous work by Eder (2016), who uses waves one and four to investigate the effects of inheritance receipt using only retirement as an outcome.

The empirical strategy I employ closely relies on the work by Brown et al. (2010). The latter use the Health and Retirement Study (HRS) and apply a reduced form approach to investigate whether individuals respond to inheritance receipt by retiring earlier than expected. In general, the literature investigating the effect of inheritances is not able to clearly distinguish between expected and unexpected inheritances, which is a crucial aspect to take into account when identifying their effect on life-cycle choices. Using a question in the HRS about inheritance expectations, Brown et al. (2010) classify an inheritance as unexpected if the recipient previously reported a zero chance of receiving an inheritance in the near future. On the contrary, they classify it as expected if the previously reported chance of receiving an inheritance is above zero.[4] The SHARE provides information on inheritance expectations, which allows me to follow this same strategy. Furthermore, I introduce a new measure that takes into account the continuous nature of inheritance expectations.

To study the effect of inheritances on retirement, I derive a reduced form equation from the theoretical model which I estimate using a binary choice model. Taking into account retirement expectations is a key element in this analysis. That is because if inheritance receipt correlates with taste for retirement, individuals may go for an early retirement soon after inheriting simply because they already planned it regardless of the inheritance. To solve this issue, I follow Brown et al. (2010) and study whether unexpected inheritance receipt has an effect not only on retiring, but on retiring earlier than expected. This approach hinges on the assumption that unobserved heterogeneity in preference for early retirement is fully captured by the expected retirement age. Closely relying on the theoretical model, I set up two additional specifications to estimate the effect of inheritance receipt on the wave-to-wave changes in consumption and the intensive margin of labour supply. In this case individual unobserved heterogeneity is taken into account by taking first differences.

This study contributes to the literature in two major ways. First, by thoroughly examining both theoretically and empirically the effects of inheritance receipt on three different outcome variables: consumption, leisure, and retirement. This approach allows a mapping of the trade-offs individuals face when experimenting a transitory shock to their lifetime income. Within this framework I study how individuals solve these trade-offs according to their preferences, which provides a solid background for an empirical analysis with multiple outcome variables. Second, this study contributes to the literature by providing a detailed empirical analysis of the responses to inheritance receipt using a long European panel. Most studies using micro data focus on a particular country which often compromises the external validity of results somewhat.

[4] There are at least two alternative strategies to identify unexpected inheritances that have been used in the literature. First, i.e. Andersen and Nielsen (2010), Elinder et al. (2018), and Druedahl and Martinello (2020) identify unexpected inheritances by employing administrative data on cause of death and classifying as unexpected those inheritances that result from unexpected deaths. Second, Nekoei and Seim (2021) compare individuals who inherit in a given year with others who inherit slightly later thus exploiting random variation in the exact timing of parental death.

For this reason, it is important to have studies addressing empirical questions using micro data at a multi-country level. As mentioned above, Eder (2016) has previously studied the effect of inheritance receipt on retirement using SHARE data. However, he only uses waves one and four and only considers retirement as an outcome variable, thus not taking into account that individuals can also respond to inheritance receipt by lowering their working hours and/or increasing consumption. In addition, by examining the effect of inheriting between waves one and four on the probability of being retired at wave four, Eder (2016) does not exploit information provided in wave two, thus ignoring the fact that individuals might receive an inheritance between waves two and four while already having retired by wave two.

The results of the present study show that estimated effects of inheritance receipt are in all cases not significantly different from zero. The precision of the estimates allows ruling out any substantially large effects on retirement and on the intensive margin of labour supply. These results imply that the findings by Brown et al. (2010), who conclude that inheritance receipt increases chances of retiring by around 5%, cannot be clearly rejected using the SHARE. However, they are compatible with most of the literature on labour supply effects of inheritance receipt, since the latter usually reports effects that are either small or not significantly different from zero (e.g. Joulfaian and Wilhelm 1994; Sila and Sousa 2014; Bø et al. 2019). Regarding the consumption analysis, more research needs to be done since, due to large standard errors, I cannot rule out large responses that could be relevant. Intuitively, there could be larger responses in consumption, since labour supply and retirement decisions are usually restricted by labour market and social security regulations, while consumption is more discretionary. The availability of data solely on food consumption is an important limitation since this category is less likely to be affected by sudden changes in wealth compared to other less essential products.

The reminder of the paper is structured as follows. Section 2 reviews the related literature and gives a broader motivation for the study. Section 3 describes the empirical strategy that derives from the theoretical model provided "Appendix D". Section 4 describes de data. Section 5 presents de results. Section 6 concludes and discusses different possible explanations for the results that I find and the venues for future research. The appendices provide variable definitions, summary statistics, full regression results, additional results of the empirical analysis, and the theoretical model.

2 Related literature

Studying behavioural responses to inheritance receipt has relevant implications for several strands of the economic literature. First of all, it is of relevance for the literature estimating wealth effects. This literature aims at finding evidence that can be used to asses policies that induce changes in wealth such as pension and tax reforms. The main challenge is that changes in wealth are generally, in some way or another, endogenously related to the behavioural response of interest. Therefore, this literature tends to exploit exogenous sources of wealth variation. For instance: unanticipated policy changes that affect social security wealth (Krueger and Pischke 1992), stock market fluctuations (Coile and Levine 2006; McFall 2011), lottery winnings (Imbens et al. 2001; Cesarini et al. 2015), and tax rebates (Parker et al. 2013). Next to this sources of variation in wealth, inheritances, as long as they are unexpected, provide an additional possibility to study responses to exogenous wealth shocks. The case of inheritances is in particular interesting since, besides providing information to assess policies affecting household wealth, understanding their effect can help optimally calibrate estate taxation.

In addition, behavioural responses to inheritance receipt are of relevance for the literature studying the contribution of inheritances and inter-vivos transfers to wealth accumulation (Modigliani 1988; Kotlikoff 1988; Gale and Scholz 1994; Brown and Weisbenner 2004; Piketty and Zucman 2014) and wealth inequality (Wolff 2002; Boserup et al. 2016; Elinder et al. 2018; Karagiannaki 2017; and Nekoei and Seim 2021). These strands of literature largely assume that individuals fully save inheritances and gifts, thus the share of transfer wealth is typically estimated as the capitalized total value of inheritances and gifts received in the past divided by total wealth. In case inheritances increase consumption and/or reduce work effort, ignoring this effect may bias upwards the estimates of their share of total wealth (Blinder 1988). Furthermore, if the effect is conditional on pre-inheritance wealth it will also determine how inheritances affect wealth inequality (Elinder et al. 2018; Nekoei and Seim 2021).

Previous literature investigating responses to inheriting has mostly focused on labour supply effects. In two early contributions, Holtz-Eakin et al. (1993) and Joulfaian and Wilhelm (1994) use US administrative data and find a strong negative effect of receiving a large inheritance on labour force participation and a weaker effect on hours worked. Other studies using administrative tax data and/or survey data have followed, with a fast growing literature during the last decade (Elinder et al. 2012; Sila and Sousa 2014; Bø et al. 2019; Doorley and Pestel 2020). While most of these studies focus on labour supply measures such as hours worked and labour force participation, a recent sub-trend in this literature pays specific attention to the effect of inheritances on retirement (Brown et al. 2010; Eder 2016; Garbinti and Georges-Kot 2016). Overall, the existing literature suggests that there is a negative effect, albeit small, of receiving an inheritance on labour supply. Using the same data I employ in this study, i.e. SHARE, and exploiting changes between waves one and four, Eder (2016) finds a mildly significant increase of about eight percentage points in the probability of retirement as a result of receiving an inheritance.

Parallel to the literature on labour supply responses, there are a few studies investigating the effect of inheritances on consumption. Joulfaian (2006) uses US administrative data and finds that the year right after inheriting wealth of heirs increases by less than the inherited amount, suggesting that part of the inheritance is spent right away. Elinder et al. (2018) use Swedish administrative data and find a similar result. They find that those with the lowest level of pre-inheritance wealth spend a higher share of the inheritance compared to those at the top of the wealth distribution. Following a similar strategy, Karagiannaki (2017) uses UK survey data and finds that, after ten years of inheriting, heirs spend on average about a third of the amount received. Druedahl and Martinello (2020) study the effects of unexpected inheritance due to sudden death using Danish administrative data and find that only one third of inherited wealth is left after nine years. In line with Elinder et al. (2018), they find that depletion takes place faster when considering financial wealth compared to when considering non-financial wealth. Nekoei and Seim (2021) exploit random variation in the timing of parental death and find that the average heir depletes her inheritance within a decade while inheritances of wealthy hairs remain intact. Differently from Elinder et al. (2018), they find that this divergence is not due to different consumption patterns but to differences in rates of return on wealth.

Besides the literature studying labour supply and consumption responses to inheriting, there are additional streams of literature studying the effects on entrepreneurship (Holtz-Eakin et al. 1994; Hurst and Lusardi 2004), stock market participation (Andersen and Nielsen 2010) and bequest giving (Cox and Stark 2005; Stark and Nicinska 2015). These are potentially important responses that should also be taken into account to fully understand how individuals react to the receipt of an inheritance. However, they are beyond the scope of the present paper.

3 Empirical strategy

The empirical analysis is grounded on a stylized theoretical model which I base on Blundell and MaCurdy (1999). The main difference with respect to Blundell and MaCurdy (1999) is that I introduce retirement as a choice variable. The latter is introduced following the tradition of the option value models in the spirit of Stock and Wise (1990). Within this theoretical setting, I study the consequences of the receipt of a fully expected inheritance and a fully unexpected inheritance. I consider only inheritances received while individuals are not yet retired and employed in the labour market and I assume retirement to be an absorbing state. This allows focusing on the trade-offs between consumption, labour supply, and retirement responses.[5] In this way, I build on Joulfaian (2006), who considers the effect of inheritances on consumption assuming exogenous labour supply, and Eder (2016), who constructs a model in which individuals can only react to inheritance receipt by changing their retirement age. For a detailed explanation of the model and its implications, see "Appendix D".

To test the implications of the model I rely on a mixed approach consisting of an empirical approximation to Eqs. (D.9) and (D.10) for the labour supply and consumption response, and a reduced form equation for the retirement response. In this section I lay out the specifications that result from this approach and which I use to produce the results presented in Sect. 5.

3.1 Specification 1: consumption and labour supply

The empirical approximation to Eqs. (D.9) and (D.10) in the model relies on the previous work by Banks et al. (1998) and Attanasio et al. (1999) who lay out the foundations for the empirical estimation of Euler equations. To estimate the effect of inheritance receipt on consumption I set up the regression equation

[5] In this framework, inheritance receipt at or after retirement could only have an effect on consumption. Including this possibility would make the problem more complicated since, as shown by the literature on the retirement-consumption puzzle (e.g. Banks et al. 1998), retirement has usually substantial effects on consumption that should be included in the model when studying inheritance receipt at or after retirement.

$$\Delta \ln c_{it} = \beta_0 + \beta_1 inherit_{it} + \boldsymbol{\iota}_{it}'\boldsymbol{\beta}_2 + \Delta\mathbf{Z}_{it}'\boldsymbol{\beta}_3 + \boldsymbol{\xi}_{it}'\boldsymbol{\beta}_4 + \epsilon_{it}, \tag{1}$$

where the constant term captures the average rate of time preference, $inherit_{it}$ is a dummy that takes value one if the individual receives an unexpected inheritance between waves t and $t-1$, $\boldsymbol{\iota}_{it}$ is a vector containing a set of variables that proxy for the features of the forecast error in Eq. (D.8), i.e. the inverse hyperbolic sine of household net worth at period $t-1$, education, age, and subjective survival probabilities, $\Delta\mathbf{Z}_{it}$ contains changes in marital status, household structure and health status, $\boldsymbol{\xi}_{it}$ is a vector of wave and country dummies which captures changes in the interest rate over time and across countries as well as other possible country- and/or time-specific effects, and ϵ_{it} is an error term capturing changes in unobserved taste shifters and individual-specific deviations from the average rate of time preference. I assume that, except for the inheritance receipt, all changes between t and $t-1$ are expected and thus ϵ_{it} does not contain an expectational error.[6] Expressing Eq. (1) in first differences has the advantage that any individual fixed effect related to demographics and taste for leisure is cancelled out.

Note that the assumption of separability between consumption and leisure excludes the change in the wage rate from Eq. (1). However, as long as inheritance receipt is not correlated with the change in the wage rate, including or excluding the latter in Eq. (1) will not have an effect on the estimate of β_1. Non-separability between consumption and leisure would also imply an effect on consumption of transitions to unemployment or retirement. However, I abstract from these transitions here and focus only on the effect of inheritance receipt on employed individuals. As I explain in Sect. 4 below, the data on consumption are given at the household level. Therefore I estimate Eq. (1) for singles and couples separately.[7] When performing the couples estimation, all individual level variables are included for both members in the couple.

Regarding the effect of inheritance receipt on the intensive margin of labour supply, I rely on Eq. (D.10) and on the fact that an increase (decrease) in hours of leisure implies and equal decrease (increase) in hours of work. Therefore, I use a specification that expresses the change in log hours worked, i.e. $\Delta \ln h_{it}$, as a function of the same independent variables as in Eq. (1). I exclude the change in the hourly wage rate since the data at hand do not allow to measure this variable. Furthermore, the same reason to excuse its inclusion in the consumption specification applies to the hours worked specification. $\Delta \ln h_{it}$ captures changes only along the intensive margin of labour supply and thus excludes transitions to retirement or any other labour market status.

As mentioned above, the error term in Eq. (1) captures changes in unobserved taste shifters and individual-specific deviations from the average rate of time preference. The latter can be treated as a random effect or as a fixed effect. For all estimations I run using consumption or hours of work, the Hausman test fails to reject the null hypothesis of a random effect. Therefore, I assume each individual deviates from the average rate of time preference in a random way. Assuming as well that changes

[6] In practice there can be unexpected changes in other variables that also affect consumption. However, as long as they are not correlated with inheritance receipt, they do not interfere with the estimation of β_1.

[7] For the predictions of the model to apply to the analysis for couples I adopt the unitary assumption and thus refrain from writing a model with collective decision making

in taste shifters (observed and unobserved) are fully expected and uncorrelated with inheritance receipt, I impose strict exogeneity and apply a random effects estimator.

3.2 Specification 2: retirement

The reduced form strategy I employ to estimate the retirement effect closely follows the approach by Brown et al. (2010). Consider Eq. (D.11) from the theoretical model, which provides an expression for the utility difference between retirement and continued work denoted as G_{it}. I assume the distribution of G_{it} can be approximated by a linear and additive function of observable characteristics plus an error term such that

$$G_{it} = \gamma_0 + \gamma_1 inherit_{it} + \mathbf{X}'_{it}\boldsymbol{\gamma}_2 + \boldsymbol{\xi}'_{it}\boldsymbol{\gamma}_3 + u_{it}, \tag{2}$$

where vector $\mathbf{X}_{it}$ contains a set of set of demographic variables: age, gender, marital status at $t-1$, age of the partner, educational level, presence of children, presence of grandchildren, parental death between t and $t-1$, and health status at $t-1$; and economic variables: household income and wealth at wave $t-1$, present value of future retirement income at $t-1$, sector of employment at $t-1$ (public, private or self-employed), type of occupation at wave one, and a dummy indicating whether the household already received an inheritance or gift before wave one.[8]

According to the theoretical model, an individual who is employed will keep on working if $G_{it} > 0$ and will retire if $G_{it} \leq 0$. This decision can thus be studied using a binary choice model of the type

$$\Pr(retire_{it} = 1 | inherit_{it}, \mathbf{X}_{it}, \boldsymbol{\xi}_{it}) = \mathrm{F}(\gamma_0 + \gamma_1 inherit_{it} + \mathbf{X}'_{it}\boldsymbol{\gamma}_2 + \boldsymbol{\xi}'_{it}\boldsymbol{\gamma}_3), \tag{3}$$

where $\mathrm{F}(\cdot)$ is the cumulative distribution function (cdf) of $-u_{it}$. If the distribution of $-u_{it}$ is symmetric, $\mathrm{F}(\cdot)$ is also the cdf of u_{it}. In this type of models, the economic literature commonly assumes two alternatives for the distribution of u_{it}, *i.e* the standard normal cdf, which results in the probit model and the standard logistic cdf leading to the logit model. Both provide essentially the same results in this analysis thus I report only the results of the probit specification.

4 Data and descriptive statistics

To estimate the equations in Sect. 3 I use data from the Survey on Health Ageing and Retirement in Europe (SHARE). The SHARE is a cross-national panel survey that provides detailed information on respondents' labour supply, health, finances, family relations, and socio-economic status. It targets people aged 50 and older and their spouses/partners independent of age. The survey is conducted every two years on average and I use waves one to six, which run from 2004 until 2015. The third wave

[8] The choice of variables to be included in the vector $\mathbf{X}_{it}$ closely follows Brown et al. (2010). Their reasoning behind th inclusion of a variable capturing parental death between t and $t-1$ is to control for any direct effect of the death of a parent that does not take place through the receipt of an inheritance.

is excluded from the sample because it focuses on people's life histories and does not contain information on most of the variables used in this analysis.

Interviews have been conducted in twenty-one European countries, out of which I include in the analysis only the ten countries present in all waves, i.e. Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, and Switzerland. Out of all respondents in these countries, I select those who are employed in wave one and are observed at least until they retire. This selection leaves me with 3093 individuals who live in 2604 households. Since the consumption and hours worked analyses are conducted conditional on not being retired, I start out this section by laying out the empirical definitions of retirement that I employ. These are followed by a description of the data used to measure consumption, labour supply, and inheritances received. The samples used for each of the analyses are summarized in Table 8 of "Appendix A". The same appendix provides definitions for all variables employed in the analyses, and summary statistics for the most relevant variables.

4.1 Retirement

The initially selected 3093 individuals are employed (or self-employed) in wave one. From wave two they may transit to any of the other possible labour market statuses considered by the SHARE: *retired*, *unemployed*, *disabled*, *homemaker*, and *other*. As a first measure of retirement, I create a dummy variable that takes value one if since the previous wave an individual transits from any other labour market status to *retired* and zero otherwise. Therefore, on their path from employment to retirement individuals may transit through any of the other possible labour market statuses. Once an individual transitions to retirement, she is dropped from the sample in further waves.[9] I call this measure *narrow retirement* since it does not consider any path towards retirement other than a transition to job status *retired*. Panel (a) of Table 1 shows the total number and share of individuals who retire in every wave under this definition. The yearly flow of new retirees results in a total of 75.85% of all initially selected individuals retiring at some point during the sample period.[10]

The transition matrix in Table 2 shows that individuals follow different trajectories when transiting from employment to retirement. Even though the most common path consists in transiting directly from employment to retirement, there are a considerable number of individuals that transit through other labour market statuses before retiring. This evidence suggests that individuals may use unemployment and disability benefits as alternatives for early retirement, and that transition to *homemaker* may imply a definitive exit from the labour force. Therefore, I generate a broader measure of retirement consisting in a dummy that takes value one if the individual transits from her initial status (either *employed* or *self-employed*) to any of the other possible labour

[9] In the theoretical model I assume that retirement is an absorbing state. However, in the data there are 115 individuals who still experience a labour market status transition after they retire. For the sake of simplicity, I ignore these transitions.

[10] Narrow retirement can alternatively be defined by selecting only individuals who transit directly from (self)employment to retirement. This selection implies excluding 450 individuals from the sample who transit through another labour market status between (self)employment and retirement. When using this alternative definition the empirical results do not change significantly.

Table 1 Retirement by wave of the SHARE

	Wave					Total
	One	Two	Four	Five	Six	
(a) Narrow retirement						
Not retired	3093	2402	1436	1063	747	747
Retired	0	691	966	373	316	2346
Total	3093	3093	2402	1436	1063	
Share retired	0.00%	22.34%	31.23%	12.05%	10.21%	75.85%
(b) Broad retirement						
Not retired	3093	2183	1226	847	558	558
Retired	0	910	957	379	289	2535
Total	3093	3093	2183	1226	847	
Share retired	0.00%	29.42%	30.94%	12.25%	9.34%	81.96%
(c) Retired before expected						
Not retired	2663	2521	1903	1237	956	956
Retired	0	142	228	78	55	503
Total	2663	2663	2131	1315	1011	
Share retired	0.00%	5.33%	8.56%	2.93%	2.06%	18.88%

Individuals are selected conditional on being *employed* or *self-employed* in wave one. Under *narrow retirement*, individuals may transit through status *unemployed*, *disabled* or *homemaker* before transiting towards *retired*. Under *broad retirement*, transitions from employment to any other labour market status is considered as retirement. In all cases individuals exit the sample after having transited to retirement. *Retired before expected* is based on *narrow retirement*. Due to missing or inaccurate information 430 individuals are lost when computing *retired before expected*. See main text for more details on the computation of *retired before expected*. The share of retired individuals refers in all cases to the share of individuals who retire in each wave out of the initial sample

market statuses. Just like with the narrower measure of retirement, I drop individuals from the sample once they are considered to be retired. Panel (b) of Table 1 shows that under this definition 81.96% of all initially selected individuals end up retiring at some point during the sample period.

At the end of Sect. D.3 in the model I argue that what matters is not whether individuals retire after receiving an inheritance, but whether they retire before they expected previous to the receipt if the inheritance. Not taking this issue into account will result in a spurious correlation between retirement and inheritance receipt if the latter is associated with a special taste for retirement. In terms of the theoretical model, this would be implied by a cross-sectional correlation between I_n and ϕ. If that is the case, inheritors may retire early or later than non-inheritors simply because of a special taste for retirement that is already determined before the receipt of an unexpected inheritance. To tackle this issue I follow the strategy of Brown et al. (2010) who use retirement expectations reported by HRS respondents. They generate a dummy that takes value one if an individual retires before expected and zero otherwise. This approach relies on the assumption that taste for retirement is fully captured by the expected retirement age.

Table 2 Labour market status transition matrix

Lagged l.m. status	Labour market status							Total
	Retired	Employed	Self-emp.	Unemp.	Disabled	Homemaker	Other	
Employed	1796	4018	73	168	81	67	70	6273
	28.63%	64.05%	1.16%	2.68%	1.29%	1.07%	1.12%	100%
Self-emp.	307	71	712	20	14	32	14	1170
	26.24%	6.07%	60.85%	1.71%	1.20%	2.74%	1.20%	100%
Unemp.	96	37	3	68	5	4	4	217
	44.24%	17.05%	1.38%	31.34%	2.30%	1.84%	1.84%	100%
Disabled	51	9	0	3	61	1	1	126
	40.48%	7.14%	0.00%	2.38%	48.41%	0.79%	0.79%	100%
Homemaker	48	10	5	4	2	57	2	128
	37.50%	7.81%	3.91%	3.13%	1.56%	44.53%	1.56%	100%
Other	48	13	4	2	2	3	8	80
	60.00%	16.25%	5.00%	2.50%	2.50%	3.75%	10.00%	100%
Total	2346	4158	797	265	165	164	99	7994
	29.35%	52.01%	9.97%	3.31%	2.06%	2.05%	1.24%	100%

I assume retirement to be an absorbing state. Therefore, labour market status *retired* does not appear as a possible lagged labour market status. There are however 115 individuals (5% of those who retire at some point during the sample period) who still experience a labour market status transition after they retire. Out of these, only 65 transit from *retired* to *employed* or *self-employed*. For the sake of simplicity, I ignore these transitions

The SHARE offers the possibility to apply the strategy by Brown et al. (2010) since respondents are asked about the age at which they expect to collect each of the pensions they are entitled to. For each individual, I take the youngest out of all the ages of collection provided, and generate an additional retirement variable that takes value one if the age of retirement is lower than the expectation as of wave one, and zero otherwise. Since SHARE respondents provide the age at which they transfer into retirement but not the age at which they transfer from employment to other labour market statuses, I use the narrow definition of retirement to measure whether someone retired before expected. Due to inaccuracies in the data on the age of retirement and/or the pension collection age I lose 430 individuals. As shown in Panel (c) of Table 1, out of all individuals selected, 503 (18.88%) retire before they expected, which is considerably less compared to the other definitions of retirement.

4.2 Consumption

The SHARE provides information on total expenditures, as well as on expenditures in two specific categories, i.e. telephone and food. All expenditures are given at the household level and refer to a typical month out of the last twelve months preceding the interview. Total and telephone expenditures are not provided for all waves thus I use only the information on food consumption. The latter includes food consumption both inside and outside of the household. Following Joulfaian and Wilhelm (1994), I assume that, to a certain extent, food expenditures are a good representation of total household expenditures in non-durable goods, and that, as long as inheritances and gifts are not fully saved or dedicated to the purchase of a particular item, they are likely affect food consumption along with other expenditure categories that I cannot capture.

Since the consumption data are given at the household level, I divide households between singles and couples. The 3093 individuals who form my initial sample live in 2604 households, which keep in the consumption analysis as long as they are not retired yet. I consider a household composed by a couple to be retired once one of the two members in the couple retires. For this selection I use the broad definition of retirement. After excluding those household who experience marital transitions and those who are already retired by wave two I am left with a sample of 431 singles and 1317 couples. Out of which, there are 39 singles and 561 couples with missing information on consumption for at least one wave. To prevent loss of observations, I use the imputed consumption data provided by the SHARE. The SHARE uses a multiple imputation technique that generates five values for each household-wave unit, which are computed following the methodology explained by Christelis (201). Figure 2 shows distributions of the wave-to-wave change in the logarithm of food consumption for singles and for couples. Both distributions are to a large extent symmetric around zero, which is always the most popular value.

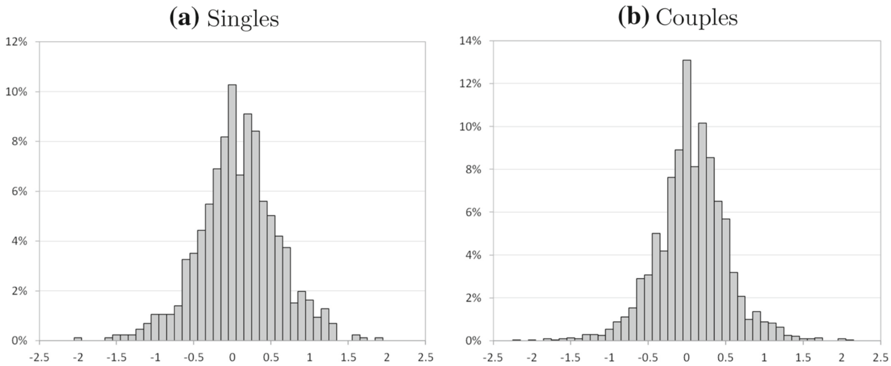

Fig. 1 Sample distribution of change in log food consumption. *Notes:* Out of the initially selected 2604 households, 789 are dropped because they are retired by wave two, and 67 are dropped because they experience a marital transition, which results in a sample of 431 singles and 1317 couples. To construct the histograms, I take the average of the five imputations for each household-wave unit. All waves are pooled together which results in 935 household-wave observations for singles and 2589 household-wave observations for couples

4.3 Labour supply

The SHARE asks individuals how many weekly hours are stipulated in their working contract and how many hours they actually work in a typical week. The question on contracted hours is not present in all waves hence I use only the measure based on actual hours. For this analysis I take the initially selected 3093 individuals and compute wave-to-wave changes in the logarithm of hours worked. Since the focus is here on the intensive margin of labour supply, I compute wave-to-wave changes as long as individuals are not retired. For this selection, I follow again the broad definition of retirement, which ensures individuals who are in the sample do not experience labour market transitions.

After excluding individuals who already retired by wave two, and thus for whom I cannot compute any wave-to-wave changes in labour supply, and excluding individuals with missing information on hours worked for at least one wave I am left with a sample of 2082 individuals who live in 1764 households. Panel (a) of Fig. 1 provides the distribution of the logarithm of weekly worked hours pooling all waves together. The distribution shows a clear peak at the value corresponding to forty hours per week. Panel (b) provides the distribution of the corresponding wave-to-wave change which appears to be fairly symmetric around zero.

4.4 Inheritances and gifts received

The SHARE provides information on inheritances and gifts received larger than five thousand Euros. The exact question is: "[Since the last wave] Have you or your husband/wife/partner received a gift or inherited money, goods, or property worth more than 5000 Euros?". Therefore, due to question design it is not possible to distinguish inheritances from gifts. However, for the age range targeted by the SHARE it is very

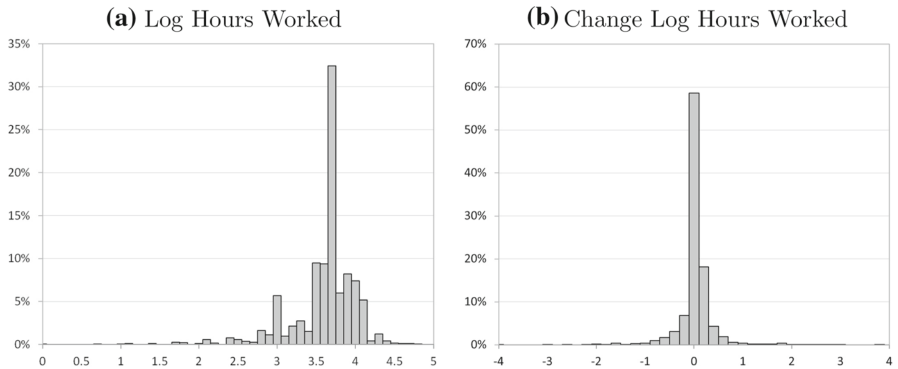

Fig. 2 Sample distributions of level and change in log hours worked. *Notes:* The sample is composed by the initially selected 3093 individuals minus those who retire in wave two according to the broad definition (910), those with missing information on hours worked (48), and those who at some point report zero worked hours in a typical week even though they report to be employed (53). Both figures include thus observations corresponding to 2082 individuals followed over the six waves of SHARE (third wave excluded) resulting in 6673 wave-individual observations in Panel (a) and 4591 in Panel (b)

likely that the large majority of cases of receipt correspond to an inheritance.[11] The survey also provides information on the year of receipt, the amount received, and from whom the inheritance or gift was received. The amount is only available for inheritances and gifts received before wave one and between waves one and two.[12] Since the empirical analysis requires information before and after the receipt of an inheritance, only the information on amounts received between waves one and two could be used. Since this would imply using a rather small sample, I do not use information on amounts received in the empirical analysis. Furthermore, all information on inheritances and gifts is given at the household level. It is thus not possible to identify who is the legal heir within a household if it is formed by more than one person.

Considering the initial sample of 3093 individuals, 26.32% of them (814 individuals) live in a household that receives at least one inheritance or gift between wave one and wave six while not being retired.[13] I use this information to generate a variable that takes value one if an individual belongs to a household that receives an inheritance or gift since the previous wave.[14] Out of all inheritances and gifts reported, 66.21% come from parents, 9.79% from partners, 4.77% from siblings, 7.73% from uncles and aunts and 2.42% from children. As indicated by the theoretical model, it is crucial to know whether inheritances are expected or unexpected. The SHARE offers an inter-

11 For this reason I often refer to inheritances and gifts as just inheritances in the remaining of the document.

12 For inheritances and gifts received before wave one there is no information on how long before the first wave these were received.

13 All summary statistics on inheritance and gifts reported in this section refer to the initial sample of 3093 individuals. The summary statistics for the samples used in the labour supply and consumption analyses (which are essentially sub-samples of that initial sample) are, to a very large extent, similar to the ones reported here and are not reported in this document for economy of space.

14 There are 71 individuals for whom information on inheritance receipt is missing for one wave and five individuals for whom it is missing for two waves. I keep these individuals in the sample and generate an additional value for the inheritance receipt variable indicating a missing value.

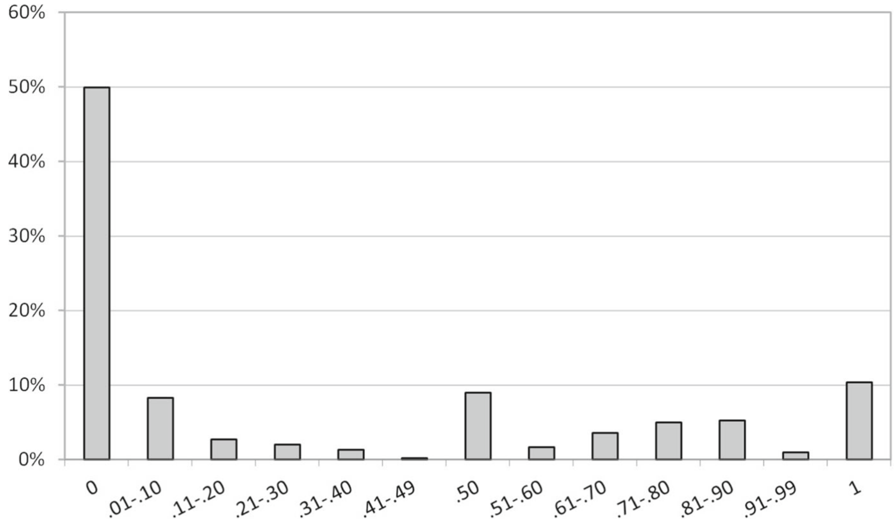

Fig. 3 Probability of receiving an inheritance during the next 10 years. *Notes:* Probabilities are measured in wave one and refer to 3041 out of the 3093 initial selected individuals since 52 observations are lost due to non-response of the question on inheritance expectations in the SHARE

esting possibility to take this into account since it asks respondents about the chance of receiving an inheritance within the next ten years. Figure 3 reports the probability of receiving an inheritance in the next ten years as reported in wave one by initial sample of 3093 individuals. I lose 52 individuals due to missing information on expected inheritances, hence Fig. 3 provides information on 3041 individuals. The distribution looks very similar to the one reported by Brown et al. (2010) using the HRS. It shows that about 50% of individuals report zero chance of receiving an inheritance, with 0.50 and one being the next most common answers.

Table 3 reports the correlation between self-reported probability of receiving an inheritance in wave one and actual receipt of an inheritance or gift while being in the sample. Out of those individuals who report zero chance of receiving an inheritance, 12.57% do receive an inheritance or gift afterwards. These are the ones that are truly surprised by the receipt. For probabilities above zero, the share of individuals who receive a gift or inheritance increases with the self-reported probability. For those who report absolute certainty, 54.30% receive an inheritance or gift during the sample period. A slightly stronger correlation is observed when considering the probability of receiving an inheritance larger than fifty thousand Euros. Table 3 suggests that self-reported probabilities of receiving an inheritance are a useful predictor of actual receipt.[15] However, there is still enough miss-match between expectation and receipt to be able to distinguish between expected and unexpected inheritances.

Following Brown et al. (2010), I consider an inheritance received at any point between waves one and six to be unexpected if at wave one the respondent declared a

[15] The correlation I find is very similar to the one reported by Brown et al. (2010) using HRS. In their data, they can distinguish between inheritances and gifts. Therefore, the fact that I find a similar correlation gives credit to the assumption that most cases of receipt in SHARE correspond to inheritances.

Table 3 Expected versus received inheritances

Probability of inheritance receipt during 2004–2014	Sample distribution		Receipt by wave six	
	Any value	Above 50 thousand	Any value	Above 50 thousand
0	49.79%	72.60%	12.48%	19.31%
	(1514)	(2191)	(189)	(423)
0.01–0.49	14.53%	11.46%	22.17%	32.95%
	(442)	(346)	(98)	(114)
0.50	9.08%	4.80%	40.94%	50.34%
	(276)	(145)	(113)	(73)
0.51–0.99	16.38%	7.09%	46.18%	49.07%
	(498)	(214)	(230)	(105)
1	10.23%	4.04%	54.98%	57.38%
	(311)	(122)	(171)	(70)
All	100%	100%	26.34%	26.01%
	(3041)	(3018)	(801)	(785)

Probability of receiving an inheritance is measured at wave one. Out of the 3093 individuals in the sample reported in Table 1, 52 do not report a probability of receiving an inheritance regardless of the amount, and 75 do not report a probability of receiving an inheritance of more than 50 thousand Euros. Out of the individuals who do not report these probabilities, 13 and 29 respectively receive an inheritance or gift during the sample period

zero chance of receiving an inheritance in the next ten years. If the chance reported is above zero, then I consider the inheritance to be expected. Following this definition, I generate a dummy that takes value one in case of unexpected inheritance and zero otherwise. In a second approach, I generate a variable that in case of receipt takes a value equal to one minus the chance of receiving an inheritance reported in wave one. In that way, I take into account the continuous nature of reported probabilities. Both approaches might be problematic if focal answers are an issue when individuals report inheritance probabilities. For instance, individuals may report a chance of 0.50 when they do not know the answer, or when they believe the chance is above zero but they cannot think of an exact probability. Furthermore, Fig. 3 shows some signs of rounding towards 0.50 and one, since the probabilities reported around these values are specially low. However, given the strong correlation between expected and actual receipt reported in Table 3, I assume that self-reported probabilities contain enough useful information to identify unexpected inheritances.

As already mentioned, the monetary amounts received in inheritances and gifts are only available for those received between waves one and two. Due to this limitation, the amounts are not considered in the empirical analysis. Nevertheless, the data available allows producing suggestive descriptive statistics. Table 4 provides the distribution of the available amounts and shows how they correlate with pre-inheritance wealth.[16]

[16] By wealth I refer here to total household net worth. An important caveat to take into account is that the wealth data provided by the SHARE are self-reported and thus suffer from inaccuracies and missing values.

Table 4 Inherited amounts and their contribution to wealth

	Percentage who inherit (%)	Inheritance amount		Wealth				Inheritance-wealth ratio	
				Recipients		Non-recipients			
		Median	Mean	Median	Mean	Median	Mean	Median	Mean
Total	12.98	21.75	51.44	233.91	366.94	189.1	296.16	0.09	0.14
Wealth ≤ 0									
Total	10.58	10.86	33.01	− 28.60	− 40.62	− 10.40	− 24.99		
Wealth > 0									
Q1	12.18	15.84	32.27	52.77	51.37	37.76	41.58	0.30	0.63
Q2	10.36	21.72	39.61	148.11	149.29	155.55	152.09	0.15	0.27
Q3	14.18	20.01	50.37	297.63	295.21	274.28	278.12	0.07	0.17
Q4	15.64	38.75	76.10	663.54	889.61	582.17	796.20	0.06	0.09
Total	13.09	21.72	52.08	250.60	383.99	198.43	311.78	0.09	0.14

The unit of observation is the household and all monetary amounts are given in thousands of Euros. Inheritance amounts are reported conditional on receipt and refer to those received between wave one and wave two of the SHARE by the 2604 households included in the initial sample described in Sect. 4. Out of these, there are 326 households who received an inheritance. There are 39 households for whom it is not known whether they received one, these are excluded from the table. There are 29 households who received an inheritance but do not know the amount, these are excluded only when reporting inheritance amounts. Wealth refers here to household net worth at wave one, i.e. before receiving the inheritance. As in the rest of the analysis, it is not possible to separate inheritances from gifts

Table 5 Effect of inheritance receipt on food consumption

Variable	Dependent variable: change log food consumption					
	Singles			Couples		
	(1)	(2)	(3)	(4)	(5)	(6)
Inheritance	0.038			− 0.017		
	(0.061)			(0.026)		
Unexpected inheritance		0.118			− 0.031	
(dummy)		(0.115)			(0.060)	
Unexpected inheritance			0.017			− 0.027
(continuous)			(0.117)			(0.049)
Number of observations	935	935	935	2589	2589	2589
P value Hausman test	0.970	0.072	0.972	0.990	0.988	0.987
R^2	0.071	0.071	0.070	0.030	0.030	0.031

All coefficients are estimated using a random effects estimator. Standard errors (clustered at the household level) are reported in parenthesis. There are 39 and 561 households (for couples and singles respectively) that rely for at least one wave on multiple imputations provided by the SHARE. Each unit has five imputed values. Coefficient estimates and standard errors are computed using the combination rules described by Rubin (2004). All regressions include the change in the number of children in the household, the change in the number of parents (of the respondent or her partner) living in the household, the change in health, dummies capturing parental death, as well as country and time dummies. In addition, the features of the forecast error in Eq. (D.8) are captured by the inclusion of the inverse hyperbolic sine of pre-inheritance household net worth, education, age, and subjective survival probabilities. For the couples regressions, all individual level variables are included for both members in the couple. See main text for further details, and "Appendix A" for variable definitions and summary statistics, and "Appendix B" for full regression results
*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 4 shows that the likelihood of receiving an inheritance increases with wealth but not very substantially. However, recipients tend to be wealthier than non-recipients and inherited amounts increase with pre-inheritance wealth. More interestingly, Table 4 shows that inheritances tend to represent about one tenth of pre-inheritance wealth, and that inheritance-wealth ratios decrease with pre-inheritance wealth. In line with the evidence provided by Wolff (2003) and Elinder et al. (2018), this shows that inheritances are relatively more important at the bottom than at the top of the wealth distribution. Combined with Eq. (D.8) in the model, which indicates that what matters is not the absolute amount received but its size relative to previous wealth and future income streams, this suggests that the effect of receiving an inheritance may differ along the wealth distribution. As explained in Sects. 1 and 2, this can have important implications for how inheritances affect wealth inequality.

According the SHARE release guide, 30% of observations in the SHARE contain imputed data on wealth. For more details on the imputation methods employed in the SHARE, see Christelis (201)

Table 6 Effect of inheritance receipt on hours worked

Variable	Dependent variable: change log hours worked		
	(1)	(2)	(3)
Inheritance	− 0.018		
	(0.019)		
Unexpected inheritance (dummy)		0.004	
		(0.043)	
Unexpected inheritance (continuous)			− 0.011
			(0.033)
Number of observations	4591	4591	4591
P value Hausman test	0.319	0.374	0.389
R^2	0.018	0.017	0.018

All coefficients are estimated using a random effects estimator. Standard errors (clustered at the individual level) are reported in parenthesis. All regressions include changes in marital status, the change in the number of children in the household, the change in the number of parents (of the respondent or her partner) living in the household, the change in health, and dummies capturing parental death as well as country and time dummies. In addition, the features of the forecast error in Eq. (D.8) are captured by the inclusion of the inverse hyperbolic sine of pre-inheritance household net worth, education, age, and subjective survival probabilities. See main text for further details, and "Appendix A" for variable definitions and summary statistics, and "Appendix B" for full regression results

*Significant at the 10% level; **significant at the 5% level, ***significant at the 1% level

5 Results

Tables 5 and 6 show the results I find for the consumption and labour supply analyses.[17] Both tables show that the estimates of the inheritance receipt effect are in all cases not significantly different from zero. For the consumption analysis, the point estimates are positive for singles and negative for couples. The couples estimates are slightly more precise. However, in all cases lack of precision does not allow ruling out rather large effects of the order of around 10 to 20 percentage point increases (or decreases) in food consumption growth due to inheritance receipt. Taking the estimated results for the unexpected inheritance dummies, the 95% confidence intervals indicate that I cannot reject effects between -10.74 and 34.34 percentage points for singles and between -14.86 and 8.66 percentage points for couples.[18] Regarding the effect on the intensive margin of labour supply, Table 5 shows that point estimates are very close to zero regardless of the measure of inheritance receipt that I employ. In this case the estimates are more precise compared to the consumption results. Taking again the results of the unexpected inheritance dummy, the 95% confidence interval indicate I

[17] For economy of space, I just provide coefficient estimates for the explanatory variables of interest. For full regression results, see Tables 11 and 12 in "Appendix B". The latter provides full results for regressions in Column 1 of Tables 5, 6, and 7. Results for other columns do not differ significantly. They are available upon request.

[18] Table 5 provides the results for total food consumption, i.e. the addition of food consumption inside and outside of the household. Tables 13 and 14 in "Appendix C" show that the effects are still not significantly different from zero when estimating the effects separately for food inside and outside of the household.

Table 7 Effect of inheritance receipt on retirement

Variable	Short term effect			Longer term effect		
	(1)	(2)	(3)	(4)	(5)	(6)
(a)	*Dependent variable: narrow retirement*					
Inheritance	−0.006			−0.044**		
	(0.016)			(0.016)		
Unexpected inheritance		0.014			−0.040	
(dummy)		(0.033)			(0.030)	
Unexpected inheritance			0.013			−0.040*
(continuous)			(0.027)			(0.021)
Number of observations	7994	7994	7994	3093	3093	3093
Log Pseudolikelihood	−3115	−3115	−3115	−932	−934	−933
Pseudo R^2	0.287	0.287	0.287	0.395	0.394	0.395
(b)	*Dependent variable: broad retirement*					
Inheritance	0.003			−0.021*		
	(0.033)			(0.013)		
Unexpected inheritance		0.021			−0.027	
(dummy)		(0.038)			(0.024)	
Unexpected inheritance			0.027			−0.039**
(continuous)			(0.030)			(0.017)
Number of observations	7349	7349	7349	3093	3093	3093
Log Pseudolikelihood	−3297	−3297	−3297	−888	−880	−881
PseudoR^2	0.228	0.228	0.228	0.335	0.336	0.335

Table 7 continued

Variable	Short term effect			Longer term effect		
	(1)	(2)	(3)	(4)	(5)	(6)
(c)	*Dependent variable: retired before expected*					
Inheritance	− 0.009			− 0.035		
	(0.008)			(0.019)		
Unexpected inheritance		0.002			− 0.007	
(dummy)		(0.018)			(0.033)	
Unexpected inheritance			− 0.013			− 0.036
(continuous)			(0.015)			(0.027)
Number of observations	7120	7120	7120	2663	2663	2663
Log Pseudolikelihood	− 1388	− 1388	− 1389	− 1042	− 1041	− 1040
PseudoR^2	0.102	0.102	0.102	0.064	0.064	0.068

Marginal effects (evaluated at the sample means) from a probit model are reported with standard errors (clustered at the household level) in parenthesis. All regressions include controls for age, gender, marital status, age of the partner, educational level, presence of children and grandchildren, parental death, health status, household income and wealth, present value of pension wealth, sector of employment, type of occupation, pre-sample period inheritance receipt as well as country and time dummies. See main text for further details, and "Appendix A" for variable definitions and summary statistics, and "Appendix B" for full regression results

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

cannot reject effects between −8.03 and 8.83 percentage points while the interval is narrower for the continuous measure of unexpected inheritances.

Table 7 reports the results of the retirement analysis. Each panel in Table 7 reports results using a different retirement measure, and each of them provides the short-term effect of inheritance receipt, i.e. the effect of receipt since the previous wave, and the longer term effect, i.e. the effect of receipt at any point during the sample period on retirement in all subsequent waves. When estimating the longer term effect, each individual contributes only one observation to the sample and all control variables are fixed at their level in wave one. In that way, I allow individuals a few more years to respond to inheritance receipt by retiring at some point between receipt and the last wave available. The point estimates for the short-term effect on retirement are in all cases very close to zero, rarely implying an increase (decrease) larger than one percentage point in the probability of retirement. Regarding the longer term effect, there are a few estimates that are significantly different from zero. However, when retirement expectations are taken into account, i.e. in Panel (c), the estimates become not significantly different from zero. It is therefore not appropriate to view this as a causal effect. Taking the results obtained when using the dummy for unexpected inheritance in Panel (c), the 95% confidence intervals do not allow ruling out effects between -3.33 and 3.72 percentage points in the short term and between -7.17 and 5.77 percentage points in the longer term.[19]

The retirement results suggest that the SHARE does not offer enough statistical power to reject the results by Brown et al. (2010). The latter find that, when not taking into account inheritance and retirement expectations, inheritance receipt is related with increases in the chance of retiring of about two percentage points in the short term and about four percentage points in the longer term. When taking into account inheritance and retirement expectations, they find a point estimate of about five percentage points. These are effects of a magnitude that I cannot clearly rule out given the precision of my estimates. Using the SHARE, Eder (2016) finds a significant increase in the probability of being retired at wave four of about eight percentage points as a response to inheritance receipt between waves one and four. However, Eder (2016) does not exploit information on labour market status provided in wave two. Table 7 shows that this result does not hold once waves two, five, and six are included in the analysis. Regarding previous results on the effect of inheritance receipt on the intensive margin of labour supply by e.g. Joulfaian and Wilhelm (1994), Sila and Sousa (2014), and Bø et al. (2019) find either a small effect or an effect that is not statistically significant. When significantly different from zero, their findings cannot, in most cases, be ruled out by the results in Table 7. However, in this case the outcomes are not directly comparable due to methodological differences.

As indicated by the descriptive evidence in Table 4, the relative importance of inherited amounts decreases with the level of pre-inheritance wealth, which suggests that the effects of receiving an inheritance may be different along the wealth distribution. This is in line with Eq. (D.8) in the model which indicates that inherited amounts should be put in relation to previous wealth and future income streams. For this rea-

[19] Results do not change significantly when using an alternative definition of narrow retirement constructed by selecting only individuals who transit directly from (self)employment to retirement, thus excluding any other intermediate status. These results are reported in Table 15 in "Appendix C".

son, Table 16 in "Appendix C" provides effects estimated by quartile of the household wealth distribution. For economy of space, I consider in this case only the specification including unexpected inheritances.[20] Table 16 shows that the results for food consumption and hours worked are still not significantly different from zero when estimated separately for each wealth quartile. Regarding the retirement results, there is an indication of a pattern suggesting that the effect of receiving an inheritance or gift increases with wealth. For both the short and the longer term effects, the point estimates increase with the wealth distribution reaching a statistically significant effect of around ten percentage points for the fourth quartile. However, the effects at the top of the distribution are only significant at the 10% level and the effects for the different quartiles are in most cases not significantly different from each other. This can be because the partition of the sample into quartiles renders each subsample quite small, thus decreasing the precision of the estimates and making it difficult to reach a clear conclusion.

Finally, using a large European panel has the advantage that it allows estimating effects separately for different regions of Europe. This is relevant since especially the labour supply and retirement responses are likely to depend on labour market regulations and other aspects of the institutional setting that are specific to every country or region. For that reason, Table 17 in "Appendix C" provides the effects estimated for three separate regions of Europe, i.e. Northern (including Denmark and Sweden), Western (including Austria, Belgium, France, Germany, the Netherlands and Switzerland), and Southern Europe (including Italy and Spain).[21] Again in this case I consider only the specification including unexpected inheritances as a main explanatory variable. Table 17 shows that the effects are still not significantly different from zero when estimated for the three European regions separately.

6 Conclusions

In this paper I investigate the effect of receiving an inheritance on behavioural responses of older Europeans. Employing waves one to six of the SHARE, I differentiate between expected and unexpected inheritances and estimate their effect on consumption, labour supply, and retirement. The results show that the estimated effects are in all cases not clearly significant in statistical sense. Regarding the results of the analyses on retirement and the extensive margin of labour supply, I reject (at the 95% level of confidence) any jump in the relative change of hours worked much larger than five to eight percentage points, and any change in the probability of retiring larger than five percentage points when taking into account retirement expectations. These results allow ruling any substantially large effects, and imply that the findings by Brown et al. (2010), who conclude that inheritance receipt increases chances of retiring by around

[20] The results provided correspond to the specifications using the dummy variable for unexpected inheritances as a main explanatory variable. Results are not significantly different when using the continuous measures for unexpected inheritances.

[21] The groups are made following the classification provided by EuroVoc. The latter is a thesaurus maintained by the Publication Office of the European Union. This classification coincides with most groupings by welfare state regime as provided by Isakjee (2017).

five percentage points, cannot be clearly rejected using the SHARE. However, they are compatible with most of the literature on labour supply and retirement effects of inheritance receipt, since the latter usually reports effects that are either very small or not significantly different from zero. Regarding the consumption analysis, the estimates are less precise compared to the analysis on retirement and labour supply. Therefore, it becomes more difficult to draw conclusions.

An heterogeneity analysis reveals that there are no clearly significant differences in the effects on consumption, labour, and retirement when estimated separately for each quartile of the household wealth distribution, as well as when estimated separately by European region. In the case of retirement, the analysis by wealth level does point to a pattern indicating an increase in the estimated effects on retirement as wealth increases. For the short and the longer term retirement effects, the point estimates reach a level of around ten percentage points for the fourth quartile of the wealth distribution. This indicates that, at the top of the wealth distribution, receiving an inheritance or gifts increases the chance of retirement by ten percentage points. This result is somewhat counterintuitive since Table 4 shows that inheritances are in relative terms more important at the bottom of the distribution than at the top. However, these effects are only significant at the 10% level. An important limitation of the data in this respect is that the partition of the sample renders each of the estimation subsamples rather small which increases the uncertainty of the estimates. This makes it difficult to draw strong conclusions from the heterogeneity analysis.

The results that I find are compatible with different explanations. For instance, given that I do not find substantial effects on labour supply and retirement, which seems to be the general trend in the literature, the results are compatible with individuals smoothing the effect of an inheritance over time. If inheritances are not very large in general, and individuals still expect to live many years after receiving them, this smoothing behaviour will lead to very small immediate effects, that could nevertheless accumulate over time. The evidence in Table 4 suggests that, specially for the wealthiest, inheritances do not represent a substantial increase in lifetime income. Nevertheless, more research needs to be done to fully understand the relation between inherited amounts, previous wealth, future income streams, and life expectancy to fully grasp how relevant is the impact of inheritances relative to lifetime income.

In addition, the results I find are compatible with substantially large effects of inheritances on consumption. The lack of precision of the estimates does not allow ruling out effects of up to 20 percentage point jumps in food consumption growth due to inheritance receipt. Intuitively, it make sense to think of larger responses in consumption compared to labour supply and retirement decisions, since the latter are usually restricted by labour market and social security regulations, while consumption might be more discretionary. In addition, the availability of only data on food consumption is an important limitation since this category is less likely to be affected by sudden changes in wealth compared to other consumption categories including less essential products.[22] Another important limitation is the lack of information on the type of wealth inherited since inheritances consisting of financial wealth may

[22] By using rich data on a range of consumption categories Been et al. (2021) show how sensible estimates of the effect of unemployment on consumption are to the choice of consumption category. This is likely to apply to the effects of inheritance receipt as well.

have a stronger immediate impact on consumption than inheritances consisting of non-financial wealth.

In summary, the results that I find seem to agree with the stylized fact reported in the literature stating that inheriting does not have substantially large effects on labour supply and retirement. However, it is difficult to tell whether this is because individuals have a weak taste for leisure, because of tight labour market regulations, or because inheritances are actually small in general in relation to lifetime income. In addition my results cannot rule out large effects on consumption. More research needs to be done in the future to incorporate additional trade-offs in the model and better understand how individuals react to inheritance receipt.

Appendices

A Estimation samples, variable definitions, and summary statistics

* See Tables 8, 9 and 10.

Table 8 Number of observations estimation samples

	Individuals	Households	Individual-wave units	Household-wave units
Narrow retirement	3093	2604	7994	6760
Broad retirement	3093	2604	7349	6201
Retired before expected	2663	2249	7120	6013
Consumption (singles)	–	431	–	935
Consumption (couples)	–	1317	–	2589
Labour supply	2082	1764	4591	3601

The narrow retirement and broad retirement samples form the baseline sample. All other samples are sub-samples of the base line sample. For more details, see Sect. 4 in the main text

Table 9 Variable definitions

Variable	Definition
Narrow retirement	Dummy variable indicating whether respondent retired between waves $t-1$ and t. Considers as retirement transitions to labour market status *retired* from any other labour market status. For the classification of labour market statuses in the SHARE, see Table 2
Broad retirement	Dummy variable indicating whether respondent retired between waves $t-1$ and t. Considers as retirement transitions from *employed* or *self-employed* to any other labour market status. For the classification of labour market statuses in the SHARE, see Table 2
Retired before expected	Dummy variable indicating whether respondent retired between waves $t-1$ and t. Considers as retirement transitions from *employed* or *self-employed* to any other labour market status, as long as they take place before expected as of wave one. For the classification of labour market statuses in the SHARE, see Table 2
Change log food consumption	Change in the natural logarithm of household food consumption between waves $t-1$ and t
Change log hours worked	Change in the natural logarithm of weekly hours worked (regardless of contracted hours) between waves $t-1$ and t
Inheritance	Inheritance or gift larger than five thousand Euros received by a member of the household between waves $t-1$ and t. 0: Not received;1: Received; 2: Do not know
Unexpected inheritance (dummy)	Inheritance or gift larger than five thousand Euros received by a member of the household between waves $t-1$ and t when probability of inheritance receipt was reported to be zero at wave one. 0: Not received; 1: Received; 2: Do not know
Unexpected inheritance (continuous)	If an inheritance or gift larger than five thousand Euros is received by a member of the household between waves $t-1$ and t, takes value equal to the difference between one and probability of inheritance receipt reported at wave one. If no inheritance or gift is received, takes value one
Age category	1: age < 55; 2: $55\geq$ age < 60; 3: $60 \geq$ age < 65, 4: age ≥ 65
Gender	Dummy variable indicating whether the individual is female
Marital status	1: Married, living with the spouse; 2: Registered partnership; 3: Married, not living with the spouse; 4: Never married; 5: Divorced; 6: Widowed
Age category partner	0: no partner; 1: age < 55; 2: $55 \geq$ age < 60; 3: $60 \geq$ age < 65, 4: age ≥ 65
Children	Dummy variable indicating the presence of children
Grandchildren	Dummy variable indicating the presence of grandchildren

Table 9 continued

Variable	Definition
Mother death	Dummy variable indicating the death of the respondent's mother between waves $t-1$ and t
Father death	Dummy variable indicating the death of the respondent's father between waves $t-1$ and t
Education	International standard classification of education (ISCED) 1997. 0: None; 1: Primary education or first stage of basic education; 2: Lower secondary education or second stage of basic education; 3: Upper secondary education; 4: Post-secondary non-tertiary education; 5: First stage of tertiary education; 6: Second stage of tertiary education; 7: Do not know
Poor health	Dummy variable indicating poor health
Health improved	Dummy variable indicating individual moved out of poor health status between waves $t-1$ and t
Health worsened	Dummy variable indicating individual moved to poor health status between waves $t-1$ and t
Household income	Total yearly income of the household
Household wealth	Total household net worth
Present value of pension wealth	Present value of net pension wealth calculated using expected retirement age, wage earnings, expected replacement rate, and life expectancy. Life expectancy data by country, year, and gender is provided by the OECD. Missing values in the replacement rate are filled with data by country, year, and gender provided by Eurostat. The calculation assumes a discount rate of 3% and follows the formula applied by Bönke et al. (2019)
Sector	Sector of employment. 0: Labour market status is not employed; 1: Private sector; 2: Public sector; 3: Self-employed; 4: Labour market status is employed but sector is unknown
Occupation	International standard classification of occupation (ISCO). 1: Legislators, senior officials and managers; 2: Armed forces; 3: Professionals; 4: Technicians and associate professionals; 5: Clerks; 6: Service workers and shop and market sales workers; 7: Skilled agricultural and fishery workers; 8: Craft and related trades workers; 9: Plant and machine operators and assemblers; 10: Elementary occupations; 11: Do not know

Table 9 continued

Variable	Definition
Previous gift	Dummy indicating whether Inheritance or gift above five thousand Euros already received before wave one
Marital status transition	Change in marital status between waves $t-1$ and t. 1: Married or registered partnership to separated or divorced; 2: Married or registered partnership to widowed; 3: Separated or divorced to married or registered partnership; 4: Widowed to married or registered partnership
Change children in household	Change in the number of children living in the household between waves $t-1$ and t
Change parents in household	Change in the number of parents of the respondent living in the household between waves $t-1$ and t
Survival probabilities	Subjective probability of surviving up to the following 10 to 15 years
Missing survival	Dummy indicating missing information on the subjective probability of surviving up to the following 10 to 15 years. If *missing survival* equals one, *survival probabilities* is set to zero in the regression analysis
Country	1: Austria; 2: Germany; 3: Sweden; 4: Spain; 5: Italy; 6: France; 7: Denmark; 8: Switzerland; 9: Belgium

Table 10 Summary statistics

Variable	Mean	Median	Std. Dev.	Min	Max.
Consumption Analysis Singles					
Change log food consumption	– 0.035	– 0.025	0.558	– 3.292	3.064
Inheritance	0.101	–	–	–	–
Unexp. inheritance (dummy)	0.015	–	–	–	–
Unexp. inheritance (continuous)	0.041	0	0.170	0	1
Consumption Analysis Couples					
Change log food consumption	– 0.044	– 0.043	0.458	– 2.315	2.009
Inheritance	0.138	–	–	–	–
Unexp. inheritance (dummy)	0.031	–	–	–	–
Unexp. inheritance (continuous)	0.057	0	0.204	0	1
Labour Supply Analysis					
Change log hours worked	– 0.034	0	0.381	– 3.114	3.738
Inheritance	0.140	–	–	–	–
Unexp. inheritance (dummy)	0.026	–	–	–	–
Unexp. inheritance (continuous)	0.057	0	0.202	0	1
Retirement Analysis					
Narrow retirement	0.293	–	–	–	–
Broad retirement	0.345	–	–	–	–
Retired before expected	0.083	–	–	–	–
Inheritance	0.127	–	–	–	–
Unexp. inheritance (dummy)	0.026	–	–	–	–
Unexp. inheritance (continuous)	0.053	0	0.198	0	1

For economy of space only summary statistics on dependent variables and main explanatory variables are provided. Summary statistics for control variables are available upon request. Summary statistics for *narrow retirement*, *broad retirement* and *retired before expected* are based on the short-term regressions, i.e. Columns 1 to 3 in Table 7. Summary statistics for inheritance variables in the retirement analysis are based on the *narrow retirement* regression, i.e. Panel (a) of Table 7

B Full regression results

See Tables 11 and 12.

Table 11 Results consumption and labour supply analysis

		(1) Change log food consumption (singles)	(2) Change log food consumption (couples)	(3) Change log hours worked
Inheritance	1	0.038	− 0.017	− 0.018
		(0.061)	(0.026)	(0.019)
	2	0.116	− 0.027	0.009
		(0.209)	(0.094)	(0.049)
Change children		0.112**	0.030	− 0.011
in household		(0.045)	(0.017)	(0.012)
Change parents		0.075	− 0.062	0.091
in household		(0.128)	(0.101)	(0.096)
Health worsened		− 0.004	− 0.140	− 0.049
		(0.203)	(0.090)	(0.078)
Health improved		0.247*	0.037	− 0.160
		(0.133)	(0.116)	(0.097)
Mother death		− 0.091	0.052	− 0.002
		(0.083)	(0.039)	(0.023)
Father death		− 0.078	0.085*	− 0.006
		(0.107)	(0.050)	(0.034)
Lagged household		0.010**	− 0.003	0.001*
wealth (arsinh)		(0.005)	(0.002)	(0.001)
Age category	2	− 0.001	0.027	− 0.017
		(0.667)	(0.033)	(0.017)
	3	0.001	0.054	− 0.044**
		(0.069)	(0.033)	(0.017)
	4	− 0.003	0.071	− 0.176***
		(0.086)	(0.044)	(0.032)
Survival		− 0.101	0.019	− 0.009
probabilities		(0.103)	(0.055)	(0.032)
Missing		− 0.137	0.024	0.009
survival		(0.15)	(0.087)	(0.045)
Education	1	0.049	− 0.011	− 0.009
		(0.123)	(0.080)	(0.064)
	2	0.044	0.019	− 0.009
		(0.118)	(0.079)	(0.063)
	3	− 0.033	0.058	− 0.034
		(0.119)	(0.080)	(0.062)
	4	0.027	− 0.004	− 0.029
		(0.129)	(0.088)	(0.068)
	5	0.016	0.056	− 0.026
		(0.123)	(0.081)	(0.062)

Table 11 continued

		(1) Change log food consumption (singles)	(2) Change log food consumption (couples)	(3) Change log hours worked
	6	−0.227	−0.012	−0.041
		(0.183)	(0.139)	(0.081)
	7	−0.638	0.097	−0.029
		(0.295)	(0.115)	(0.070)
Wave	4	0.173	0.043	−0.042
		(0.138)	(0.081)	(0.039)
	5	−0.028	0.006	0.011
		(0.057)	(0.028)	(0.016)
	6	−0.026	0.033	0.026
		(0.068)	(0.037)	(0.017)
Germany		−0.044	0.015	−0.024
		(0.102)	(0.054)	(0.038)
Sweden		0.007	0.093	−0.015
		(0.093)	(0.051)	(0.038)
Netherlands		−0.219	−0.033	−0.035
		(0.112)	(0.060)	(0.039)
Spain		−0.067	0.047	0.012
		(0.113)	(0.058)	(0.044)
Italy		−0.176	−0.035	−0.014
		(0.121)	(0.057)	(0.044)
France		−0.007	0.048	−0.002
		(0.103)	(0.061)	(0.039)
Denmark		0.060	0.075	−0.008
		(0.097)	(0.054)	(0.036)
Switzerland		0.045	0.085	0.006
		(0.094)	(0.055)	(0.044)
Belgium		0.021	0.077	−0.017
		(0.100)	(0.053)	(0.038)
Observations		935	2589	4591
R^2		0.074	0.030	0.018

All coefficients are estimated using a random effects estimator. Standard errors (clustered at the household level) are reported in parenthesis. In Columns 1 and 2 , there are 39 and 561 households (for couples and singles respectively) that rely for at least one wave on multiple imputations provided by the SHARE. Each unit has five imputed values. Coefficient estimates and standard errors are computed using the combination rules described by Rubin (2004). For the couples regressions, all individual level variables are included for both members in the couple. For economy of space, here only results for one household representative are reported. Estimates of the partner variables are available upon request. For economy of space estimates of the effect of changes in marital status on labour supply are not reported here. They are available upon request. See Tables 9 and 10 for variable definitions and summary statistics. *Significant at the 10% level, **significant at the 5% level, ***significant at the 1% level

Table 12 Results retirement analysis

		(1) Narrow retirement	(2) Broad retirement	(3) Retired before expected
Inheritance	1	−0.019	0.007	−0.073
		(0.056)	(0.054)	(0.075)
	2	0.039	0.077	0.004
		(0.159)	(0.156)	(0.228)
Gender		−0.074*	0.055	−0.067
		(0.041)	(0.040)	(0.055)
Lagged marital status	2	−0.146	−0.172	−0.140
		(0.112)	(0.106)	(0.153)
	3	−0.036	−0.197	0.249
		(0.190)	(0.184)	(0.235)
	4	0.034	−0.121	−0.037
		(0.186)	(0.179)	(0.251)
	5	0.178	−0.067	0.275
		(0.176)	(0.171)	(0.236)
	6	0.369**	0.117	0.276
		(0.187)	(0.183)	(0.253)
Age category	2	0.892***	0.513***	0.683***
		(0.114)	(0.073)	(0.137)
	3	1.949***	1.323***	1.200***
		(0.116)	(0.078)	(0.140)
	4	3.267***	2.524***	1.222***
		(0.126)	(0.093)	(0.155)
Age category partner	1	0.157	−0.009	0.224
		(0.175)	(0.168)	(0.233)
	2	0.300*	0.172	0.222
		(0.170)	(0.165)	(0.228)
	3	0.375**	0.255	0.168
		(0.170)	(0.165)	(0.229)
	4	0.317*	0.176	0.181
		(0.174)	(0.170)	(0.235)
Children		−0.190***	−0.221***	−0.220**
		(0.073)	(0.070)	(0.092)
Grandchildren		0.153***	0.194***	0.105**
		(0.040)	(0.039)	(0.053)
Mother death		0.079	−0.032	0.128
		(0.067)	(0.066)	(0.084)
Father death		−0.072	−0.100	−0.096

Table 12 continued

		(1) Narrow retirement	(2) Broad retirement	(3) Retired before expected
		(0.090)	(0.084)	(0.120)
Lagged poor		0.315	0.597**	0.406*
health		(0.195)	(0.259)	(0.239)
Health worsened		0.121	0.994***	0.108
		(0.127)	(0.118)	(0.161)
Health improved		− 0.311	− 0.437	− 0.504
		(0.242)	(0.307)	(0.307)
Education	1	0.048	0.156	0.061
		(0.157)	(0.157)	(0.227)
	2	0.079	0.232	0.066
		(0.157)	(0.157)	(0.227)
	3	0.075	0.162	0.002
		(0.156)	(0.155)	(0.226)
	4	0.029	0.076	0.088
		(0.180)	(0.179)	(0.252)
	5	− 0.059	0.003	0.000
		(0.159)	(0.159)	(0.230)
	6	− 0.364	− 0.303	0.014
		(0.253)	(0.249)	(0.346)
	7	− 0.139	0.028	− 0.048
		(0.205)	(0.203)	(0.371)
Lagged household		− 0.054	− 0.062*	− 0.038
income		(0.034)	(0.033)	(0.048)
Lagged household		− 0.001	− 0.006**	− 0.001
wealth		(0.003)	(0.003)	(0.004)
Lagged present value		0.145***	0.110***	0.0731***
pension wealth		(0.018)	(0.017)	(0.0221)
Lagged sector	1	− 0.124*		− 0.355***
		(0.069)		(0.084)
	2	0.034	0.070*	− 0.362***
		(0.076)	(0.041)	(0.094)
	3	− 0.633***	− 0.396***	− 0.610***
		(0.083)	(0.055)	(0.108)
	4	0.582	0.845**	0.541
		(0.382)	(0.401)	(0.520)
Occupation	1	0.545***	0.588***	0.027
		(0.171)	(0.165)	(0.223)
	2	− 0.040	− 0.065	− 0.069

Table 12 continued

		(1) Narrow retirement	(2) Broad retirement	(3) Retired before expected
		(0.066)	(0.063)	(0.087)
	3	0.161**	0.084	0.139*
		(0.065)	(0.063)	(0.085)
	4	0.072	0.068	0.084
		(0.077)	(0.075)	(0.099)
	5	− 0.105	− 0.063	− 0.102
		(0.078)	(0.075)	(0.105)
	6	0.131	0.137	0.031
		(0.114)	(0.109)	(0.156)
	7	0.123	0.170**	0.121
		(0.084)	(0.081)	(0.107)
	8	0.222**	0.273***	0.076
		(0.099)	(0.098)	(0.128)
	9	− 0.096	0.011	− 0.184
		(0.089)	(0.086)	(0.120)
	10	− 0.017	0.056	− 0.300
		(0.147)	(0.143)	(0.251)
Previous gift	1	0.135***	0.077**	0.130***
		(0.037)	(0.037)	(0.049)
	2	0.698	0.336	0.038
		(0.246)	(0.241)	(0.361)
Wave	4	0.111**	0.050	0.029
		(0.046)	(0.044)	(0.060)
	5	− 0.411***	− 0.375***	− 0.263***
		(0.055)	(0.053)	(0.074)
	6	− 0.519***	− 0.489***	− 0.371***
		(0.061)	(0.061)	(0.084)
Germany		− 1.019***	− 0.683***	− 0.644***
		(0.106)	(0.104)	(0.119)
Sweden		− 1.412***	− 1.151***	− 1.00***
		(0.105)	(0.102)	(0.121)
Netherlands		− 0.954***	− 0.609**	− 0.884***
		(0.109)	(0.106)	(0.132)
Spain		− 1.295***	− 0.789***	− 0.992***
		(0.118)	(0.114)	(0.146)
Italy		− 0.721***	− 0.448***	− 0.652***
		(0.110)	(0.108)	(0.129)

Table 12 continued

	(1) Narrow retirement	(2) Broad retirement	(3) Retired before expected
France	– 0.483***	– 0.315***	– 0.802***
	(0.104)	(0.102)	(0.124)
Denmark	– 1.306***	– 0.953***	– 1.016***
	(0.105)	(0.101)	(0.121)
Switzerland	– 1.313***	– 0.983***	– 0.929***
	(0.119)	(0.115)	(0.140)
Belgium	– 0.715***	– 0.444***	– 0.724***
	(0.099)	(0.098)	(0.115)
Observations	7994	7349	7120
Pseudo R^2	0.287	0.228	0.102

All coefficients are estimated using a probit model. For marginal effects (evaluated at the sample means) of the variable *inheritance*, see Table 7 in the main text. Standard errors (clustered at the household level) are reported in parenthesis. *Household income*, *household wealth*, and *present value of pension wealth* are scaled by 100.000. See Tables 9 and 10 for variable definitions and summary statistics
*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

C Additional results

See Tables 13, 14, 15, 16 and 17.

Table 13 Effect of inheritance receipt on food consumption inside the household

Variable	Dependent variable: change log food consumption inside					
	Singles			Couples		
	(1)	(2)	(3)	(4)	(5)	(6)
Inheritance	0.026			– 0.049		
	(0.063)			(0.032)		
Unexpected inheritance (dummy)		0.176			– 0.038	
		(0.124)			(0.069)	
Unexpected inheritance (continuous)			0.021			– 0.052
			(0.112)			(0.058)
Number of observations	935	935	935	2589	2589	2589
P value Hausman test	0.989	0.990	0.994	0.997	0.993	0.997
R^2	0.100	0.102	0.100	0.023	0.022	0.022

Notes: All coefficients are estimated using a random effects estimator. Standard errors (clustered at the household level) are reported in parenthesis. For further information see main text and notes in Table 5.
*Significant at the 10% level, **significant at the 5% level, ***significant at the 1% level

Table 14 Effect of inheritance receipt on food consumption outside the household

Variable	Dependent variable: change log food consumption outside					
	Singles			Couples		
	(1)	(2)	(3)	(4)	(5)	(6)
Inheritance	0.477*			0.157		
	(0.286)			(0.162)		
Unexpected inheritance (dummy)		0.190			−0.128	
		(0.327)			(0.363)	
Unexpected inheritance (continuous)			0.427			0.053
			(0.368)			(0.294)
Number of observations	935	935	935	2589	2589	2589
P value Hausman test	0.913	0.912	0.909	0.897	0.883	0.876
R^2	0.026	0.024	0.025	0.022	0.023	0.022

All coefficients are estimated using a random effects estimator. For further information see main text and notes in Table 5. Standard errors (clustered at the household level) are reported in parenthesis
*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 15 Effect of inheritance receipt on narrow retirement (alternative definition)

Variable	Dependent variable: narrow retirement					
	Short term effect			Longer term effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Inheritance	−0.008			−0.042**		
	(0.019)			(0.019)		
Unexpected inheritance (dummy)		0.014			−0.035	
		(0.038)			(0.029)	
Unexpected inheritance (continuous)			0.018			−0.037*
			(0.031)			(0.020)
Number of observations	6506	6506	6506	2632	2632	2632
Log Pseudolikelihood	−2796	−2763	−2763	−800	−804	−803
Pseudo R^2	0.315	0.316	0.316	0.411	0.410	0.410

Marginal effects (evaluated at the sample means) from a probit model are reported with standard errors (clustered at the household level) in parenthesis. The alternative definition of narrow retirement considers only direct transitions from (self-employment) to retirement, thus excluding any other intermediate status. For further information see main text and notes in Table 7
*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 16 Effect of inheritance receipt by household wealth level

Quartiles lagged household wealth	(1) Consumption singles	(2) Consumption couples	(3) Hours worked	(4) Retirement short term	(5) Retirement longer term
1st quartile	−0.163	−0.122	0.021	−0.039***	−0.054
	(0.255)	(0.119)	(0.165)	(0.010)	(0.057)
2nd quartile	0.143	0.003	−0.007	−0.023	−0.066
	(0.108)	(0.130)	(0.026)	(0.027)	(0.059)
3rd quartile	0.267	0.043	−0.011	0.003	−0.023
	(0.547)	(0.175)	(0.063)	(0.031)	(0.056)
4th quartile	0.086	−0.065	0.031	0.093*	0.133*
	(0.184)	(0.124)	(0.039)	(0.053)	(0.075)

All estimations use the dummy variable for unexpected inheritance as a main explanatory variable. Results are not significantly different when using the continuous measure for unexpected inheritances. Regression in Columns 1 to 5 correspond respectively to regressions in Columns 2 and 5 of Table 5, Column 2 of Table 6, and Columns 2 and 5 of Table 7-Panel (c). For each regression, the sample is divided into quartiles of the household net worth distribution and a regression is estimated for each of them. For further details, see main text and notes in Tables 5, 6 and 7

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 17 Effect of inheritance receipt by European region

European	(1) Consumption singles	(2) Consumption couples	(3) Hours worked	(4) Retirement short term	(5) Retirement longer term
Northern Europe	−0.044	−0.023	0.024	−0.005	−0.002
	(0.157)	(0.061)	(0.022)	(0.015)	(0.047)
Western Europe	0.043	−0.037	−0.032	−0.003	−0.010
	(0.193)	(0.081)	(0.076)	(0.020)	(0.046)
Southern Europe	−0.671	−0.037	0.093	0.019	−0.073
	(0.690)	(0.143)	(0.194)	(0.097)	(0.096)

All estimations use the dummy variable for unexpected inheritance as a main explanatory variable. Results are not significantly different when using the continuous measure for unexpected inheritances. Regression in Columns 1 to 5 correspond respectively to regressions in Columns 2 and 5 of Table 5, Column 2 of Table 6, and Columns 2 and 5 of Table 7-Panel (c). For each regression, the sample is divided into three European regions: Northern Europe (including Denmark and Sweden), Western Europe (including Austria, Belgium, France, Germany, the Netherlands, and Switzerland), and Southern Europe (including Italy and Spain), and a regression is estimated for each of them. For further details, see main text and notes in Tables 5, 6 and 7

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

D Theoretical framework

D.1 Optimization problem

Consider a setting with separability between consumption and leisure, neither income nor lifetime uncertainty, no liquidity constraints, and no bequest motive. Consider an individual that lives up to age L. Her lifetime utility is defined as

$$U(c,l,R)=\sum_{t=s}^{R-1}\frac{D_t}{(1+\rho)^{t-s}}\left(\theta\ln c_t+(1-\theta)\ln l_t\right)+\sum_{t=R}^{L}\frac{D_t}{(1+\rho)^{t-s}}\left(\theta\ln c_t+\phi\right), \tag{D.1}$$

where c_t is consumption at age $t = s, ..., L$, $l_t = T - h_t$ is hours of leisure defined as the difference between T, the total time endowment in a year, and hours of work h_t, R is the retirement age which cannot be larger than the mandatory retirement age M, D_t is a factor determining the way in which demographic variables scale consumption and leisure, $\rho \geq 0$ is the rate of time preference, $0 \leq \theta \leq 1$ determines the weight the individuals gives to c_t relative to l_t, and ϕ is the extra utility the individual gets from being retired, which can be expressed as $\phi = (1-\theta)\ln T$.[23] The factor D_t takes the form

$$D_t = \exp(\delta_0 + \boldsymbol{\delta}'\mathbf{Z}_t), \tag{D.2}$$

where δ_0 is a an individual fixed effect and $\mathbf{Z}_t$ is a vector of demographic variables. Conditional on not being retired yet, at the initial age s the individual chooses a path for c_t, l_t, and the optimal R such as to maximize (1) subject to

$$\sum_{t=s}^{L}\frac{c_t}{(1+r)^{t-s}}=\frac{I_n}{(1+r)^{n-s}}+\sum_{t=s}^{R-1}\frac{(T-l_t)w_t}{(1+r)^{t-s}}+\sum_{t=R}^{L}\frac{y(R)}{(1+r)^{t-s}}+A_{s-1}(1+r), \tag{D.3}$$

where r is the constant interest rate, w_t is the hourly wage rate, I_n is an inheritance the individual receives at age $n < R$, $y(R)$ is constant retirement income, which assumed to be lower than wage income, and $A_{s-1}(1+r)$ is initial wealth. The individual can choose to retire any time between s and the mandatory retirement age M. I assume retirement to be an absorbing state. To solve the model I first derive the optimal path for c_t and l_t taking R as given. Then I discuss the trade-off the individual faces when choosing the optimal R.

D.2 Consumption and leisure decision

Fully Expected Inheritance

If the individual has full awareness of the future inheritance, she sets an optimal path for c_t and l_t already taking I_n into account. Allowing only an interior solution for

---

[23] The elasticity of intertemporal substitution and the elasticity of substitution between c_t and l_t are both assumed to be equal to one. Note that allowing the elasticity of intertemporal substitution to differ from one results in non-separability between c_t and l_t.

the leisure choice, thus discarding the $l_{t<R} = T$ scenario, the first-order conditions with respect to c_s and l_s imply

$$c_s = \frac{1}{\lambda} D_s \theta, \tag{D.4}$$

$$l_s = \frac{1}{\lambda} \frac{D_s}{w_s} (1 - \theta), \tag{D.5}$$

where λ is the marginal utility of lifetime income which summarizes all relevant information affecting c_s and l_s from all periods other than s. For ages above s, the first order conditions imply

$$c_t = c_s \frac{D_t}{D_s} \left(\frac{1+r}{1+\rho} \right)^{t-s} \quad \forall\, t \in \{s, ..., L\}\,, \tag{D.6}$$

$$l_t = l_s \frac{D_t}{D_s} \frac{w_t}{w_s} \left(\frac{1+r}{1+\rho} \right)^{t-s} \quad \forall\, t \in \{s, ..., R-1\}\,. \tag{D.7}$$

Substituting Eqs. (D.4) to (D.7) in the budget constraint (D.3), allows finding an expression for λ which can then be used to find a solution for the optimal values of c_s and l_s. The latter are a function of r, ρ, θ, lifetime wages, full retirement income, the lifetime path of D_t, R, and I_n.[24] Since it is expected, the inheritance is already taken into account from age s and it does not have an impact upon receipt. The relative values of the parameters r and ρ determine how the inheritance (jointly with the other components of lifetime income) is allocated over time, while the preference parameter θ determines how it is allocated between consumption and leisure.

Fully Unexpected Inheritance

In case the individual considers the chance of receiving an inheritance to be zero at every age, the path chosen for c_t and l_t at age s is the same as with a fully expected inheritance but setting $I_n = 0$. However, if the individual receives an unexpected inheritance at age $n < R$, she then re-optimizes current and future choices taking into account the new information. The effect of the inheritance on consumption and leisure is given by the forecast error $\nu_t = c_t^n / c_t^s = l_t^n / l_t^s$,[25] where the superscripts n and s indicate consumption and leisure as planned at age n and s respectively. Keeping R fixed, the forecast error can be expressed as

$$\nu_t = \frac{\lambda^s}{\lambda^n} = \frac{I_n}{\sum_{t=n}^{R-1} \frac{w_t T}{(1+r)^{t-n}} + \sum_{t=R}^{L} \frac{y(R)}{(1+r)^{t-n}} + A_{n-1}(1+r)} + 1, \tag{D.8}$$

where λ^s and λ^n denote the marginal utility of lifetime income that results from the optimizations at age s and at age n respectively, and A_{n-1} is wealth accumulated up to age $n-1$.[26] Equation (D.8) shows that the forecast error is conditioned by the size

24 For the full solution to this part of the model, see the extensions of the model in Suari-Andreu (2018).

25 The forecast error is the same for consumption and leisure when expressed in relative terms. In absolute terms, the forecast error differs for consumption and leisure according with the preference parameter θ.

26 For a full derivation of the forecast error, see the extensions of the model in Suari-Andreu (2018).

of the inheritance in relation to pre-inheritance wealth and future (potential) labour income and retirement income streams. The sum of all future streams of $w_t T$ and $y(R)$ is lower the older the individual is, which implies that, keeping everything else fixed, ν_t increases with age. The positive age dependence of ν_t is a result of the usual life-cycle model prediction stating that any unexpected transitory shock will be smoothed across the remaining lifetime horizon.

Using Eqs. (D.6) and (D.7) to express the yearly change in c_t and l_t, substituting in the definitions of ν_t and D_t, and taking the natural logarithm on both sides of the expression, allows writing the change in consumption and leisure as

$$\Delta \ln c_t = \ln\left(\frac{1+r}{1+\rho}\right) + \boldsymbol{\delta}'\Delta\mathbf{Z}_t + \Delta \ln \nu_t \quad \forall\, t \in \{s, ..., L\}, \tag{D.9}$$

$$\Delta \ln l_t = \ln\left(\frac{1+r}{1+\rho}\right) - \Delta \ln w_t + \boldsymbol{\delta}'\Delta\mathbf{Z}_t + \Delta \ln \nu_t \quad \forall\, t \in \{s, ..., R-1\}, \tag{D.10}$$

where $\Delta \ln \nu_t = \ln \nu_t$ if $t = n$, and $\Delta \ln \nu_t = 0$ otherwise. That is because at period n the lifetime profiles of consumption and leisure jump from the optimal path set at period s to the new optimal path set once the unexpected inheritance is received. Note that if the elasticity of intertemporal substitution is allowed to be different from one, then there is non-separability between consumption and leisure and the wage change would also feature in Eq. (D.9). That is because with non-separability the marginal utility of consumption (leisure) depends on leisure (consumption), and changes in the wage rate affect consumption through their effect on leisure. For the sake of simplicity, and without loss of generality with respect to the effect of inheritance receipt, I ignore here any cross-derivative effects between consumption and leisure.

D.3 Retirement decision

Fully Expected Inheritance

Given the optimal choices for consumption and leisure conditional on R, they can be substituted into the utility function (C.1) to set up an optimization problem in which R is the only choice variable. The individual chooses then the optimal R which can take values from s up to the mandatory retirement age M. Following the modelling approach of Stock and Wise (1990), I express the value of retiring at age t conditional on not having retired before as

$$G_t(\bar{R}) = U(\bar{R}) - U(t) \quad \forall\, t \in \{s, ..., M-1\}, \tag{D.11}$$

where $\bar{R}$ is the retirement age that maximizes $U(\cdot)$ out of the set of possible retirement ages ahead of age t, and $G_t(\bar{R})$ is the utility difference between postponing retirement up to $\bar{R}$ and retiring at t. The individual decides to keep working at age t if $G_t(\bar{R}) > 0$ and retires if $G_t(\bar{R}) \leq 0$. If the individual knows whether she is going to receive an inheritance, then there is no uncertainty and at age s she already solves (C.11) for every possible retirement age and chooses the optimal R.

The trade-off between quitting the work force and keeping the option value of retirement comes from the fact that if ϕ is large the individual would like to retire early, however, by doing so she incurs a reduction in lifetime income because retirement income is lower than wage income. Keeping everything else constant, receiving an inheritance increases lifetime income thus, if it is large enough, it may compensate for the costs of retiring early. Therefore, the individual is more likely to plan an earlier retirement when she expects to receive an inheritance compared to when she does not.

Fully Unexpected Inheritance
Besides the re-optimization of consumption and leisure, an unexpected inheritance receipt also leads to a re-optimization of R. If the individual is indifferent between retirement and continued work, i.e. $\theta = 1$ and $\phi = 0$, then the inheritance is distributed between consumption before and after retirement and R remains unchanged. However, if the individual's taste for leisure is strong enough and the value of the inheritance compensates for the costs of retiring earlier, then it pays off to revise the optimal R downwards. In that case, the forecast error is not defined as in Eq. (D.8) since λ^n and λ^s differ not only due I_n but also due to $R^n \neq R^s$.

As mentioned, a decrease in R implies a drop in lifetime income because retirement income is lower than wage income. If this change results in a decline in lifetime income that offsets I_n, then $\ln \nu_t = \ln 1 = 0$, which implies that the individual spends the whole inheritance by retiring earlier and there are no consumption and leisure responses.[27] Note however that the room to change R critically depends on how far ahead the individual is at age n from the retirement age initially set (R^s) before the news about the inheritance. Therefore, what matters is not whether an individual who receives an inheritance retires earlier than the mandatory age, but whether she retires earlier than planned at age s and how far she is from R^s at age n.

References

Andersen S, Nielsen KM (2010) Participation constraints in the stock market: evidence from unexpected inheritance due to sudden death. Rev Financ Stud 24(5):1667–1697

Attanasio O, Banks J, Meghir C, Weber G (1999) Humps and bumps in lifetime consumption. J Bus Econ Stat 17(1):22–35

Banks J, Blundell R, Tanner S (1998) Is there a retirement-savings puzzle? Am Econ Rev 88(4):769–788

Been J, Suari-Andreu E, Knoef M, Alessie R (2021) Consumption and time use responses to unemployment. Netspar Design Paper 187

Blinder A (1988) Comments on chapter 1 and chapter 2. In: Kessler D, Masson A (eds) Modelling the accumulation and distribution of wealth. Clarendon Press, Oxford, pp 68–76

Blundell R, MaCurdy T (1999) Labor supply: a review of alternative approaches. In: Ashenfelter O, Card D (eds) Handbook of labor economics, vol 3a. Elsevier, Amsterdam, pp 1559–1695

Bø E, Halvorsen E, Thoresen T (2019) Heterogeneity of the Carnegie effect. J Hum Resour 54(3):726–759

Bönke T, Grabka M, Schröder C, Wolff E, Zyska L (2019) The joint distribution of net worth and pension wealth in Germany. Rev Income Wealth 65(4):834–871

Boserup S, Kopczuk W, Kreiner C (2016) The Role of bequests in shaping wealth inequality: evidence from Danish wealth records. Am Econ Rev 106(5):656–661

Brown J, Weisbenner S (2004) Intergenerational transfers and savings behavior. In: Wise DA (ed) Perspectives on the economics of aging. University of Chicago Press, Chicago, pp 181–204

Brown J, Coile C, Weisbenner S (2010) The effect of inheritance receipt on retirement. Rev Econ Stat 92(2):425–434

Cesarini D, Lindqvist E, Notowidigdo M, Östling R (2015) The effect of wealth on individual and household labor supply: evidence from Swedish lotteries. NBER Working Paper 21762

[27] For more details on this, see the extensions of the model in Suari-Andreu (2018).

Christelis D (2011) Imputation of missing data in waves 1 and 2 of SHARE. SHARE Working Paper 01-2011
Coile C, Levine P (2006) Bulls, bears, and retirement behavior. ILR Rev 59(3):408–429
Cox D, Stark O (2005) Bequests, inheritances and family traditions. Boston College Centre for Retirement Research Working Paper 2005-09
Doorley K, Pestel N (2020) Labour supply after inheritances and the role of expectations. Oxford Bull Econ Stat 82(4):843–863
Druedahl J, Martinello A (2020) Long-run saving dynamics: evidence from unexpected inheritances. Rev Econ Stat 1–44
Eder A (2016) The impact of inheritances on the retirement behaviour of older Europeans. Empirica 43(2):299–331
Elinder M, Erixson O, Waldenström D (2018) Inheritance and wealth inequality: evidence from population registers. J Public Econ 165:17–30
Elinder M, Erixson O, Ohlsson H (2012) The impact of inheritances on heirs' labor and capital income. BE J Econ Anal Policy, 12(1)
Gale W, Scholz J (1994) Intergenerational transfers and the accumulation of wealth. J Econ Perspect 8(4):145–160
Garbinti B, Georges-Kot S (2016) Time to smell the roses? The effect of inheritance receipt on retirement. INSEE Working Paper G2016/01
Holtz-Eakin D, Joulfaian D, Rosen H (1993) The Carnegie conjecture: some empirical evidence. Q J Econ 108(2):413–435
Holtz-Eakin D, Joulfaian D, Rosen H (1994) Sticking it out: entrepreneurial survival and liquidity constraints. J Political Econ 102(1):53–75
Hurst E, Lusardi A (2004) Liquidity constraints, household wealth, and entrepreneurship. J Political Econ 112(2):319–347
Imbens G, Rubin D, Sacerdote B (2001) Estimating the effect of unearned income on labor earnings, savings, and consumption: evidence from a survey of lottery players. Am Econ Rev 91(4):778–794
Isakjee A (2017) Welfare state regimes: a literature review. IRIS Working Paper 18/2017
Joulfaian D (2006) Inheritance and saving. NBER Working Paper 12569
Joulfaian D, Wilhelm M (1994) Inheritance and labor supply. J Hum Resour 24(4):1205–1234
Karagiannaki E (2017) The impact of inheritance on the distribution of wealth: evidence from Great Britain. Rev Income Wealth 63(2):394–408
Kotlikoff L (1988) Intergenerational transfers and savings. J Econ Perspect 2(2):41–58
Krueger A, Pischke J-S (1992) The effect of social security on labor supply: a cohort analysis of the notch generation. J Labor Econ 10(4):412–437
McFall B (2011) Crash and wait? The impact of the great recession on the retirement plans of older Americans. Am Econ Rev 101(3):40–44
Modigliani F (1988) The role of intergenerational transfers and life cycle saving in the accumulation of wealth. J Econ Perspect 2(2):15–40
Nekoei A, Seim D (2021) How do inheritances shape wealth inequality? Theory and evidence from Sweden. CESifo Working Paper 9017
Parker J, Souleles N, Johnson D, McClelland R (2013) Consumer spending and the economic stimulus payments of 2008. Am Econ Rev 103(6):2530–2553
Piketty T, Zucman G (2014) Wealth and inheritance in the long run. In: Atkinson A, Bourguignon F (eds) Handbook of income distribution, vol 2B. Elsevier, Amsterdam, pp 1303–1368
Rubin D (2004) Multiple imputation for nonresponse in surveys. Wiley, New York
Sila U, Sousa R (2014) Windfall gains and labour supply: evidence from the European Household Panel. IZA J Labor Econ 3(1):1–27
Stark O, Nicinska A (2015) How inheriting affects bequest plans. Economica 82(s1):1126–1152
Stock J, Wise D (1990) Pensions, the option value of work, and retirement. Econometrica 58(5):1151–1180
Suari-Andreu E (2018) Housing, savings and bequests over the life cycle. PhD Thesis, University of Groningen
Wolff E (2002) Inheritances and wealth inequality, 1989–1998. Am Econ Rev 92(2):260–264
Wolff E (2003) The impact of gifts and bequests on the distribution of wealth. In: Munnell A, Sundén A (eds) Death and Dollars. Brookings Institution, Washington, pp 345–375