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Abstract

This study uses the German SAVE panel study in order to estimate the effect of intergenerational transfers on the expected retirement entry age of individuals. The literature in this field typically estimates the transfer effect on the actual retirement probability. We suggest to base the analysis on the expected retirement age instead. This entails two methodological advantages: First, it is possible to exploit the within individual variation for the entire sample (even of those who do not retire) and thereby permits to analyze the life-cycle considerations of younger age groups. Second, the effect size can easily be expressed in terms of time and thereby monetary opportunity costs. We find that heirs expect to retire earlier, even when receipts are expected to some degree. Specifically, heirs plan to retire four to five months earlier and thereby accept costs in the form of foregone income and pension entitlements corresponding to 20-30% of the inheritance.

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I. Introduction

Economists have recently devoted much attention to the increasing relevance of intergenerational transfers. Piketty (2011) and Piketty and Zucman (2014) for instance find evidence for increasing bequest flows and warn about a return of a rentier society. Elinder et al. (2016) and Boserup et al. (2016) analyze the immediate distributional impacts of bequest flows and Boserup et al. (2014) and Adermon et al. (2016) relate transfer accrual to intergenerational wealth mobility. All these works point to different dimensions of the consequences intergenerational transfer flows will probably entail. But almost all of these papers fail to take the behavioral adjustments to wealth shocks into account: How are households responding economically to a bequest receipt? A response to these kind of questions is key to a deeper understanding of how the awaited inheritance flows will change living in western societies.

In this paper, we want to quantify individuals' economic responses to wealth transfers.[1] The economic responses can of course materialize in very different dimensions: Among others, Elinder and Erixson (2012) for instance identify a reduction in the intensive margin of labor supply after bequest receipt. Similarly, individuals might increase their level of consumption (Hrung, 2004) or, having bequest motives themselves, primarily add wealth gains to their savings. The tracking of economic reactions is furthermore complicated by the timing of reactions that are apparently subject to complex life-cycle considerations: Inheritances are certainly among those wealth gains that can be expected. Individuals might thus have adjusted their labor supply, savings and consumption to their loosened intertemporal budget constraint long before the wealth gain becomes visible to the econometrician. Bo et al. (2015), furthermore, convincingly show that economic reactions might still occur several years *after* the receipt.

In face of these methodological challenges, economists have recently focused on a lifetime event that appears particularly well-suited to circumvent some of these problems: The retirement decision of individuals. Retirement is a major change in the individuals economic life-cycle and thereby subject to long standing, deliberate considerations. It is furthermore typically irreversible and comparably simple to track in data. And despite decreasing replacement rates of public pension schemes,[2] most people still face a financially stable and predictable future when leaving

[1] Our paper thus undertakes a slight shift in the perspective: Typically, the literature uses wealth transfers as exogenous variation in wealth in order to track the individuals' economic responses to wealth shocks. Savings, consumption and labor supply are likely to be planned simultaneously, using such exogenous variation is thus required to estimate behavioral repercussions of changes in wealth on one of these dimensions.

[2] In the early 2000s the German public pension system experienced a significant period of reform. Formerly equipped with relatively high replacement rates from the statutory pension increasingly required individuals to private provision in a multi-pillar system. See Börsch-Supan et al. (2014) and Geyer and Steiner (2010) for a description and evaluation of the

the labor force.[3] Brown et al. (2010), Bo et al. (2015), Garbinti and Georges-Kot (2016), Blau and Goodstein (2016) are recent studies[4] looking at effects of intergenerational transfers on labor supply exits. The literature typically estimates changes in the probability to retire after bequest receipt. In line with economic intuition, recipients in most studies show a significantly higher probability to retire. An ongoing debate in the literature however revolves around expectations: Brown et al. (2010) presented the first study controlling for expectations about future transfers. While they find that expectations matter for the strength of the economic reaction, they do not find statistically significant differences between the point estimates for expected and for unexpected transfer receipts. Surprisingly, individuals do not seem to adjust to expected transfers *before* receipt. The authors hypothesize that risk averse individuals would only take the certainty equivalent of the expected transfer into account and not its expected value. Garbinti and Georges-Kot (2016) indeed find weak evidence for this presumption: Risk averse individuals seem to show stronger, albeit again not significantly different reactions to transfers than risk neutral ones. The authors also suggest credit constraints as possible alternative explanation for the non-adjustment to expected transfers.[5] With this paper, we want to tackle two remaining gaps in the literature: First, effect sizes, mostly expressed in changes in the retirement probability following a transfer receipt of non-uniform size, are difficult to compare across studies.[6] Second, most studies dismiss the life-cycle dimension of retirement entry and wealth shocks. The corresponding implications might e.g. well explain the ambiguity of expectations in the last publications.

With the current paper, we suggest to look at the effect of intergenerational transfers on the extensive margin of labor supply by using the self-reported individual *expected retirement age* as dependent variable. Doing so comes with some advantages over the regular estimation of retirement probabilities: The retirement decision apparently is a matter of long-term life-cycle considerations. When modelling retirement probabilities, however, studies focus on a narrow time span before the typical retirement entry age. The *expected retirement age* instead is available for all age groups and thereby permits to analyze the effect of a wealth gain in a life-cycle perspective.[7]

major reforms. Also, we are confident that the reform efforts do not interfere with our analysis: Most reforms already took effect before our sample period. Only the long-discussed gradual prolongation of the statutory pension age by two years introduced in 2007 kicked in later. We control for potential effects of this reform.

[3] In an interesting paper, Dolls et al. (2016) test how informing individuals about their pension entitlements affects the savings behavior.

[4] Holtz-Eakin et al. (1993) and Joulfaian and Wilhelm (1994) were the first studies assessing the relationship between inheritance receipt and labor market participation.

[5] We tested whether risk attitude or being credit constrained matters for the effect of inheritance receipt on retirement plannings. Our results did not consistently back the mentioned hypotheses. Results are available upon request.

[6] The calculation of marginal effects also require the unconditional retirement probability in the sample and is thus highly depending on the data composition. Many studies also ignore possible non-linearities in their specifications.

[7] We focus here on age effects. Since we only have a sample period of 5 years, we do not find relevant differences in the behavior of individuals from different cohorts.

In fact, the *expected retirement age* should already contain the entire life-cycle considerations of individuals after bequest receipt, albeit only the *expected* instead of the *revealed* ones.[8] The *expected retirement age* is surveyed in multiple periods and thus permits to exploit the within-individual variation over time. A feature that also helps us to preclude potential biases due to unobserved time-constant heterogeneity that can well introduce a spurious correlation between bequest size and individual behavior. We thus claim to provide causal estimates of the effect of inheritances on the retirement behavior. Expressing effects in terms of time furthermore allows us to monetize the individuals economic response to transfer receipts: Specifically, we predict individual shifts of the expected retirement entry age attributable to inheritance receipts and translate these time ranges into monetary terms by calculating the opportunity cost of the earlier retirement. These costs consist of the foregone labor income and the penalized statutory pension income during retirement. Relating these economic costs of earlier retirement to the actually received inheritance amount gives in our opinion a more informative picture of the scale of the economic response to wealth gains. In contrast to previous papers in this field, we are able to answer the question: How much of an intergenerational transfer do households typically spend on earlier retirement?

We are studying the effect of transfers on the extensive margin of labor supply in Germany using a particularly well-suited, representative panel data set: The SAVE survey data was designed for studying retirement decisions and covers specifically the financial environment of individuals, their labor market history and their expectations about their financial future. Our sample period ranges from 2005 to 2010. A minor downside of the data set is the relatively small sample size.[9]

Our results are as follows: Transfers lead on average to a moving forward of the expected retirement entry by about four to five months. The labor market response to unexpected transfers seems to be stronger than to expected transfers, albeit taking effect later. When using our main estimation results in order to monetize the change in the expected retirement age, we find heirs expecting to spend on average one third of their inheritance on a moving forward of their retirement entry.

The remainder of the paper is organized as follows: Section II covers the description of the SAVE data set, provides some descriptive statistics, and introduces in the methodology used in the analysis. Our results are presented in Section III, we conduct some robustness checks in Section IV and discuss our results in Section V. We conclude in Section VI.

[8] Critics may respond that inheritances typically accrue in the age group close to retirement anyway. While this is true for many individuals, there is a sizable share of individuals inheriting in their prime working age. Also, the temporal proximity of bequest accruals and usual retirement entry bedevils the identification of the causal effect of transfers on the retirement probability when resorting to cross-sectional variation.

[9] We also only observe comparably few retiring heirs in the sample. While we tested modelling the actual retirement entry age depending on inheritances, we do not report the results here.

II. Data and Methodology

II.1. The German SAVE Study

We use the German SAVE (Sparen und Altersvorsorge in Deutschland) panel survey from the Munich Center for the Economics of Aging (MEA) to conduct our analysis. The SAVE has firstly been surveyed in 2001 and was specifically designed for research on retirement planning and old-age provision of households. We use the SAVE waves from 2005 to 2010 as they provide us with 5 consecutive years of panel observations. The survey is conducted on the household level and covers up to 3,000 households. Compared to other data sets, the SAVE is rather small.[10] We have however decided to use this data set as it permits us to put the labor supply decisions of heirs into a broad life-cycle perspective.[11]

Labor market variables and expectations about future transfers are recorded at the (quasi-) individual level in that the respondent answers most questions for him and his spouse. For most of our analysis, we treat the adults of observed households as distinct observations on the individual level. We are thereby able to increase the number of observations to roughly 26.000. As survey data, particularly with respect to wealth, is always prone to item non-response issues, the SAVE data provides numerous variables with 5 implicates.

We now briefly describe the key variables of the study and provide the corresponding descriptive statistics:

Expected retirement Respondents of the SAVE survey are asked annually, at what age they expect to retire or to receive pension income.[12] Panel *a* and *b* of table 1 describe the expected retirement age over age groups for the entire sample and for heirs respectively. The statistics show that the expected retirement age neither varies substantially over age groups, nor are there considerable differences between the full sample and heirs. It is rather conclusively close to the

[10]We thus do not analyze subgroups in this paper.

[11]The SAVE provides us for instance with data on old-age provision, the expected retirement age, expectations about future inheritances and future replacement rates during retirement. The SAVE is also very detailed with respect to household finances and socio-demographics. The SOEP data instead might have provided us with many more observations of actually *observed* retirement entries. It however collects less information on retirement-relevant dimensions and has e.g. only surveyed the *expected retirement age* in 1987. It has also only surveyed expectations about future transfers once, i.e. in 2001.

[12]In appendix VII.1 we provide the reader with some background information about the actual retirement behavior in the sample. We naturally exclude all observations that are already retired in the first period of of our sample.

statutory retirement age of 65 years.[13]

Table 1: *Descriptives - Key variables over age groups*

Age group	< 30	30-49	50-59	60-69	70-79	> 80	total
a. Expected retirement age:							
Mean	65.95	64.93	63.83	64.49	.	.	64.82
St. Dev.	4.14	3.62	2.88	3.08	.	.	3.64
b. Expected retirement age of heirs[1]:							
Mean	64.63	64.86	63.97	64.37	.	.	64.56
St. Dev.	3.08	3.18	2.43	1.65	.	.	2.91
c. Share of recipients[2] and heirs[1]:							
Recipients	.0148	.0280	.0425	.0452	.0355	.0233	.0332
Heirs	.0242	.07	.1014	.1185	.0969	.0654	.0828

Based on SAVE 2005-2010, own calculations. Estimates are weighted.
[1] Heirs are considered heirs if they have received an inheritance in the current or any previous period.
[2] Recipients are those individuals that have received a transfer in the current period.

Intergenerational transfers The SAVE data surveys inheritances and records the size and the wealth type of transfers on the household level.[14] Overall the dataset contains 537 distinct inheritances on the household level. We however do not know which household member is the recipient. We assign a transfer that has been received by a household to both spouses in order to measure the individual level effects of the actual respondent. This translates into 901 individuals that live in a household that currently received a transfer, which is equivalent to a share of 3.3% of the entire sample over the observation period of five years. Blau and Goodstein (2016) find that primarily the actual heir or heiress is most likely to adjust its labor supply. The assignment of the transfer to both spouses thus introduces a measurement error in the explanatory variable. This will tend to bias our estimates downwards (attenuation bias).

In each wave respondents report the probability with which they expect to receive a transfer in the upcoming two periods. We treat inheritances as expected if the stated probability for any household member is above zero.[15] The mean size of transfers ranges from 24,000 to 55,000 over

[13] One might directly compare the ages of observed retiring individuals with their previously stated expected retirement ages. We abstain from this comparison, as its results are likely to suffer from a severe bias: Since our sample period only covers 5 years, we can merely observe a retiring individual understating its expected retirement age by a maximum of 5 years. However, individuals might overestimate their expected retirement age by any margin.

[14] We base our analysis on actually observed inheritances and thus do not use the imputed transfers.

[15] Unfortunately, we cannot analyze the change in expectations about future transfers. Changes in the stated probability over time might either result from arrival of new information about the expected event or simply from the fact that the respondent is chronologically closer to the period of the expected event. Unfortunately, the data set lacks a variable that

the time span. The average transfer as a share of total current net wealth has a mean of 38% and median of 8% for individuals with positive wealth. The mean share of the transfer relative to net wealth less of the transfer size $\left(\frac{TransferAmount}{NetWealth-TransferAmount}\right)$ is around 50% for individuals with positive net wealth.

Table 2 summarizes accrual and size of intergenerational transfers and corresponding expectations. Panel *a* reports for instance that for 2006 we observe 227 individuals living in households that received a transfer. Panel *c* clarifies that of these 227 transfers only 57 were expected. In return, 656 individuals stated in previous periods to expect a transfer with a positive probability in the next two periods. The low fraction of received transfers out of the high number of expected transfers is not inconsistent since the stated probabilities for receipt agglomerate between 10 and 30%.

Table 2: *Descriptives - Intergenerational Transfers*

	2005	2006	2007	2008	2009	2010	total
a. Accrual of transfers:							
Number of incidents	95	227	203	151	123	102	901
Share of recipients	.0245	.0419	.0371	.0348	.0300	.0240	.0332
b. Size of transfers (cond. on receipt):							
Mean	34791.23	54190.12	46602.75	24904.05	34724.8	42105.53	41675.65
Minimum	540.54	745.47	624.35	608.52	606.67	700	540.54
Maximum	281081.1	1171459	624349.7	202839.8	328614.8	385000	1171459
c. Expected transfers [1]:							
Individuals expecting	.	656	1224	1089	861	874	4704
Thereof receiving	.	57	103	75	59	56	350
Mean size of exp. transfers	.	49619.33	51739.3	29252.26	39427.17	57725.71	45160.11

Based on SAVE 2005-2010, own calculations. Estimates are weighted.
[1] As we do not observe expectations for 2003 and 2004, we cannot provide the statistics for 2005.

As we will explain in detail below, calculating the opportunity costs of retirering earlier requires to know the expected retirement duration and the expected retirement income.

Expected retirement duration In order to get a measure of the expected retirement duration we have to (at least partly) rely on external data sources. We use a mortality table[16] that differentiates life expectancy with respect to age, gender and east and west German origin respectively. We combine these data with a SAVE variable that covers how long individuals expect to live compared to their age cohort. Mean and Median of this variable are virtually zero. Generally, by far most people do not expect to deviate from their peers. The difference between the expected retirement age and the calculated individual life expectancy then yields the expected retirement duration.

enquires whether the respondent expects to receive a transfer at all.

[16]The data is provided by the Max Planck Institute for Demographic Research and publicly accessible at `http://www.mortality.org/`

Expected retirement income The SAVE includes a variable that contains the percentage of current income that the individual expects to receive from the statutory pension scheme during retirement.[17] We obtain the expected retirement income by multiplying this variable with current individual net income. Therefore, we can abstain from an inflation adjustment. We neglect private and company pension claims. Table 3 summarizes the variables underlying the expected retirement income calculation over income quintiles. The average share of the expected statutory pension income is relatively constant over the income distribution.

Table 3: *Descriptives - Income and Expected Pension Income*

Income quintile	1	2	3	4	5	total
a. Individual monthly net income [in Euro]:						
Mean	260.18	771.03	1177.45	1673.2	3111.55	1396.92
Std. deviation	186.27	133.47	112.47	178.92	1976.73	1322.04
b. Total expected income during retirement [as % share of current income]:						
Average share	66.89	66.82	68.35	69.05	69.48	68.26
Std. deviation	17.55	16.68	16.84	15.63	16.01	16.51
c. Expected statutory pension income [as % share of current income]:						
Average share	53.67	53.74	55.34	56.15	55.88	55.03
Std. deviation	17.49	16.56	16.37	15.02	15.85	16.27

Based on SAVE 2005-2010, own calculations. Estimates are weighted. Income deciles are based on individual income.

Control Variables Table 9 in the appendix presents a summary of statistics for the control variables used for our main results in section III for the entire sample and the subsample of heirs. Our main controls are *age*, *individual net income* (in logs), a dummy set controlling for self-reported *health status*, controls for the *employment type* (civil servant, self-employed, regular employment), *unemployment history* (never unemployed, long term unemployed), *educational achievements*, living in *east Germany* and *time* effects. We furthermore control in all our specifications for the birth-cohort specific statutory retirement entry age. Table 11 in the appendix shows how the statutory retirement age varies.[18]

Because of endogeneity concerns, we exclude wealth as control variable in our main specification, but will come back to the role of wealth in Section IV.1.[19] We explore the concept of wealth

[17] In order to reduce the number of missing observations we simulate this variable with an OLS model. In total, we gain 12 observations for our analysis.

[18] The default statutory pension age was 65 for all cohorts before 2007 and depends on birth cohort since then. That is, the *statutory pension age* varies over time and cohorts in our sample. See Buslei et al. (2017) for a recent analysis of the implications of this reform.

[19] Wealth could indeed still be correlated with inheritances: First, by previous transfers, i.e. gifts, that reduce the inheritance and increase the wealth of the children. Second, testators' bequest motives could be driven by the wealth of their heirs. After all, we address these concerns in a robustness check in IV.1.

in the SAVE data further in the appendix section VII.1.

Table 9 in the appendix shows that the median household income is around 2,100 Euro. Heirs are on average a bit older, richer, and have higher income and seem to be better educated compared to the entire sample.

II.2. Conceptual Approach and Estimation Methods

This paper primarily addresses the question, how inheritance receipt affects the early retirement behavior. In an optimal setting we would observe individuals and households over their entire life-cycle. This would allow us to draw conclusions about how individuals and households respond later in life to inheritances received at any earlier stage. While such data is not available, relying on cross-sectional variation to answer the research question entails two major disadvantages: As noted in the descriptive statistics, most inheritances are received at an age between 60 and 69. As this is also the typical age range for retirement entry, it is likely that cross-sectional analysis suffers from spurious correlation. In order to deal with the limitations at hand, we will instead ask how inheritances affect the *expected retirement age*. The expected retirement age is available for all age groups and part of the survey in all periods which allows us to exploit the within variation. Thereby, we prevent our estimates from being biased by unobservables that influence both the retirement decision and transfers.[20] Our main results depend on a linear fixed effects model with the following baseline specification:

$$EAR_{it} = \gamma_1 + \theta_t + \beta_1 D_{ht} + \beta_2 A_{ht} + \beta_3 A_{ht}^2 + Z_{it}\gamma_k + \alpha_i + u_{it}, \quad (1)$$

with EAR_{it} as the expected age at retirement of individual in period $t = 2005, 2006, ..., 2010$, a set of time dummies θ_t, individual effect α_i, a dummy D_{ht} indicating if the individual i is part of a household h that received an inheritance in period t, A_{ht} and A_{ht}^2 being the linear and squared Euro value of the inherited amount respectively (in 10T). In order to assure a consistent estimation of the standard errors, we cluster on the household and individual level in all specifications. Z_{it} is a list of individual and household specific control variables consisting of a third order polynomial of the individuals age, logarithmic household net income, the statutory retirement age, a dummy set for self-reported health status (5-point-scale from very good to very bad), and indicators for being self-employed, civil servant, unemployment history and living in East Germany. The error

[20] Specifically, we think of earlier inheritances, family background and thereby determined values and disutility from work. More such variables are conceivable.

term u_{it} is assumed to be uncorrelated with any of the covariates given α_i. The estimated $\hat{\beta}$s are the paramters of interest, that we will employ for our further calculations as described in the Section II.3.

Equation 1 is our main specification. For analyzing whether expectations regarding future inheritance receipts matter, we slightly extend it by interacting the inheritance variables with an dummy variable indicating whether a transfer is expected. The specification then changes to:

$$EAR_{it} = \gamma_1 + \theta_t + \beta_1 D_{ht} + \beta_2 A_{ht} + \beta_3 A_{ht}^2 + \delta d_{hj} + \epsilon_1 d_{hj} D_{ht} + \epsilon_2 d_{hj} A_{ht} + \epsilon_3 d_{hj} A_{ht}^2 + Z_{it}\gamma_k + \alpha_i + u_{it}, \tag{2}$$

where d_{hj} is the dummy indicating that household h in period $j \in (t-1, t, 2005)$ expected ($d_{hj} = e_{ht-1}$) to receive a transfer. ϵ-denoted variables cover the respective interaction effect.

In a further specification we include lagged inheritance dummies and interact them with the expectations indicator:

$$EAR_{it} = \gamma_1 + \theta_t + \sum_{\tau=t-2}^{t} \left(\beta D_{h\tau} + \delta e_{i\tau-1} + \eta D_{h\tau} e_{i\tau-1}\right) + Z_{it}\gamma_k + u_{it} \tag{3}$$

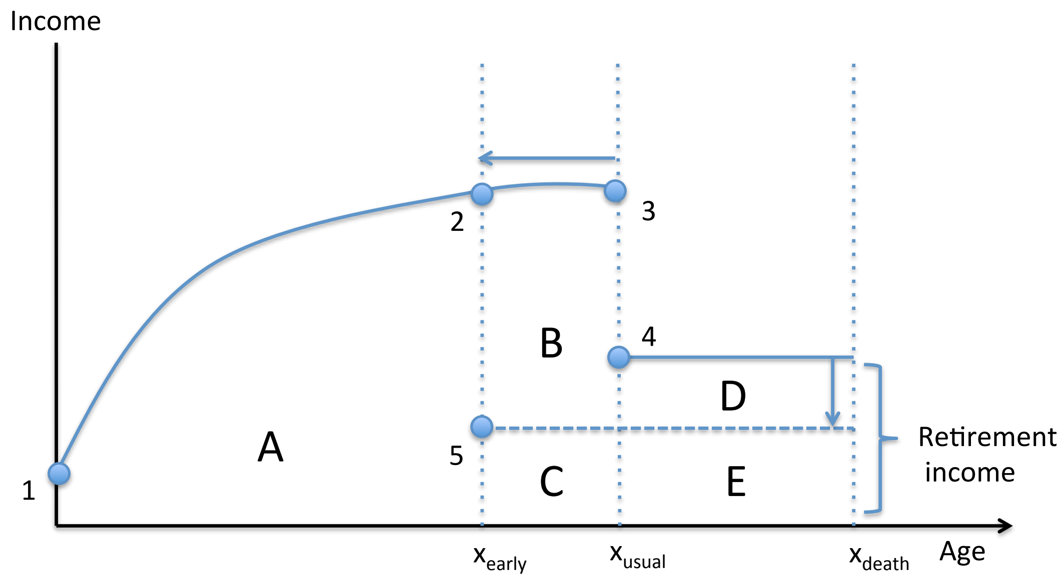
This will allow us to analyze if the adjustment of the expected retirement age after the receipt of an unexpected inheritance takes time as for instance the results in Bo et al. (2015) suggest.

II.3. Monetary Cost of Early Retirement

II.3.1 Problems with Direct Interpretations of Changing Retirement Durations

In order to interpret the influence of inheritances on early retirement behavior, various approaches are conceivable. Most other studies estimate how transfers affect the probability to retire through different econometric models (e.g. Probit (Brown et al., 2010; Joulfaian and Wilhelm, 1994) or survival models (Garbinti and Georges-Kot, 2016)). Similarly, other studies evaluate the labor force participation rate depending on heir status (Holtz-Eakin et al., 1993; Blau and Goodstein, 2016). An estimated probability is however difficult to link to the opportunity costs an early retiring household is facing, even thouth these costs are crucial for the retirement decision. It would therefore be more informative to express the effect in the dependent variable in monetary terms in

Figure 1: *Monetary Effect of Early Retirement*



order to relate it to the value of the inheritance.[21]

In other words, retiring a year earlier can mean monetarily different things depending in particular on the expected income path and the expected duration of retirement. Specifically, we ask what individuals give up when they decide to retire early in relation to what they gain by the inheritance. This approach will permit us to answer the question: What part of the inheritance is virtually spent on early retirement?

II.3.2 A Graphical Illustration of the Monetary Cost of Early Retirement

Figure 1 is a stylized graphical illustration of our method to measure what households give up when they retire early.[22] Imagine an individual with an age somewhere below x_{early} earning an income as shown by the curve connecting points 1 and 2.[23] The individual forms expectations about her income over her entire life-cycle. In the case of retirement at age x_{usual} it expects to earn

[21]Expressing the inheritance amount in terms of the households income or wealth (as e.g. done in Brown et al. (2010)), is certainly preferable over a simple specification, but does not solve the key issue.

[22]We thus interpret the financial quantities here as stocks, i.e. we add up flows as e.g. income to aggregates comparable to the wealth stock of received inheritances. One could of course also translate inheritances in a *fair annuity* and thus in annual payments comparable to the observed flows. Such an approach is e.g. taken by Bönke et al. (2017).

[23]Figure 1 is only a stylized illustration and does not reflect sample properties.

an income stream that follows through points 1, 2, and 3. When reaching the usual retirement age the income level drops to the height of point 4 which is equivalent to the statutory pension entitlement. The income at retirement is expected to stay constant until the individual dies at x_{death}. If the individual now decides to retire early at age x_{early} instead, the expected income stream now follows a path through points 1, 2 and 5, i.e. the individual will earn a lower retirement income but for a longer duration.[24] According to the German statutory pension scheme individuals loose 0.3% of their pension entitlement for every month of early retirement.[25] The regular pension entry age depends on the birth year (see table 11 in the appendix). The area under the income stream equals the total income over the lifecycle. In the case of retirement at x_{usual} the individual expects to acquire $A + B + C + D + E$ while in case of early retirement aggregated income only sums up to the size of the area $A + C + E$. Therefore the individual expects to monetarily give up $L = B + D$, which we will call the monetary cost of early retirement. An intuitive way to measure how much of the inheritance is spent on early retirement would be to divide L by the amount of the inheritance. Obviously, individuals also gain from retiring earlier in the form of forgone disutility of work. In a world without uncertainty, discounting and bequest motives our method could provide a way to measure the marginal utility from leisure during last periods of employment: The marginal utility of a monetary amount that is not spent on retirement should then be close to the marginal disutility of work that results from not spending the amount on retiring even earlier.

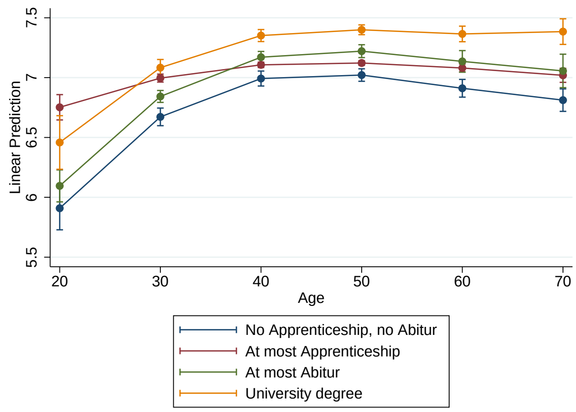
In order to estimate to which degree the inheritance is used to retire early, we first of all have to estimate x_{usual} and x_{early}. These are provided by our main estimation in section 4. In a second step, we calculate the areas C and D on the basis of the *expected retirement duration* and *expected retirement income* and the penalty term for anticipated retirement entry. We estimate the size of D on the basis of the *expected retirement duration* in the period before the wealth gain and therefore neglect that inheritances might affect the expected life expectancy. We do this in order to get a clear insight in how far the income at retirement varies only due to the effect of earlier retirement (and not due to a prolonged life[26]). Similarly, we assume that an earlier retirement does not affect the expected

[24]The retirement income of course also includes private and company pension claims. We however abstract from these income sources as it is difficult to assess how earlier pension entries affect the individual claims. The SAVE data set in fact contains a variable reflecting the overall retirement income as percentage of current income, which permits us to calculate the share of retirement income attributable to private and company pensions. Regressing this share on the expected retirement age and control variables gives a rough idea of the relationship. We do not use this information for two reasons: First, private pension contracts are very heterogeneous. Second, from the individuals' perspective, private pension contributions and withdrawals can be seen more or less as a zero sum game. The same argument applies to the savings of the household, which we ignore in our life-cycle considerations.

[25]Bönke et al. (2017) and Giesicke (2016) recently analyzed the effect of such penalty terms on the retirement behavior.

[26]See Attanasio and Emmerson (2003) for a detailed analysis between wealth and life-expectancy.

Figure 2: *Average Income over the Life-Cycle by educational achievement*



lifetime duration. Lastly, we simulate the expected foregone income[27] between the two retirement ages (the path between points 2 and 3 in figure 1). The simulation is based on a cross section estimation for the net income of non-retired individuals (see table 13 in the appendix). We regress the logarithmic individual income on a third order polynomial of age interacted with a dummy set of educational achievement and various other control variables. Figure 2 shows the simulated logarithmic individual net income for different educational achievement levels. We here follow the approach by Duan (1983) in order to yield the corresponding income in levels. We then use our estimates of x_{usual} and x_{early} in order to simulate the income at the two estimated retirement ages.[28] We average the income at the two simulated expected retirement ages and multiply the result by their estimated difference, i. e. the estimate for $\Delta\hat{x}_i = \hat{x}_{usual} - \hat{x}_{early}$. From this we have to subtract C in order to obtain the area B. Adding D to B yields the required estimate for the total costs of a moved forward retirement entry, L.

II.3.3 Discounting

In order to make the immediate monetary gain through a wealth transfer comparable to the future monetary loss through an expected change in labor supply, we have to account for inflation and discounting. In our baseline specification we will only account for inflation in order to make the monetary figures comparable. Since the simulated future labor income loss is expressed in *current*

[27]Since we are interested in the *expected* foregone income, we assume that individuals basically rely on a similar procedure: They do in fact also not know what they will earn before retirement. We thus only need to match their expectations about their future income path instead of the actual path.

[28]Since the estimates retirement ages are usually not round numbers we actually estimate the retirement income four times - each year has then two estimates: one for the round year before the simulated expected retirement age and one for the round year after.

Euros and the calculation for the expected income in retirement is based on a stated percentage of *current* income that the individual expects to receive in retirement, we do not have to further adjust these measures.

We additionally have to account for the fact that a gained current Euro is usually worth more than a future Euro even when accounting for inflation, i.e. the real interest rate is positive. We therefore present a second specification where we capitalize the wealth transfer by 3% per year until the expected early retirement date. Instead of discounting future foregone income, we translate the transfer amount in future values.

We argue here that a further adjustment (due to the discounting of future values) is unnecessary since we simply compare two monetary amounts and are not interested in the utility of current or future income changes.[29] That said, using a fixed effects estimator, allows us to control for unobserved individual differences in impatience. The estimated change in the retirement age is thus not affected by individual differences in the discount factor, as long as the discount factor is constant over time.

III. Results

At first, we present the results of regressing the *expected retirement age* in a fixed effects framework. We furthermore implement some variations by addressing questions that have appeared in the literature: How do expectations about future receipts shape the reaction to receipts? Do individuals react immediately to the receipt or only with a time lag? We then use our modelling results in order to predict the change in the expected retirement age (i.e. $\Delta\hat{x}_i = \hat{x}_{usual} - \hat{x}_{early}$ in figure 1). On the basis of this result, we are able to calculate the opportunity cost of early retirement which we then can compare to the transfer size.

III.1. Effects on the Expected Retirement Age

While using the *expected retirement age* as dependent variable certainly lacks the advantages of revealed preferences, it comes along with two features that seem particularly helpful for our analysis: The literature has raised the puzzle that subjects do not fully adjust to expected wealth shocks. Using the expected retirement age then introduces a staging post in the analysis as it

[29]For that reason we also do not have to account for utility gains in the form of reduced disutility of work.

Table 4: *Expected Retirement Age - FE Estimations*

	(1)	(2)	(3)	(4)
Dependent Variable: Expected Retirement Age				
Specificaiton				
Baseline				
Non-zero Inheritance Received=1	-0.348*	-0.111		
	(0.1663)	(0.1817)		
Total Inheritance in 10T Euro		-0.084**		
		(0.0266)		
Total Inheritance in 10T Euro × Total Inheritance in 10T Euro		0.001**		
		(0.0002)		
Expectations				
Non-zero Inheritance Received=0 × Expected Inher. Indicator=1			0.066	0.111
			(0.1047)	(0.1717)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=0			-0.254	-0.404
			(0.3362)	(0.3718)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=1			0.458+	0.412
			(0.2735)	(0.5100)
Expected Inher. Indicator=0 × Total Inheritance in 10T Euro			0.142	
			(0.2241)	
Expected Inher. Indicator=1 × Total Inheritance in 10T Euro			-0.143**	
			(0.0552)	
Expected Inher. Indicator=0 × Total Inheritance in 10T Euro × Total Inheritance in 10T Euro			-0.010	
			(0.0195)	
Expected Inher. Indicator=1 × Total Inheritance in 10T Euro × Total Inheritance in 10T Euro			0.003*	
			(0.0013)	
Various Periods				
One Lag				
Non-zero Inheritance Received=0 × Expected Inher. Indicator=1				-0.062
				(0.1708)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=0				-0.847
				(0.5653)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=1				0.337
				(0.3625)
Two Lags				
Non-zero Inheritance Received=0 × Expected Inher. Indicator=1				0.015
				(0.1701)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=0				-1.194**
				(0.3803)
Non-zero Inheritance Received=1 × Expected Inher. Indicator=1				0.196
				(0.3966)
Year FE	YES	YES	YES	YES
Additional Controls	YES	YES	YES	YES
Number of Observations	16766	16766	10568	4679
Number of Groups	4798	4798	3334	2117

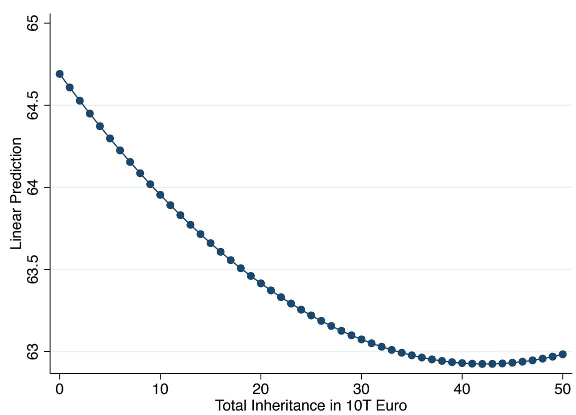
[1] The table shows results of Linear Fixed Effect estimations where the dependent variable is the expected retirement age. All estimations are based on a sample of individuals that are not retired in the first observation period. The estimations include a third order polynomial of age, Log(Net Household Income), an indicator for having children, the number of children in the household, for indicators for self-evaluated health status, indicators for being self-employed, civil servant and region (East/West) as control variables.
[2] Standard errors account for clustering on the household and individual level.
[3] Estimations are based on a multiple imputed dataset (5 imputations).
[4] Estimations are based on SAVE 2005-2010.
[5] Coefficients marked with +,*,** are statistically significant at the 10, 5, 1 percent level.

reveals whether individuals at least had the intention to adjust or whether already the intention is lacking. Secondly, as the expected retirement age has been surveyed in all years, we do not rely anymore on the cross-sectional variation, but can rather attribute changes in the response to the within-individual variation.

We begin this section by an FE estimation of the expected retirement age on the inheritance dummy and the set of controls as described in Section II.2. The estimate in column (1) of table 4, representing the average planned retirement response of all heirs (in the first period after receipt), shows that the expected retirement age decreases by pretty much 1/3 of a year. Hence, receiving a transfer reduces the expected retirement age by four months on average.

Column (2) from table 4 is our main specification and adds a linear and a squared term to the previous model and thus corresponds to Equation 1. Note that the three estimates have to be interpreted jointly.[30] We see that also this specification hints at a strong, nonlinear effect of inheritances on the moving forward of the expected retirement entry age: The dummy estimate is negative, albeit insignificant. The transfer amount estimates suggest that increasing transfers reduce the expected retirement age (up to very high transfers), however with a decreasing pace reaching the highest reduction at transfers with slightly above 420.000 Euros. Figure 3 plots the linear prediction depending on different values of the inheritance. The three transfer-related estimates are jointly significant at the 1 percent level. The effect of the mean inheritance ($\approx 40T$ Euro) on the expected retirement age equals -.33 years ($\approx$ 4 month) and is significant at the 1 percent level. The average marginal effect yields -0.08. That is, increasing the transfer by 10T decreases the *expected retirement age* on average by 1 month.[31]

Figure 3: *Estimated Influence of Inherited Amount on the Expected Retirement Age*



From a theoretical point of view, individuals with expectations should adjust prior to the receipt while individuals without expectations should show stronger economic responses. We now interact both the dummy and the transfer amount variables with an indicator equalling one if the individual stated to expect a transfer with a positive probability. The results are presented in column (3) of table 4: Generally, the results from our main specification seem to be driven by expected transfers. Expected transfers reduce the *expected retirement age* with a decreasing

[30]This specification requires a careful interpretation: The dummy itself can be interpreted as a counterfactual denoting the effect of an inheritance on the expected retirement age of a heir when the inheritance is zero. While this might occur counterintuitive, the dummy is necessary as the inheritance variable contains many zero values, the dummy thus makes the identification of the effect more flexbile. The linear and squared terms of the inheritance amount, isolated interpretation, describe the effect of an inheritance of the size of 10T Euro on the expected retirement age *conditional* on being a heir in this period.

[31]This effect holds conditional on receipt, that is, when only increasing the transfer size. In contrast, when increasing the transfer from zero to 10T, one has to consider also the transfer dummy: The average marginal effect then amounts to -.19 which corresponds to a reduction of slightly more than two months.

margin. The effect of expected transfers is jointly significant at the 5% level. Increasing an expected transfer by 10T reduces the expected retirement age by 1/7 of a year. This confirms previous findings from the literature that recipients do not fully adjust to expected transfers *before* the receipt. Additionally, unexpected transfers do not significantly reduce the expected retirement time, at least immediately after receipt. Similar to the findings in Brown et al. (2010), the estimates for the expected transfers do not significantly differ from those of the unexpected transfers.

Bo et al. (2015) find that reactions to transfer receipt sometimes only take a lagged effect.[32] We want to check whether unexpected transfers will perhaps result in a lagged adjustment of the expected retirement age. We thus estimate a model in which we regress expected retirement age on the dummy for bequest receipt from period t, period $t-1$ and period $t-2$. We interact all of these three dummies with the correspondingly lagged dummies that are equal to 1 if the individual has stated in the previous period to expect a transfer receipt. In this specification (reported in column 4), none of the estimates for the current period is significant.[33] The lagged estimates however suggest significant reductions in the expected retirement age for unexpected transfer receipts. The effects for both lagged estimates for unexpected transfers are strong and highly significant. Hence, apparently individuals need some time to decide how to treat their unexpected positive wealth shock. The results by Bo et al. (2015) might therefore well be driven by the hidden expectation status of the observed transfers. In contrast to Doorley and Pestel (2016), we however do not find significant effects in labor supply before the actual transfer receipt. The results show that unexpected transfers rather entail a lagged response. Hence, expectations about transfers determine the reaction time after receipt.

We might however underestimate the effect of expectations: The data does not allow to estimate whether individuals already adjust their expected retirement age when they learn about the future inheritance. Even a change in the perceived probability from zero to positive over two periods does not necessarily preclude that individuals have already adjusted to their expectations. The core problem here is that the survey question asks with what probability a person expects to receive a transfer *in the next two periods* (and not if a transfer is expected at all).

[32]Note, that Bo et al. (2015) look at the difference between heirs and non-heirs using early retirement schemes, i.e. actual retirement.

[33]The reasons for the insignificance of current receipts in this specification does not necessarily mean that our previous model is misspecified. Note that the previous model specified the transfer amount in linear and squared term next to the dummy. Also, the lags in the model of column (4) reduce the number of observations.

III.2. Simulating the Share of the Transfer spent on Retirement

We here estimate to what degree inheritances are used to retire early. In order to calculate the expected monetary effect of early retirement, the monetary equivalents of the areas $B + D = L$ in figure 1 have to be estimated. Since we are focussing on how inheritances finance early retirement, we exclude observations for which our model predicts an extension of the working life after inheritance receipt.[34] Table 5 summarizes our results (we report some additional quantities of the simulation in table 15 in the appendix) and is divided in three parts referring to different subsamples: The first panel shows the results for all possible observations. Panel two restricts the results to only those observations for which we can calculate the opportunity costs of early retirement for heirs. The third panel presents the results for the same subsample of observations under the restriction that the costs of early retirement may not exceed the nominal transfer amount.

First of all, we use our main results from column (2) of table 4 for predicting the individual change in the expected retirement age caused by the transfer receipt, i.e. Δx_i (the difference between x_{usual} and x_{early}). For each heir in the dataset we simulate the (hypothetical) expected retirement age if the household had not inherited and deduct from this the estimated retirement age that the model predicts with the actual inherited amounts. Δx_i has a mean of roughly 0.39 years and a median of 0.22 years, as described in column (1) of table 5.

Based on the estimate of Δx_i, we calculate the reduction in pension income as described in Section II.3. This is the first component of the costs of early retirement. The second is represented by the foregone labor income: The simulated monthly mean net income at x_{usual} amounts to roughly 1830 Euro.[35] Columns 3-5 present different measures for the monetary costs of early retirement in levels: The median of the plain Euro amount of estimated opportunity costs revolves around slightly more than 3500 Euro, the mean varies between 6600 and 6900 Euro. The mean of area C equals 4770 Euro, the mean of area D 3028 Euro. Our simulation thereby suggests that the decrease in the aggregated statutory pension income, D, is usually offset by the expected prolonged pension receipt for heirs, C. This somewhat surprising finding has also been established by a more detailed study on the penalty term in the German pension system by Bönke et al. (2017) based on administrative pension data.

Relating the costs of early retirement (L) to the size of the inheritance on the individual level

[34] We thereby exclude 6 observations.

[35] Note, that this is the simulated average income at the initial retirement age. Hence, this figure refers to different years and also different ages. The number indicates what individuals can expect to earn, on average, in the period of their initially stated retirement entry age. This figure on average hardly deviates from the income at x_{early} since Δx_i is typically low.

yields our estimates in column (4). For 10% of the sample, we observe that the estimated costs of early retirement exceed the nominal inheritance amounts. Since we focus on the share of the inheritance that is spent on early retirement (which by definition cannot exceed unity), we consider the estimates in the first two panels upwards biased and limit the costs of the early retirement to the inheritance amount. Limiting does of course not affect the median which is constantly 36% of the inheritance. Limiting the costs of early retirement yields however a lower mean estimate of 50%. That is, we estimate that heirs on average expect to use up half of their receipt for retiring earlier than initially planned. This estimate might appear high, it is however noteworthy that we look here at opportunity costs: It is likely that the expenditure that individuals have to finance in order to retire earlier is below the total foregone income during the early retirement period and therefore the share of the bookkeeping costs to the inherited amount is likely to be much lower. Individuals might thus not perceive to spend half of the inheritance on their earlier retirement. Also, the uncertainty that is attached to the estimated future income might lead people to devalue the future income stream. Similarly, the value of the future income stream is subject to the individuals discount rate.

Table 5: *Simulation Results (main model)*

	(1) Δ Expected Retirement Age ($\Delta x_i = x_{usual} - x_{early}$)	(2) Estimated Income (at x_{usual})	(3) Cost of Early Retirement (Area $L = B + D$)	(4) Share of Inheritance (L/Inherited Amount)	(5) Share of Capitalized Amount (L/Capitalized Inherited Amount)
Baseline					
Mean	.39	1788	6905	.76	.43
Median	.22	1755	3916	.36	.22
Obs.	807	807	262	262	262
Subsample					
Mean	.38	1830	6905	.76	.43
Median	.22	1716	3916	.36	.22
Obs.	262	262	262	262	262
Subsample with Limited Loss					
Mean	.38	1830	6602	.50	.30
Median	.22	1716	3550	.36	.22
Obs.	262	262	262	262	262

Based on SAVE 2005-2010, own calculations. Estimates are weighted.
Labelling follows figure 1

The last column of table 5 shows an attempt to treat the potential discounting problem. Under the assumption that individuals did not fully discount when adjusting their expected retirement age, we capitalize the transfer amount with 3% per annum until the expected retirement age. This calculation leads to an estimated income loss that has an average size of 43% of the capitalized inherited amount. Limiting again the costs of early retirement to the inheritance amount yields an estimate of 0.3. The median equals almost one fourth of the inheritance. Hence, our preferred estimates for the opportunity costs of a moved forward retirement are displayed in the last two columns of the third panel of table 5: We estimate that heirs on average spend one fourth to one third of their inheritance on an earlier retirement.

Table 6 reports the simulation results based on the interaction model (eq. 2). Recall that this model extends the main model by interactions between inheritance variables and indicators on having expected to receive a transfer (see table 4, column (3)). The reported results should be interpreted with caution, though, as both the estimation of the model and the simulation base on a particularly low number of observations. We report the simulation results here nonetheless for completeness. Note that table 6 only contains the *subsample with limited loss* case but reports the simulation results separately for heirs that expected to receive a transfer (panel *c*), heirs that did not expect to receive a transfer (panel *b*) and all heirs that stated their expectations (panel *a*). These results are thus conceptually comparable to panel *c* of table 5.

Table 6: *Simulation Results (expectations model), subsample with limited loss only*

	(1) Δ Expected Retirement Age ($\Delta x_i = x_{usual} - x_{early}$)	(2) Estimated Income (at x_{usual})	(3) Cost of Early Retirement (Area $L = B + D$)	(4) Share of Inheritance (L/Inherited Amount)	(5) Share of Capitalized Amount (L/Capitalized Inherited Amount)
All possible observations					
Mean	.39	1803	6803	.44	.27
Median	.17	1753	3354	.22	.15
Obs.	110	110	110	110	110
Heirs not expecting a transfer					
Mean	.15	1763	2476	.67	.42
Median	.16	1753	2101	.75	.45
Obs.	64	64	64	64	64
Heirs expecting a transfer					
Mean	.72	1860	12877	.11	.07
Median	.75	1856	11960	.10	.06
Obs.	46	46	46	46	46

Based on SAVE 2005-2010, own calculations. Estimates are weighted.
Labelling follows figure 1

The pattern in panel *a* strongly resembles the corresponding results in panel *c* of the main simulation with a mean of close to 1/3. The results however seem to vary massively based on the expectations status: While heirs that expected to receive a transfer react strongly in absolute terms (col. (1), panel (*c*)) and thus also face high absolute costs (col. (3)), their relative costs, measured in the inheritance, are much lower than those for the non-expecting heirs. The main reason for this divergence is the size of inheritances in the two groups: The average expected inheritance amounts to 111T Euros in contrast to an average unexpected transfer of only 5500 Euros.[36] Also, the point estimate for the average expected retirement age is slightly smaller for the group of expecting heirs *before* receipt, what suggests that they might have already counted in a part of their expected inheritance. While concedingly based on weak evidence, the simulation

[36]Again, note that the low number of observations leads to somewhat misleadingly low average inheritances. These values however provide the intuition behind table 6

might however help to solve the riddle about heirs not adjusting to their expectations: The strong absolute reaction suggests that heirs did not adjust to their expected transfers. The low relative share of the inheritance that these heirs then actually raise for an earlier retirement, is however small, which suggests that they either already did adjust in some respect[37] or that they prefer to spend their inheritance on other goods.

IV. Robustness

IV.1. Endogenous Wealth

Our main results are based on estimations in which we excluded wealth as a control variable due to the high likelihood of endogeneity of this variable. Individuals might save a lot over their life-cycle and therefore acquire more wealth *in order to leave the workforce early*. Including wealth as an additional control might be problematic as the inclusion of an endogenous variable can cause our estimates for the influence of the transfer to be biased. On the other hand, excluding wealth as control variable can introduce a bias, too: Wolff and Gittleman (2014) show that the chance of receiving a transfer correlates with wealth. Hence, if households that have other large changes in wealth are also more likely to receive large transfers, then our inheritance estimate will be biased. A similar argument could be made with respect to income. In this subsection we present a robustness check to see how severe the problem might be for our baseline results.

Columns (1) - (3) of table 7 show the results for our baseline fixed effect specification that correspond to column (2) in table 4 with an inheritance dummy and the respective amount in linear and squared terms. In column (1) we excluded Log(Net Income) as control variable, column (2) again shows the results from table 4 (i.e. our main results), and column (3) additionally includes the inverse hyperbolic sine transformed[38] wealth of the household. Overall the results are reassuring that the coefficients and standard errors of our main variables of interest remain almost identical across the three estimations. Excluding wealth (and including income) in our main specification therefore seems unlikely to cause problems. The fixed effect estimator already should control for general wealth and other changes in wealth seem to be orthogonal to transfers.

[37] This might also be through already lowered expected retirement ages. If this logic would apply, we would however also expect the dummy estimate in a more accurately estimated model to indicate a lower expected retirement age of expecting heirs (irrespective of the size of the inheritance).

[38] The inverse hyperbolic sine transformation is an alternative to log-transformations, that prevents us from discarding wealth-observations with non-positive values.

Table 7: *Expected Retirement Age - Endogenous Wealth*

	(1)	(2)	(3)
Dependent Variable: Expected Retirement Age			
Estimation Method:	FE	FE	FE
Non-zero Inheritance Received=1	-0.110	-0.111	-0.096
	(0.1817)	(0.1817)	(0.1809)
Total Inheritance in 10T Euro	-0.084**	-0.084**	-0.082**
	(0.0266)	(0.0266)	(0.0266)
Total Inheritance in 10T Euro × Total Inheritance in 10T Euro	0.001**	0.001**	0.001**
	(0.0002)	(0.0002)	(0.0002)
Log(Net Income)		-0.072	-0.064
		(0.0870)	(0.0864)
Log(Wealth+Sqrt(Wealth^2+1)			-0.076+
			(0.0426)
Year FE	YES	YES	YES
Additional Controls	YES	YES	YES
Number of Observations	16766	16766	16766
Number of Groups	4798	4798	4798

[1] The table shows results of Linear Fixed Effect estimations, where the dependent variable is the expected retirement age. All estimations are based on a sample of individuals that are not retired in the first observation period. The estimations include a third order polynomial of age, an indicator for having children, the number of children in the household, for indicators for self-evaluated health status, indicators for being self-employed, civil servant and region (East/West) as control variables.
[2] Standard errors account for clustering on the household and individual level in columns.
[3] Estimations are based on a multiple imputed dataset (5 imputations).
[4] Estimations are based on SAVE 2005-2010.
[5] Coefficients marked with +,*,** are statistically significant at the 10, 5, 1 percent level.

IV.2. Simulation

The simulation results from our main model (see table 5) suggest that the area C is only slightly bigger than D. The reduced public pension entitlement is typically fully compensated by the prolonged pension receipt. The calculation of these areas, however, comes at the cost of losing a considerable amount of observations. The reason for this is that we use the information on the pension income from the period before the transfer receipt. Table 8 shows our results when swapping areas C and D which increases the sample size for our simulation considerably.

Our preferred estimates in the third panel are slightly bigger than our previous estimations. Note however, that this robustness test will slightly overstate the costs of an earlier retirement as area C on average is bigger than area D (see table 15 in the appendix). We interpret these results

Table 8: *Robustness Simulation Results*

	(1) Change in Expected Retirement Age ($x_{usual} - x_{early}$)	(2) Estimated Income (at x_{usual})	(3) Foregone Labor Income (Area $B + C$)	(4) Share of Inheritance ($(B + C)$/Amount)	(5) Share of capitalized Inheritance ($(B + C)$/Capitalized Amount)
Baseline					
Mean	.39	1788	8612	.94	.68
Median	.22	1755	5023	.47	.34
Obs.	807	807	782	782	782
Subsample					
Mean	.39	1804	8612	.94	.68
Median	.22	1792	5023	.47	.34
Obs.	782	782	782	782	782
Subsample with Limited Loss					
Mean	.39	1804	8140	.55	.46
Median	.22	1792	4597	.47	.34
Obs.	782	782	782	782	782

Based on SAVE 2005-2010, own calculations. Estimates are weighted.

thus as an upper bound result which would prevail if the penalty term in the statutory pension system would not allow retirees to benefit from early retirement. After all, the estimates are still close to our main simulation results.

V. Discussion of results

V.1. Main findings

The main purpose of this paper is to quantify the effect of inheritance receipts on the extensive margin of the labor supply of heirs. In contrast to the existing literature, this paper does however not look at the actual retirement entry but at the effects of inheritance receipt on the *expected retirement age*. This feature enables us to add to the literature in some ways: Our analysis exploits within individual variation, we are able to track reactions to transfer receipt over the entire life-cycle and we are able to relate the opportunity costs of pension entry reactions to the size of the received inheritance.

Our main estimation results indicate that heirs expect to retire on average four to five month earlier than initially stated due to their wealth gain. Following Brown et al. (2010), we can interpret this as indication that leisure is a normal good: The transfer receipt loosens the intertemporal budget constraint, the income effect renders people demanding more free time. Rescaling these estimates by taking the corresponding financial losses into account then reveals that this is a quite sizable effect. The average effect of five months translates into costs that amount, on average, to one third of the total inheritance.

One might oppose, that this estimate is too high. And, indeed, it only reflects *expected* and not yet actual changes in the retirement age. Also, as argued above, it is well possible that individuals do not perceive to implicitly spend one third of their transfer on a moving forward of their retirement: They only give up labor income that they do not yet have earned in return for the very certain gain of leisure. While these losses are costs from an economic point of view, individuals might rather focus on the sheer bookkeeping costs, which are presented by the difference between area D (representing the decrease in statutory pension wealth) and C (representing the gains through prolonged receipt of the statutory pension) in figure 1. Our calculations however predict that these areas are not only of almost same size but rather seem to reward an early retirement. Hence, the estimated reaction of heirs seems plausible judging on the actual bookkeeping costs.

The literature has recently focused on the ambiguous role of expectations about future inheritances on retirement decisions: Remarkably, individuals do not seem to adjust their life-cycle consumption path to their expected inheritances.[39] Also in our study, individuals receiving an expected transfer seem to adjust *after* the actual receipt. As mentioned above, the literature has suggested risk aversion and credit constraints as explanations.[40] When receiving unexpected inheritances, individuals do not react immediately, but rather seem to need some time to consider the opportunities this wealth shock brings along. Further obstacles for (immediate) adjustment might be that inheritances have a genuine value to the inheriting family, own bequest motives and expectations of the preceding generations. Uncertainty (instead of calculable risk) about the wealth of parents might add to the complex situation the heir is in. Hence, while this version of the paper does not test or discuss possible explanations for the unexpectedly late adjustment behaviors, it provides point estimates consistent with the results from the literature. Taking into account the opportunity costs of early retirement however then relativizes these very findings: While heirs which were expecting transfers showed strong reactions in absolute terms, their opportunity costs measured in the inheritance amount are much smaller than in the baseline case.

[39] As mentioned above, different explanations for this finding were suggested. In another version of this paper, we have tested most of these hypothesis. The thesis of *Tobias Crusius* will contain this detailed discussion.

[40] Myopia certainyl also qualifies as explanation.

V.2. Policy implications

We introduced the paper with a brief overview of the recent discussion about the consequences of potentially growing future inheritance flows in western societies for dimensions like inequality, efficiency and mobility. In this regard, the economic costs of the earlier retirement of heirs are most interesting. Our estimates reveal a high taste for leisure. Heirs thus work less and in consequence are likely to earn less income and to accumulate lower savings. The consequences of the awaited inheritance boom therefore might be somewhat balanced by the strong taste of heirs for leisure. The inequality introduced through inheritances thus partly materializes in the retirement behavior (and to a lesser extend in dimensions like wealth inequality): Heirs will be better able to compensate decreasing replacement rates in statutory pension schemes[41] and will rather be able to benefit from early retirement.

If inheritance flows indeed increase and enable heirs widely to move their retirement entry age forward, then this counteracts recent political attempts in Europes societies to extend working lifes and to foster employment rates of the elderly. In view of this political goal, it seems odd that individuals can extend their total pension wealth by retiring early. Increasing inheritance flows might reinforce early retirement and might thus exacerbate the demographic burden on public pension funds. An adjustment of the penalty term on statutory pension entitlements for early retirement entries thus appears particularly suitable.

Finally, if individuals expect to spend a third of their inheritance on a moving forward of their retirement entry, still 70% of the wealth gain remains. Life-cycle theory predicts that individuals will also increase their life-time consumption level. Empirical papers suggest that also the intensive margin of labor supply is decreasing after transfer receipt (Elinder and Erixson, 2012). The unknown remaining share of the transfer then might eventually be bequeathed again.[42] An interesting task for future research would thus be to further decompose how individuals treat the remaining 70% of their inheritances.

VI. Conclusion

The current paper uses the SAVE panel data set from Germany in order to estimate the effect of wealth shocks on the extensive margin of labor supply decisions. Specifically, we exploit the

[41] Note that we have ignored households' savings in our analysis.

[42] The SAVE data, in fact, also surveys whether individuals save in order to bequeath.

receipt of intergenerational transfers as variation in wealth and use the stated *expected* retirement age as variation in labor supply. We implement our estimations in a simulation study for which we use predicted wages on the verge to retirement in order to monetize the financial costs of the estimated moved forward retirement entry. Specifically, we calculate the pension losses for the rest of the remaining life expectancy and the income losses due to the earlier retirement. We find that heirs on average are willing to spend, ceteris paribus, 20-30% of their transfer on the anticipated pension entry. We address endogeneity concerns with respect to wealth and explore implications of expected transfer receipt. All in all, heirs show a high taste for leisure. The financial implications might attentuate problems that recent studies associate with a potential inheritance boom. Nonetheless, the early exit from the labor market remains only one among several channels through which individuals can respond to wealth gains. It would be particularly worthwhile to study in further detail how heirs allocate the remaining share of their wealth gains.

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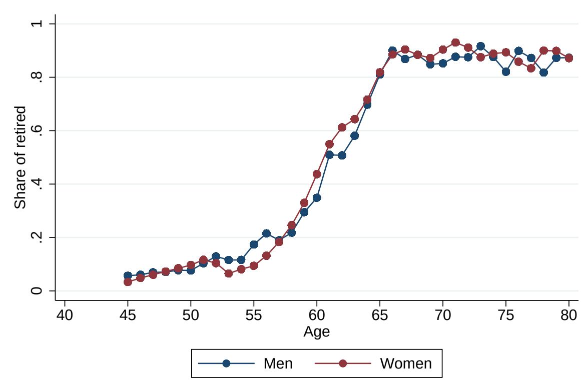
VII. Appendix

VII.1. Data

VII.1.1 Actual retirement in the sample

The SAVE contains a question asking whether individuals are retired. We only use those observations in our further analysis that are not already retired in the first period of our sample. We abstain from classifying individuals as de facto retired who report to receive zero income as we cannot be entirely sure that they will not return to the labor market at some stage. figure 4 summarizes the retirement entrance behavior for men and women in our sample by plotting the cross-sectional share of retired individuals against age. Conditional on having been part of the workforce, women and men do not differ substantially in our sample with respect to their retirement age. People of the age of 55 start to retire and by the age of 65 most individuals are retired.

Figure 4: *Retirement behavior*



Note: Share of individuals that report to be retired.
Source: SAVE 2005-2010, own calculations.

VII.1.2 The wealth concept in the SAVE data

The wealth information in the SAVE data covers assets and liabilities on the household level and differentiates between the main wealth types. The SAVE data generally differentiates between financial, real estate wealth and business assets. Financial wealth covers deposits, building society and life insurance assets, value of other private retirement savings, value of bonds, stocks and real estate funds, state-subsidized savings (so called *Riester Rente*), value of other financial savings. Real estate wealth contains the value of the households main residence and other real estates. Liabilities comprise value of mortgage loans, value of building society loans, value of consumption loans (cars, credit cards, ...), value of family and other loans. In a robustness check, we use net wealth which is the sum of all assets net of all liabilities of the household as control variable in the regressions. As reported in table 9 the median wealth is around 68,000 Euro.[43]

VII.1.3 Descriptive Statistics of Control Variables

[43] Generally, it seems difficult to compare wealth measures across different data sets. While the median wealth in the SAVE deviates from the SOEP wealth estimate ($\approx$ 15.000 Euro in 2007), it comes close to the estimate based on the PHF data (67900 Euro in 2013).(Bundesbank, 2013)

Table 9: *Descriptives - Control variables (Part I)*

	Mean	St. Dev.	Median	Min	Max
a. All Observations:					
Age	50.92656	15.74711	50	18	98
Wealth	185431.1	569364.6	67706.9	-4204975	27000000
Individual Net Income	1397.354	1322.675	1171.459	0	43243.24
HH Net Income	2403.055	1817.404	2122.471	0	43243.24
East Germany	.2821663	.4500625	0	0	1
Male	.4752042	.4993944	0	0	1
Number of Children	1.784322	1.393685	2	0	13
Married	.6723296	.4693729	1	0	1
Educational Attainment					
Tertiary	.1527594	.3597623	0	0	1
Abitur	.2627476	.4401349	0	0	1
Apprenticeship	.6938056	.4609203	1	0	1
No Regular Employment					
Selfemployed	.0391806	.1940281	0	0	1
Civil Servant	.036205	.1868034	0	0	1
Unemployed	.0815199	.2736371	0	0	1
Health Status					
very good	.0927334	.2900641	0	0	1
good	.455824	.4980542	0	0	1
mediocre	.346289	.4757958	0	0	1
rather bad	.083024	.2759238	0	0	1
bad	.0221295	.1471075	0	0	1
Risk Aversion and Credit Constraints					
Riskneutral	.0655312	.2474683	0	0	1
Riskavers=1	.0296791	.1697055	0	0	1
Riskavers=2	.1204586	.3255069	0	0	1
Riskavers=3	.7759013	.417	1	0	1
Constrained	.1254346	.3312174	0	0	1

Based on SAVE 2005-2010, own calculations. Estimates are weighted.

[1] Heirs are considered heirs if they have received an inheritance in the current or any previous period.

VII.2. Auxiliary Regressions

VII.3. Simulation: detailed results

Table 10: *Descriptives - Control variables (Part II)*

b. Heirs[1]:					
Age	54.8437	13.66648	55	21	93
Net Wealth	288228.8	589289	177939.7	-419093.3	1.18e+07
Individual Net Income	1705.381	1668.929	1460.446	0	24750
HH net Income	2878.702	1985.444	2591.051	250	25000
East Germany	.2309154	.4215075	0	0	1
Male	.5460219	.4979827	1	0	1
Number of Children	1.931367	1.288192	2	0	12
Married	.7559775	.4295969	1	0	1
Educational Attainment					
Tertiary	.2231429	.4164414	0	0	1
Abitur	.3163508	.4651499	0	0	1
Apprenticeship	.6681641	.4709719	1	0	1
No Regular Employment					
Selfemployed	.0433705	.2037328	0	0	1
Civil Servant	.0520162	.2221067	0	0	1
Unemployed	.084976	.2788519	0	0	1
Health Status					
very good	.0983533	.2978547	0	0	1
good	.452897	.4978815	0	0	1
mediocre	.3368957	.4727488	0	0	1
rather bad	.0919253	.2889815	0	0	1
bad	.0199286	.1397845	0	0	1
Risk Aversion and Credit Constraints					
Riskneutral	.0447226	.2067608	0	0	1
Riskavers=1	.0282696	.1657955	0	0	1
Riskavers=2	.1843174	.3878679	0	0	1
Riskavers=3	.7392302	.4391962	1	0	1
Constrained	.0727873	.2598419	0	0	1

Based on SAVE 2005-2010, own calculations. Estimates are weighted.

[1] Heirs are considered heirs if they have received an inheritance in the current or any previous period.

Table 11: *Regular Retirement Entry in Germany by Birth Year*

Birth Year	Regular Retirement Age
<1947	65
1947	65 and 1 month
1948	65 and 2 months
1949	65 and 3 months
1950	65 and 4 months
1951	65 and 5 months
1952	65 and 6 months
1953	65 and 7 months
1954	65 and 8 months
1955	65 and 9 months
1956	65 and 10 months
1957	65 and 11 months
1958	66 month
1959	66 month and 2 months
1960	66 month and 4 months
1961	66 month and 6 months
1962	66 month and 8 months
1963	66 month and 10 months
>1963	67

[1] Source: Deutsche Rentenversicherung

Table 12: *Expected Percentage of Income in Retirement Simulation - OLS Results*

Dependent Variable: Expected Percentage of Current Income in Retirement	
BC 1	3.266
	(2.3623)
BC 2	7.362**
	(0.8756)
BC 3	7.301**
	(0.7000)
BC 4	3.563**
	(0.6314)
Civil	8.198**
	(0.6418)
Selfemployed	-9.884**
	(1.8990)
Expected Retirement Age	1.394
	(0.8710)
Expected Retirement Age × Expected Retirement Age	-0.012+
	(0.0065)
Unemployed	0.457
	(1.0224)
Fulltime Employment	3.763**
	(0.6375)
Income	-0.000
	(0.0003)
Income × Income	-0.000
	(0.0000)
Children Dummy	2.248**
	(0.7209)
Number of Children	-0.437*
	(0.2189)
Married and Living Together	-0.328
	(0.4899)
College/University Degree	0.253
	(1.2578)
abitur	-2.866**
	(0.6478)
Apprenticeship	1.189
	(0.9320)
Never Unemployed	1.491**
	(0.5306)
Longterm Unemployed	-1.854*
	(0.7453)
east=1	-0.618
	(0.5772)
Jahr=2006	1.325+
	(0.7894)
Jahr=2007	2.808**
	(0.7487)
Jahr=2008	3.765**
	(0.7444)
Jahr=2009	4.374**
	(0.8424)
Year FE	YES
Additional Controls	NO
Number of Observations	5168

[1] The table shows the result of a OLS estimation when the dependent variable is the expected percentage of current income during retirement.
[2] Standard errors account for clustering on the household and individual level.
[3] Estimations are based on a multiple imputed dataset (5 imputations).
[4] Estimations are based on SAVE 2005-2010.
[5] Coefficients marked with +,*,** are statistically significant under the 10, 5, 1 percent significance level.

Table 13: *Income Simulation - OLS results*

Dependent Variable: Log(Individual Net Income)	
Age	0.239**
	(0.0326)
Age × Age	-0.004**
	(0.0007)
Age × Age × Age	0.000**
	(0.0000)
education=1	3.099**
	(0.5670)
education=2	0.343
	(0.6775)
education=3	0.916
	(0.7645)
education=1 × Age	-0.168**
	(0.0372)
education=2 × Age	-0.011
	(0.0458)
education=3 × Age	-0.027
	(0.0494)
education=1 × Age × Age	0.003**
	(0.0008)
education=2 × Age × Age	0.000
	(0.0010)
education=3 × Age × Age	0.000
	(0.0010)
education=1 × Age × Age × Age	-0.000**
	(0.0000)
education=2 × Age × Age × Age	-0.000
	(0.0000)
education=3 × Age × Age × Age	-0.000
	(0.0000)
Male	0.542**
	(0.0126)
Children Dummy	0.038*
	(0.0190)
Number of Children in HH	0.068**
	(0.0152)
Number of HH Members	-0.069**
	(0.0130)
Married and Living Together	-0.163**
	(0.0158)
Health Status 'very good'	0.240**
	(0.0707)
Health Status 'good'	0.192**
	(0.0681)
Health Status 'mediocre'	0.140*
	(0.0683)
Health Status 'rather bad'	0.093
	(0.0718)
Selfemployed	0.053
	(0.0325)
Civil	0.261**
	(0.0248)
Never Unemployed	0.043**
	(0.0138)
Longterm Unemployed	-0.285**
	(0.0179)
East	-0.155**
	(0.0138)
Year FE	YES
Additional Controls	NO
Number of Observations	14934

[1] The table shows the result of a OLS estimation when the dependent variable is the log of the individuals' net income if the individual is not retired. For the years 2006-2010 the dependent variable was created by multiplying the share of

[2] Standard errors account for clustering on the household and individual level.

[3] Estimations are based on a multiple imputed dataset (5 imputations).

[4] Estimations are based on SAVE 2005-2010.

[5] Coefficients marked with +,*,** are statistically significant under the 10, 5, 1 percent significance level.

Table 14: *Expected Retirement Age - FE Estimation - Plus 60 excluded*

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Expected Retirement Age						
Specificaiton						
Baseline						
Non-zero Inheritance Received=0	0.000	0.000				
	(.)	(.)				
Non-zero Inheritance Received=1	-0.111	-0.096				
	(0.1817)	(0.1940)				
Total Inheritance in 10T Euro	-0.084**	-0.078**				
	(0.0266)	(0.0271)				
Total Inheritance in 10T Euro × Total Inheritance in 10T Euro	0.001**	0.001**				
	(0.0002)	(0.0002)				
Age	0.808**	0.218				
	(0.3022)	(0.3106)				
Age × Age	-0.017*	-0.002				
	(0.0078)	(0.0077)				
Age × Age × Age	0.000+	-0.000				
	(0.0001)	(0.0001)				
rag	0.126	0.087				
	(0.0906)	(0.1118)				
Log(Net Income)	-0.072	-0.070				
	(0.0870)	(0.0889)				
Health Status 'very good'	1.092+	0.841				
	(0.5767)	(0.5846)				
Health Status 'good'	1.091+	0.853				
	(0.5678)	(0.5738)				
Health Status 'mediocre'	1.078+	0.816				
	(0.5662)	(0.5692)				
Health Status 'rather bad'	1.171*	0.895				
	(0.5460)	(0.5629)				
never UnEmployed	0.005	-0.021				
	(0.1160)	(0.1202)				
longterm UnEmployed	0.018	0.055				
	(0.1163)	(0.1210)				
College/University Degree	-0.128	-0.128				
	(0.2221)	(0.2338)				
abitur	0.234	0.250				
	(0.2055)	(0.2235)				
Apprenticeship	0.103	0.079				
	(0.1723)	(0.1749)				
Selfemployed	-0.104	-0.149				
	(0.1832)	(0.1931)				
civil	-0.229	-0.314				
	(0.3785)	(0.4349)				
Jahr=2005	0.000	0.000				
	(.)	(.)				
Jahr=2006	0.337**	0.529**				
	(0.1302)	(0.1386)				
Jahr=2007	0.592**	0.922**				
	(0.1900)	(0.2680)				
Jahr=2008	0.447*	0.809*				
	(0.2255)	(0.3296)				
Jahr=2009	0.522+	0.913*				
	(0.2857)	(0.4108)				
Jahr=2010	0.291	0.736				
	(0.3351)	(0.4878)				
east=0	0.000	0.000				
	(.)	(.)				
east=1	0.107	0.007				
	(0.3768)	(0.3566)				
cons	42.321**	53.691**				
	(6.6550)	(8.9606)				
Number of Observations	.	.				
R^2	.	.				

Table 15: *Detailed simulation results (main model)*

	Estimated Income (at x_{usual})	***Costs of early retirement*** Total[1] Cost ($L = B + D$)	Foregone income (B)	Pension loss (D)	Extended pension take up (C)	***Relative costs of early retirement*** Share of Inheritance (L/Inherited Amount)	Share of Capitalized Amount (L/Capitalized Inherited Amount)
Baseline							
Mean	1788	6905	4088	2192	4867	.76	.43
Median	1755	3916	2503	473	2467	.36	.22
Obs.	807	262	373	364	383	262	262
Subsample							
Mean	1830	6905	3845	3028	4770	.76	.43
Median	1716	3916	2503	1177	2472	.36	.22
Obs.	262	262	262	240	262	262	262
Subsample with limited loss							
Mean	1830	6602	3656	3028	4770	.50	.30
Median	1716	3550	2195	1177	2472	.36	.22
Obs.	262	262	262	240	262	262	262

Based on SAVE 2005-2010, own calculations. Estimates are weighted.
[1] Note that the areas L, B, C, D are calculated individually, hence summing up average areas $\bar{B} + \bar{D}$ does not necessarily yield $\bar{L}$.
Labelling follows figure 1

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