Understanding Bequest Motives – An Empirical Analysis of Intergenerational Transfers
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An Empirical Analysis of Intergenerational Transfers

— Work in Progress —

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Abstract
This paper analyzes one of the major factors underlying old agents’ saving and consumption decisions - the individual intentions to leave bequests. We present two simple model of altruistically motivated bequests and use data from the Health and Retirement Study (HRS) to confront the theoretical implications of the two model with empirical evidence from the survey data provided.

The main findings from the data are the following: First, there is strong evidence against a strictly accidental, and in favor of intentional bequest motive for a significant share of agents aged sixty and older.

Second, we find the probability to leave an inheritance is mainly driven by wealth and individual characteristics such as health, education, race and religion, but not directly dependent on the heirs’ wellbeing, contradicting the standard altruistic model of bequest.

Keywords: Bequest, Altruism  
JEL classification: D12, D64
1 Introduction

While the overall importance of bequests is undisputed, surprisingly little agreement is found in the empirical literature on the microeconomic foundations of intergenerational transfers\(^1\). While a large part of the field continues to interpret any kind of transfer at the end of individuals’ life as evidence of excess savings made to provide insurance against life expectancy risk in the tradition of Yaari (1965), several alternative theories of bequest motivations have emerged over the last decades. Most prominently among them are the strategic bequest motive (Bernheim/Shleifer/Summers, 1985), where parents bequeath to get more attention from their children, and the frequently used altruistic bequest motive (Becker, 1981), where parents draw direct utility from leaving bequests to their descendants\(^2\).

In this paper we present two simple variations of altruistically motivated intentional bequest to test their empirical relevance against data from the Health and Retirement Study (HRS). From a theoretical viewpoint, we abstract from inter-vivos transfers\(^3\), and follow the approach originally proposed by Becker and Tomes (1986), modelling educational investment and bequests as the two principal channels of intergenerational transfers, and derive empirical predictions arising from this basic framework.

As to the data, the overall picture is quite clear: about 50% of the population in the sample indicate to be certain to leave some bequests, which does not only show that intentional bequest motives are operative, but also

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\(^1\)While there is little doubt regarding the existence and overall financial dimension of bequests, the discussion focuses on the relative importance of bequests for different population groups and its implications for inequality and growth. For an excellent survey of the empirical bequest literature see Gokhale/Kotlikoff/Sefton/Weale, 1998.

\(^2\)A slight variation of the altruistic motive is the capitalistic motive proposed by Masson and Pestieau (1997), where very rich parents prefer to share their wealth and prestige with their descendants rather than consuming it completely.

\(^3\)See, for example McGarry (1999) for a detailed analysis of inter-vivos transfers versus bequests.
that bequests matter for a significantly large part of the population. While this finding is in line with recent work by McGarry (1999) and Laitner and Ohlsson (2001), it sharply questions another stream of the literature which continues to interpret bequests largely as undesired and accidental\textsuperscript{4}. It is by no means the intention of this paper to deny the importance of accidental bequests; clearly, life time uncertainty is a significant factor for each agent’s financial planning that should not be underestimated, even if private and public (especially social security) annuities provide partial remedy for this problem. Rather, we stress the additional importance of intentional bequests in understanding individual consumption and saving patterns, and try to determine the forces driving such behavior as precisely as possible.

To do so, we deviate from most of the previous empirical literature\textsuperscript{5} by directly analyzing individuals’ bequeathing intentions rather than the actual bequest flows. Such a perspective exposes the empirical work to the risk of misreporting in the survey based data collection, but allows us to exclusively concentrate on the intentional part of bequests, and, more importantly, to analyze the factors behind individuals’ bequeathing behavior.

Similar to an earlier paper by Hurd and Smith (1999), we find that individual backgrounds (or, more generally, cultural variables) have a significant impact on individuals’ bequeathing behavior. More educated agents are more likely to leave pensions than less educated, Whites and Hispanics are more likely to bequeath than African Americans, and bequests seem to be more common in Southern and Pacific states than they are elsewhere. More importantly, and contrary to most of the previous studies, we find that descendents’ wealth does not affect parental bequests at all, and thus reject the most frequently used altruistic model in favor of simpler models of altruistic bequests commonly denoted as models of "warm glow" or "joy of giving".

\textsuperscript{4}See, e.g., Hurd and Smith (2002).

\textsuperscript{5}Two notable exceptions are McGarry (1999) and Hurd/Smith (1999), which use similar data and methodologies.
The rest of this paper is organized as follows: in section 2, we present a basic economic model, where altruistically motivated agents care sufficiently about their children to invest into their education and to leave them financial bequests. In section 3, we briefly discuss the data set used in this paper, and present the main empirical results. We conclude this paper with a brief discussion and a summary of our results in sections 4 and 5.

2 Two Basic Models of Altruistic Bequest

Let us consider a simple framework, where every period a generation \( t \) with an infinite number of agents \( i \) is born, who live for three periods: infancy, youth and old age. Agents differ with respect to their wealth, which consists of the bequest received and their own labor income, and divide their resources between own consumption, investing into their descendants’ education and leaving bequests. Investing into children’s education increases the childrens’ human capital, and thus their lifetime income. Each agent \( i \) has some number \( n \) of children. Not modelling the first period of life explicitly, we denote the young and old agents by superscript \( j = y, o \).

2.1 Paternalistic Altruism

If individuals are altruistic as assumed in most standard models, they derive utility from their own consumption in each of their adult life periods \((c^y, c^o)\) and from the consumption of their direct descendants. We shall denote this form of altruism as paternalistic, since parents do not enjoy the act of giving itself but give to make their children better off. Thus, a paternalistic agent \( i \) of generation \( t \) maximizes the following utility function:

\[
\max_{c_t^y, c_t^o, e_t, b_t} u_t^i = u(c_t^y, c_t^o) + \rho \eta_i u(c_{t+1}^y, c_{t+1}^o) \tag{1}
\]

where \( e_t \) and \( b_t \) are the levels of educational investment and bequest
chosen by generation $t$, $\rho$ is the private discount rate and $(c^y_{t+1}, c^{oi}_{t+1})$ are the average levels of consumptions of agent $i$’s descendants within generation $t+1$. $\eta^i_t \in [0, 1]$ measures the individual degree of paternalistic altruism varying among agents, with $\eta^i_t = 0$ implying fully selfish agents that do not care at all about their descendants’ consumption and $\eta^i_t = 1$ implying parents who value their descendants’ consumption just as much as their own.

Using a standard separable logarithmic specification\(^6\), each agent optimizes

$$\max_{c^i_t, c^{oi}_t, e^i_t, b^i_t} u^i_t = \log c^y_{i_t} + \rho \log c^{oi}_t + \rho \eta^i_t \log c^{yi}_{t+1} + \rho^2 \eta^i_t \log c^{oi}_{t+1}$$

subject to the following constraints:

$$h^i_t w_t + \frac{b^i_{t-1}}{n} \geq c^y_{i_t} + c^{oi}_t + s^i_t$$

$$c^y_{i_t} + b^i_t \leq s^{yi}_t r$$

$$b^i_t, e^i_t \geq 0$$

where $h^i_t$ is the human capital endowment of an agent $i$ of generation $t$, $s$ is savings, and $r$ is the capital market return on savings\(^7\). Equations (3) and (4) are the first and second period’s budget constraints, while equation (5) captures the non-negativity constraints on bequests and educational investment.

Using a standard concave educational return function, it is straightforward to see that paternalistic agents will invest some share of their income into their heirs education up to point where the marginal returns to edu-

\(^6\)The model results clearly apply to a wider class of utility functions. Using more general functional forms complicate the analytical solution of the model without adding further value to the argument.

\(^7\) $r = 1 + \text{interest rate.}$
cational investment just equal the interest rate (the marginal rate of return to bequests), and then split their income between own consumption and bequest, so that the optimal level of bequest $b^i_t$ for individual $i$ in period $t$ is given by$^8$:

$$b^i_t = \begin{cases} 
0 & \text{for } I^i_t \leq I^*_{iP} \\
\frac{\rho \eta r}{1+\rho r} (I^i_t - I^*_{iP}) & \text{for } I^i_t > I^*_{iP}
\end{cases} \quad (6)$$

where

$$I^*_{iP} = \frac{n \left( \frac{\gamma \omega r}{r} \right)^{\frac{1-\gamma}{1}} (1 + \gamma \eta r)}{\gamma \eta r} \quad (7)$$

2.2 "Warm Glow" Altruism

If agents are altruistic in a more general way (which we denote by "warm glow" or pure altruism), they derive utility directly from giving, rather than from the utility or consumption of their descendants. That is - using the same functional assumptions as before - purely altruistic agents maximize

$$\max_{c^i_t, c^o_t, e^i_t, b^i_t} u^i_t = \log c^g_t + \rho \log c^o_t + \beta^i_t \log e^i_t + \rho \delta^i_t \log (\theta + b^i_{t+1}) \quad (8)$$

subject to constraints (3), (4) and (5), where $\beta^i_t$ and $\delta^i_t \in [0, 1]$ measure the relative utility derived from education and bequest, respectively, and $\theta > 0$ allows for the empirically observed pattern of zero bequests for low income households. Solving this maximization problem, all agents allocate a fixed fraction of their income on education, and, if income is sufficiently high, leave a share of their wealth as bequest to their heirs$^9$. That is,

$$b^i_{t+1} = \frac{\delta^i_t}{2 + \beta^i_t + \delta^i_t} (I^i_t - I^*_{i}) \quad \text{if } I > I^*_{iP} \quad (9)$$

$^8$For a full derivation of this result, please see Appendix 1.
$^9$For a full derivation of results, please see appendix 1.2.
where

\[ I_{t}^{\ast w} = \frac{(2 + \beta_{t}^{i})\bar{\theta}}{\delta_{t}^{i}}. \] (10)

The basic implications of the two models are the same; both models imply agents will devote some altruism dependent fraction of their income to education, and will, if they are sufficiently rich, allocate a part of their wealth to bequests. Nevertheless, it is easy to see that the two models have some very distinct empirical predictions: while purely altruistic agents give unconditional of their children’s talent and income, paternalistic agents take their descendants’ talent and, as a consequence, income into account, and will leave bequests only if they themselves are significantly wealthier than their descendants.

Summing up, both altruism based models predict that the likelihood to bequeath will increase with each agent’s income and wealth and will critically depend on each agents degree of altruism. If individuals behave as predicted in a purely altruistic model, only their own characteristics will affect the final bequest decision, while paternalistic agents take their bequest decision based on their own, but also on their heirs financial background.

3 Empirical Part

3.1 Data and Methodology

The data set used in this paper is based on the Health and Retirement Study (HRS) a longitudinal survey conducted every two years (from 1992 to 2002) by the Institute for Social Research at University of Michigan. This survey is nationally representative of the older population and consists of four different samples representative of the cohorts born in 1947 or earlier\(^{10}\).

\(^{10}\)The original HRS sample cohort represents individuals born in 1931-41, aged 51-61 at baseline in1992. In 1993 individuals born before 1924 have been included in the AHEAD
The data are extremely rich, and do not only contain survey information on each individual’s subjective probability to leave bequests, but also cover a broad range of topics, including respondents’ socioeconomic background that allow us to thoroughly scrutinize the effect of a large set of variables on bequeathing behavior.

The relevant sample used for this analysis is based on the original HRS cohort, consisting of about 7,600 households with at least one person aged 51-61 at the baseline interview in 1992. In order to avoid potential problems of bequests imputation to step children, we select only those households among non-single households in the original sample that have children common to the couple. To keep the sample clean, we track only those households into the 2000 which were not subject to separation due to either partner’s death or separation/divorce in the meantime.

The sample summary statistics are briefly illustrated in Table 1 below.

### Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Household Assets (’00,000)</td>
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<td>1.176579</td>
<td>-.355</td>
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<td>1</td>
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<td>17</td>
</tr>
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<td>83</td>
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<td><strong>Child level characteristics</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Average Ch. Educ (yrs)</td>
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<td>13.57801</td>
<td>1.775707</td>
<td>3</td>
<td>17</td>
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<tr>
<td>Average Ch. Income</td>
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<td>19688.8</td>
<td>12910.56</td>
<td>0</td>
<td>35000</td>
</tr>
</tbody>
</table>

11 1992 HRS sample consists of 2373 single respondents, and 5234 married/partnered respondents. Of these couples, 3335 have only common children.
The relevant sample consists of 2,692 observations at household level. Wealth, health assessment and child related variables are at the household level, the remaining variables are individual characteristics.

The average wealth holding (including housing) is about US$ 400,000, the average age of the sample is 64.

As for bequest probabilities, the relevant information has been gathered from two questions present in the 2000 wave\textsuperscript{12} where each respondent is asked to report the subjective probability of leaving a bequest greater than several target amounts. The first target is set at $10,000, and the question is:

*Including property and other valuables that you might own, what are the chances that you [and your (husband/wife/partner)] will leave an inheritance totalling $10,000 or more?*

Respondents had previously been instructed to interpret 0 as absolutely no chance and 100 as absolutely certain. If the answer was 31 or more, the question was repeated but with a target of 100,000$.

In the case of a couple, each respondent was asked these questions independently. Since the reported bequest probabilities are by definition subjective, significant intra-household differences among primary and secondary respondents are observable in the data, as shown in Figures 1 and 2 below.

\textsuperscript{12}In 1992 baseline survey respondents are only asked to rank their bequest propensity on a 1 to 5 scale were possible answers are "Yes-definitely", "Yes-probably", "Yes-possibly", "Probably not", "No-definitely". Besides giving less precise information on the probability of bequeathing, no difference is made between answers at different bequest targets.
Given these discrepancies, and given that all household's wealth related information is provided by the "financial respondent" of each household (who is not necessarily the primary respondent), we focus our analysis on the financial respondent only. See Figures 3 and 4 below for details.
Figure 3: Subjective Probabilities 10k bequest- Financial Respondent

Figure 4: Subjective Probabilities 100k bequest- Financial Respondent
Clearly, a word of caution is at hand here. First, as in any survey, one might question the truthfulness of the answers given. While there might be an incentive for agents to over-indicate their propensity of bequeathing to appear generous, there might also be motives to underreport bequest incentives for tax reasons, so that the net bias is likely to be small.

More problematic is clearly the interpretation of subjective probabilities to bequeath. The way the questions are phrased in the survey one can well interpret these questions as asking for the subjective probability of dying before consuming all the wealth is consumed. In other words, a probability to bequeath 10k of 90% could be interpreted as a probability to die without reserves of 10%, which is probably something any risk averse agents will try to avoid. To minimize this problem we look only at agents who indicate subjective probabilities of 100%, which means nothing else than saying that there is a zero percent chance that they will consume all their wealth before dying. If agents are rational, such saving behavior is only possible if they are either infinitely risk averse, or if they actually do intend to leave bequests to their afterworld. While risk aversion can be assumed to be high for elderly people, it appears reasonable to believe it is finite, so that we can safely interpret indicated certainty to leave bequest as evidence of intentional bequests, the determinants of which shall be scrutinized in detail in the following.

### 3.2 Empirical Results

Eliminating the uncertainty component from the survey answers we construct two binary variables, equal to one if individuals are certain to leave at least bequests of, respectively, US$ 10k and 100k, and zero otherwise. We then run maximum likelihood probit\(^\text{13}\) on these variables.

Table 2 and 3 below summarize the results from the two dependent variables generated.

\(^{13}\text{We replicate all regressions with logit models and obtain highly similar results.}\)
Table 2: Certainty to leave a bequest > US$ 10,000

<table>
<thead>
<tr>
<th></th>
<th>bequest10k</th>
<th>bequest10k</th>
<th>bequest10k</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
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<td>[0.000]**</td>
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<td>Assets squared</td>
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<td>0.107</td>
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Note:
 Robust p values in brackets
 * significant at 5%; ** significant at 1%
 a Health assessment constructed taking the maximum value within each household of the respondent
 "self reported health status" whose values go from 1 "excellent" to 5 "poor"
 b Regional controls include 4 census regions and 9 census divisions

Estimates are based on maximum likelihood probit model; reported coefficients measure the change in the probability for an infinitesimal change in each continuous independent variable, and the discrete change for dummy dependent variables

Column 1 of Table 2 shows our baseline specification for the 10k threshold. In this first specification bequest probability is regressed only on respondent or household level characteristics. As expected, the probability to leave a bequest of this size is significatively increasing in household wealth, with wealthier households being more certain to leave sizable bequests.

Surprisingly enough, respondent’s marital status, education and age do not seem to affect bequest behaviors, whereas female respondents significatively reports lower bequests propensity. In particular our estimates show
that married women leave lower bequests than unmarried men. This finding suggests the existence of intra-couple sharing of bequest duties, or the necessity for the household assets to be partitioned among a larger number of potential heirs.

Another interesting result is given by the coefficient of "health assessment". This variable gives the self reported health status of the respondent (for single-respondent households), or its highest value in households in which respondent’s partner is present. Each individual is asked to rank his health over a 1 ("excellent") to 5 ("poor") scale. As expected, the sign of the coefficient is negative: the worse the health status, the lower the probability to leave bequests.

Thus, our findings indicate that better health has a positive and significant impact on the probability to bequeath, which, at first glance, might seem to provide evidence against the life cycle theory - the longer an agent expects to live the more resources she will be expected to use. However, this argument does not necessarily hold true; the more severe or numerous an individual’s health problems, the more likely she is to face significant medical costs in the near future. This implies for at least some share of the population in the US system, the necessity to finance at least part of these costs with household’s savings (Hurd/Smith, 1999).

The last variable considered is the number of children. As predicted by the simple theoretical model presented in section two, the number of children turns out to be significant and negative. Its negative coefficient suggests that the probability to leave sizable bequests, given household wealth and unobserved bequeathing preferences is decreasing in the number of children as the "cake" needs to be shared among more potential beneficiaries. This even more so, since there is strong empirical evidence for an equal splitting of bequests for households with several children\textsuperscript{14}. While such equal splitting in itself is inconsistent with the standard paternalistic model of bequest, it may

\textsuperscript{14}E.g., McGerry (1999) finds that over 80% of US wills divide the estate exactly equally.
well be justified based on arguments of fairness and also be efficient from an incentive perspective as noted in Gatti (1999).

The second specification adds some "cultural" and regional controls, which turn out to be surprisingly significant. In particular, being African American reduces the likelihood of bequeathing by more than 10% holding everything else constant\(^{15}\). Among regional controls, being resident of a South region or a Pacific division significantly increases the likelihood of leaving higher than 10,000$ bequests.

The last two columns of Table 2 extend the analysis to additional information on children. In particular we control for average years of education and income among children. The results are quite striking. While children’s education does not appear to have any significant effect on each agent’s bequeathing probability, the effect of income is positive and highly significant - two findings highly inconsistent with the standard paternalistic model of altruistic bequest, and only partially compatible with a simply, and purely altruistic model of bequest and shall be discussed in further detail below.

We test for the robustness of these results by trying different specifications. Adding further controls for household income and respondent’s characteristics do not change our estimates for the variables of interest.

Finally, the same analysis has been conducted for the 100,000$ bequest threshold, and we obtained similar findings, as shown in Table 3.

\(^{15}\)This result is robust even after controlling for household size, which may be bigger for the black population.
Table 3: Dependent Variable: Certainty to leave a bequest

<table>
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<td></td>
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<td>Household Assets</td>
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<td>Assets squared</td>
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<td>-0.0070</td>
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<td>Married</td>
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<td>[0.013]*</td>
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<td>Education (yrs)</td>
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<td>Health Assessment*</td>
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<tr>
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<td>Average Ch. Edc (yrs)</td>
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<tr>
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<td>[0.002]</td>
<td>[0.025]*</td>
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Regional Controls

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<td>2273</td>
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<tr>
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<td>0.186</td>
<td>0.198</td>
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</table>

Notes: Robust p values in brackets
* significant at 5%; ** significant at 1%
a Health assessment constructed taking the maximum value within each household of the respondent
"self reported health status" whose values go from 1 "excellent" to 5 "poor"
Regional controls include 4 census regions and 9 census divisions

Estimates are based on maximum likelihood probit model; reported coefficients measure the change in
the probability for an infinitesimal change in each continuous independent variable, and the
 discrete change for dummy dependent variables

4 Discussion

The strict rejection of a standard altruistic or paternalistic model in our
empirical section may appear intriguing, and yet some of the results are not
new, even though they have not received much attention so far. In two
independent studies McGarry (1999) and Laitner/Ohlsson (2001) note that
children’s education seems to have a positive effect on the likelihood to receive bequest in the US data. While McGarry argues that education is likely only a proxy for parental altruism, Laitner and Ohlsson interpret the positive sign as an indication of correlated incomes across generations. Both arguments are doubtful in our analysis; we control for parental income and wealth, and use several cultural measures to at least partially control for different degrees of altruism.

More importantly, we find that it is not education (which still might be somewhat related to parental altruism) but rather income that has major influence on parents’ intention to bequest, and that the effect is exactly opposite to the one predicted by a standard altruistic model: the richer the descendants, the more likely the parents are to leave bequests. Although some correlation of the income variable with parental altruism cannot be excluded, the sign and significance of the income variable seem to be highly robust to various controls such as inter-vivos transfers, childrens’ education and other individual controls. There are at least two possible explanations for this phenomenon: first, one could argue that parents with high income children have an additional insurance during their old age, and thus are more bound to give away a part of their wealth. Second, one might argue that children with high labor income are cheaper to raise and to support for agents, so that they have the financial leeway to leave bequests during the old age.

5 Summary and Conclusions

In this paper we present two simple theories of altruistically motivated bequest and use data from the Health and Retirement Study to demonstrate the empirical importance of intentional bequests. We show that intentional bequests are important for a sizeable share of the senior population, and that the likelihood to leave bequests is not only determined by measures of
income and wealth, but also by several other individual characteristics, most prominently health and education, but also religion and race. Further, we demonstrate that high income of descendants does not lower, but rather raise the probability of receiving bequest, and thus provide strong evidence against the standard relative income dependent model of altruistic bequests.

The results presented in this paper stress the importance of intentional or altruistic bequests in understanding old age household financial behavior, and offer at least partial explanation for the frequently observed high saving rates among the elderly population. While we have shown this effect to be significant in the US, we conjecture it to be even more important in European countries, where high annuitized incomes provided by social security systems and full public health care coverage guarantee close to perfect insurance against life time uncertainty and health cost risks for old and retired persons.
References


Appendix

6.1 Optimal Levels of Consumption, Educational Investment and Bequests With Paternalistic Altruism

As indicated in section 2, each paternalistic individual maximizes:

$$\max_{c^y_t,c^z_{t+1}} u_t = \log c^y_t + \rho \log c^z_{t+1} + \rho \eta \log c^y_{t+1} + \rho^2 \eta \log c^z_{t+1}$$  \hspace{1cm} (11)$$

Substituting the second period constraints into the maximization problem, and dropping superscripts $i$ for simplicity, equation (2) can be expressed in the following way:

$$\max_{c^y_t,c^z_{t+1},c_{t+1}} u_t = \log c^y_t + \rho \log (s_t r - b_t) + \rho \eta \log c^y_{t+1} + \rho^2 \eta \log c^z_{t+1}$$  \hspace{1cm} (12)$$

Plugging in from the first period budget, and adding the non-negativity constraint, the Lagrangian can be written as:

$$\max_{c^y_t,c^z_{t+1},b_t} \left\{ \log c^y_t + \rho \log ((h_t w_t + \frac{b_{t-1}}{n} - c^y_t - c^z_t)(r - b_t) + \rho \eta \log c^y_{t+1} + \rho^2 \eta \log c^z_{t+1} + \lambda b_t \right\}$$  \hspace{1cm} (13)$$
where $c_{t+1}^{yi}$, $c_{t+1}^{yi}$ are functions of the income of the next generation $I_{t+1} = w_{t+1} h(e_t) + b_t$. Solving for the optimal levels of consumption, educational investment and bequests, we get the following optimality conditions:

$$c_t^o = r \rho c_t^y$$

$$\frac{1}{\rho I_{t+1}} = \frac{1}{n} \frac{\partial c_{t+1} \partial I_{t+1}}{\partial e_t}$$

$$\frac{\partial I_{t+1}}{\partial e_t} = \frac{\partial I_{t+1}}{\partial b_t} + \lambda$$

$$\lambda b_t = 0$$

where $c_t$ and $c_{t+1}$ are total consumption of generations $t$ and $t+1$, respectively, and where $\lambda$ is the shadow value of the bequest constraint - if it is larger than 0 it measures the marginal cost caused to the parental generation by the fact that negative transfers to the following generation are not feasible.

Assuming a human capital return function of the type $f(e) = ae^\gamma$, with $a > 0, \gamma \in (0, 1)$, the agent’s optimal resources allocation can be derived as follows$^{16}$:

Since each agent can freely allocate resources between educational investment and bequests, the following conditions must always be satisfied:

$$b_t = 0 \ \forall e_t \ \text{s.t.} \ w_{t+1}' h'(e_t) > r$$

By our functional assumption the initial marginal returns on educational investment are very high, so that agents will support the next generation by investing into education instead of leaving bequests up to a certain threshold income level $I^*$. Within the income range $I \in [0, I^*]$, agents trade off their

---

$^{16}$While this particular functional form is not crucial for our analysis, it does not only fit the desired properties nicely, but it also greatly facilitates calculations.
own consumption against consumption of the future generation generated by educational investment, such that

\[
\frac{1}{\bar{c}_t} I_t = \eta \rho \frac{1}{\bar{c}_{t+1}(w_{t+1} f((1 - \bar{c}_t) I_{t+1})} \ast \bar{c}_{t+1} w_{t+1} f'((1 - \bar{c}_t) I_{t+1}) \tag{19}
\]

where \( \bar{c}_t \) is defined as the consumption share \( \left( \frac{c_t}{I_t} \right) \) of generation \( t \), that is \( \bar{c}_t I_t = c_t^y + c_t^o \). Plugging in the human capital return function specified above, this simplifies to\(^\text{17}\):

\[
\frac{1}{\bar{c}} = \gamma \eta \rho \frac{1}{1 - \bar{c}} \tag{20}
\]

Thus, the optimal share of consumption for any given income below \( I^* \) is given by

\[
\bar{c} = \frac{1}{1 + \gamma \eta \rho} \tag{21}
\]

Analogously, the optimal share of income spent on human capital investment \( \left( \frac{e_I}{I} \right) \) is given by

\[
\bar{c} = \frac{\gamma \eta \rho}{1 + \gamma \eta \rho} \tag{22}
\]

Following (18) the optimal amount of educational investment \( e^* \) is given by the point where \( w_{t+1} h'(\frac{e^*}{n}) = \frac{r}{n} \). Plugging in the selected human capital function, we get

\[
w_{t+1} \gamma \frac{a}{n} \frac{e^{*\gamma - 1}}{n} = \frac{r}{n} \tag{23}
\]

\[
e^* = n\left(\frac{\gamma a w_{t+1}}{r}\right)^{\frac{1}{\gamma - 1}} \tag{24}
\]

Since \( e^* = \bar{c} I^* \), we get

\(^{17}\)Since \( \frac{1}{\kappa(c)}h'(c) = \frac{1}{ae^\gamma} \gamma ae^{\gamma - 1} = \frac{\gamma}{\bar{c}} \)
Agents with income larger than $I^*$ choose and finance the efficient amount of educational investment\(^{18}\) $e^*$, and split their remaining income between own consumption and bequests. Following the same line of argument as before, it can be shown that the optimal marginal propensities to bequeath $\bar{b}$ in the various income ranges are given by

$$
\bar{b} = \begin{cases} 
0 & \text{for } I_t \leq I^*_t \\
\frac{\rho m}{1+\rho} & \text{for } I_t > I^*_t
\end{cases}
$$

Graph 1 below summarizes the results:

---

\(^{18}\)That is the amount of investment that equalizes the marginal returns on physical and human capital investment.
6.2 Optimal Levels of Bequests and Education with Warm-glow Altruism

Each agent maximizes:

$$\max_{c_t^i, e_t^i, b_t^i} u^i_t = \log c_t^i + \rho \log c_t^i + \beta_t^i \log e_t^i + \rho \delta_t^i \log (\theta + b_{t+1}^i)$$  \hspace{1cm} (27)$$

Equalizing the marginal utilities to the marginal cost it has to hold that

$$\frac{1}{c_t^i} = \beta_t^i \frac{1}{e_t^i} = \rho r \frac{1}{c_{t+1}^i} = \rho r \delta_t^i \frac{1}{\theta + b_{t+1}^i}$$  \hspace{1cm} (28)$$

Therefore, assuming $\frac{1}{\rho} = r$, we get

$$c_{t+1}^i = c_t^i = \frac{1}{\beta_t^i} e_t^i = \frac{1}{2 + \beta_t^i} I_t^i$$  \hspace{1cm} if $I \leq I_t^i$  \hspace{1cm} (29)$$

$$c_{t+1}^i = c_t^i = \frac{1}{\beta_t^i} e_t^i = \frac{1}{2 + \beta_t^i} I_t^i + \frac{1}{2 + \beta_t^i + \delta_t^i} (I_t^i - I_t^i)$$  \hspace{1cm} if $I > I_t^i$$

where $I_t^i = \frac{(2 + \beta_t^i) \theta}{\delta_t^i}$.

Similarly,

$$b_{t+1}^i = 0$$  \hspace{1cm} if $I \leq I_t^i$$

$$b_{t+1}^i = \frac{\delta_t^i}{2 + \beta_t^i + \delta_t^i} (I_t^i - I_t^i)$$  \hspace{1cm} if $I > I_t^i$$

(30)
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