

# Examining the Bequest Motive using Micro-data

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# Summary

This paper has one main objective, to examine the extent to which evidence of a bequest motive can be found in data from the Panel Study of Income Dynamics. The approach used is to look at whether individuals with children save more, as would be predicted if the bequest motive were important.

By and larger there are three main motivations for saving described in the research literature. There is precautionary saving, which is the motivation for saving that arises out of a need to insure oneself against adverse events. There is life-cycle saving, which is the motivation for saving in order to smooth the consumption across ones life-time, typically saving more during ones prime working years to both pay off debts incurred previously and save for the retirement years to come. Finally there is dynastic saving; saving that is motivated by a desire to give bequests to ones offspring. In addition to these three elements in the puzzle, various authors emphasize other factors, such as the accumulation of wealth for its own sake, the accumulation of wealth as part of a decision to be an entrepreneur, or heterogeneous preferences of some sort giving different propensities to save for different individuals. There are many theoretical papers that provide rich models to explain the behavior of individuals. Becker and Tomes (1994) is one prominent such example.

There are also numerous papers that combine some or all of these motivations to create models, and use these models to predict the earning processes and saving decisions at the individual level. Those models can then be given realistic parameters to attempt to simulate the distribution of income. These simulations can then be used to check what elements from saving theory are needed to get the “correct” result. An example of this approach can be found in De Nardi (2002).

This is not the goal of this paper. This paper does not attempt to provide a realistic model of saving behavior and its relationship to the rest of the economy to explain the patterns seen in the data. Its goals are more modest. By using data from the Panel Study of Income Dynamics, the longest running longitudinal household survey in the world, this paper will examine the extent to which predictions made by various saving motivations are supported by the data. Specifically the paper will look at whether the presence or absence of children has a

significant on saving behavior. This is done by using panel data from the PSID to check whether there is a positive relationship between an individual having adult children and his saving rate. Adult children is chosen as the key indicator, because individuals with adult children will, unlike those with underage children, not have generally higher expenses than the childless, but do have a potential bequest motive in their saving behavior.

The main analysis is based on a panel regression. The panel consists of individual saving rates between the years 1999 and 2001, 2001 and 2003, 2003 and 2005, 2005 and 2007, and 2007 and 2009. Because the individuals in the analysis belong to households and families, there is clustering in the data. This requires the use robust standard errors. A Hausman test revealed that a random effects model would yield biased estimators. This means that the rest of the empirical analysis was undertaken using a fixed effects model. To supplement the analysis of the panel data, a median regression of a longer saving rate is run, as well as a regression on the 10<sup>th</sup> and 90<sup>th</sup> percentile and an OLS-regression with cluster robust standard errors. Here the saving rate is defined as the change in wealth over the eight-year period from 1999 to 2007, divided by a measure of the income from this period (the average income described earlier multiplied by eight).

Summary statistics of the data used showed clear indications of a life-cycle pattern in the saving rates. Furthermore the effect of the business cycle was visible, which can be interpreted as supporting a precautionary motive, if the higher saving in boom years and lower saving in recession years were the results of deliberate choices, rather than simply volatility in asset prices.

In the first part of the empirical analysis, the fixed effect model panel regression provided support for the presence of a bequest motive. Both the adult children indicator and the presence of dependents in the household, the majority of which are the children of the economic decision makers in the household, had a statistically significant positive effect on the saving rate. Surprisingly the effect of adult children decreased with income, which is the opposite of what one would expect. The results from this analysis also confirmed the positive effect of income and wealth in general, and gave some indication of a life-cycle pattern in the saving rates. The analysis of long term saving rates using quantile regressions and a cluster robust OLS-regression gave strikingly different results. Where the effects of adult children and dependents was significant, it had the opposite sign of the one found in the panel analysis. Interestingly the interaction variable between income and adult children was positive in this

analysis. This means that for a sufficiently high income, the net effect of having adult children is to increase the saving rate. This is accordance with the theoretical prediction; however this was only seen for the median regression and for the regression of the lowest quintile of the saving rate distribution. The results are therefore largely inconclusive with respect to whether a bequest motive can be identified in the data.



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# 1 Introduction

This paper has one main objective, to examine the extent to which evidence of a bequest motive can be found in data from the Panel Study of Income Dynamics. The approach used is to look at whether individuals with children save more, as would be predicted if the bequest motive were important.

Inequality of income and inequality of wealth have increasingly become important questions in economics and public policy. An important factor behind this is the realization that the inequality is higher than have been previously thought, an insight produced by improved sources of data, such as Piketty and Saez (2003) use of IRS-data to document the large and increasing share of the total income going to the top 1 % and 0.1 % of the income distribution. It has long been recognized that the inequality of wealth is significantly higher than the inequality of income. This simultaneously makes inequality of wealth an interesting field of study, and poses a puzzle for researchers. Since wealth at the core is simply accumulated income, there is no obvious reason why the inequality of wealth should be higher. Indeed Friedman (1957) proposed that the higher saving rates seen among those with high incomes were an illusion, caused by not properly accounting for the permanent and transient components of income. To explain the inequality of wealth it is therefore necessary to look carefully at motivations for saving. This has value beyond simply explaining the distribution found in the data. Saving behavior play important roles in many macro-economic models, and improving the realism of these models necessitates better descriptions of saving behavior and capital accumulation at the micro level. Policy questions such as the expected effect of estate taxes on saving also require correct descriptions of the motivations for saving.

By and larger there are three main motivations for saving described in the research literature. There is precautionary saving, which is the motivation for saving that arises out of a need to insure oneself against adverse events. There is life-cycle saving, which is the motivation for saving in order to smooth the consumption across ones life-time, typically saving more during ones prime working years to both pay off debts incurred previously and save for the retirement years to come. Finally there is dynastic saving; saving that is motivated by a desire to give bequests to ones offspring. In addition to these three elements in the puzzle, various authors emphasize other factors, such as the accumulation of wealth for its own sake, the accumulation of wealth as part of a decision to be an entrepreneur, or heterogeneous

preferences of some sort giving different propensities to save for different individuals. There are many theoretical papers that provide rich models to explain the behavior of individuals. Becker and Tomes (1994) is one prominent such example.

There are also numerous papers that combine some or all of these motivations to create models, and use these models to predict the earning processes and saving decisions at the individual level. Those models can then be given realistic parameters to attempt to simulate the distribution of income. These simulations can then be used to check what elements from saving theory are needed to get the “correct” result. An example of this approach can be found in De Nardi (2002).

This is not the goal of this paper. This paper does not attempt to provide a realistic model of saving behavior and its relationship to the rest of the economy to explain the patterns seen in the data. Its goals are more modest. By using data from the Panel Study of Income Dynamics, the longest running longitudinal household survey in the world, this paper will examine the extent to which predictions made by various saving motivations are supported by the data. Specifically the paper will look at whether the presence or absence of children has a significant on saving behavior. This is done by using panel data from the PSID to check whether there is a positive relationship between an individual having adult children and his saving rate. Adult children is chosen as the key indicator, because individuals with adult children will, unlike those with underage children, not have generally higher expenses than the childless, but do have a potential bequest motive in their saving behavior.

## 2 Literature review

This section looks at previous empirical findings, and what support different theories of saving find in previous research.

### 2.1 Facts on the distribution of wealth

The determinants of the saving rates and wealth accumulation of individuals, and thus the wealth distribution in society, have been examined numerous times. According to Díaz-Giménez et al (1997) income and wealth are both unequally distributed, but the distributions of the two vary considerably. Wealth is much more unevenly distributed, with a Gini coefficient of 0.78 and a ratio of the wealth of the top 1 % to that of the bottom 40 % of 875. This is a very high level of inequality; the equivalent numbers for income are 0.57 and 84. They also report a low correlation between income and wealth. They use the Panel Study of Income Dynamics and the Survey of Consumer Finances to reach their conclusions. Other findings include that marital status and having children in the household are important factors determining income and wealth levels. For example, the ratio of the wealth level of singles without dependent children and singles with dependent children is 120.

The divergence of income and wealth distributions could to some extent be a result of the data used. Using data based on tax returns from the IRS Piketty and Saez (2003) document a sharply increasing income share of the top parts of the income distribution. They report that the wage income share of the top 0.1 % of the income distribution was 4.13 % in 1998, with the top 1 % earning 10.88 % of the total wage income.

#### 2.1.1 Do the rich save more?

One important empirical question is the extent to which the saving rate increases with permanent income, so that richer individuals save a larger proportion of their income. This was a question that was extensively studied in the year following the formulation of the Permanent Income Hypothesis in Friedman (1957). This hypothesis predicts that the saving rate does not increase with income. Dynnan et al (2000) have looked at this question. They base their study on data from the Panel Study on Income Dynamics, the Survey of Consumer

Finances and the Consumer Expenditure Survey. Based on these data sources, they conclude that there is a strong positive relationship between saving rates and personal income.

### **2.1.2 Does wealth decline after retirement?**

Another important question is whether wealth declines after retirement. Bernheim (1987) finds using panel data that bequeathable wealth does decline after retirement. Bequeathable wealth is defined as wealth excluding annuities, and similar wealth such as Social Security benefits. The rate of decline is estimated at 1 to 2 % per year for single individuals, but close to zero for most couples. When annuities are included, no decline is found. The data used in this study is the Longitudinal Retirement History Survey.

### **2.1.3 Do individuals with children save more?**

Whether individuals with children save more is an important empirical question, as it indicates whether there is in fact evidence of a bequest motive. Despite the relevance of this question to theories of saving, it has not garnered a lot of attention in the literature. Hurd (1986), one of the few studies that look at this question, does not find a higher level of saving for those with children.

## **2.2 Explaining the wealth distribution with theories of saving**

### **2.2.1 Permanent Income hypothesis**

One of the earliest and most influential theories of saving behavior is the Permanent Income hypothesis. Presented by Friedman (1957), it predicts that individuals will attempt to smooth their consumption as much as possible, so that it tracks the permanent income. The permanent income can be defined as the annual income available if one were to spread out the whole life-time income evenly. Permanent income can be contrasted with the actual income at any one point. The annual income will be related to the permanent income, but also contain a transient component. The transient component can be either negative or positive, corresponding to an unusually low income and an unusually high income. Friedman used this theory to show that empirical findings showing higher saving rates among those with higher



income did not necessarily imply that the rich saved more. It could be explained by temporarily high incomes leading to the higher saving rates, and temporarily low incomes leading to lower saving rates or even dissaving. The permanent income hypothesis has two clear implications for saving behavior. The first is that temporary high income will be saved and that individuals will save to avoid decreased consumption due to temporarily low income. The second is that individuals will attempt to smooth their consumption across their lifetime. These two implications give rise to models to precautionary saving models and life-cycle saving models respectively. While the assumptions of the permanent income hypothesis, such that almost all transient income will be saved, might be too strong, the key prediction of income smoothing is clearly important in determining saving behavior.

### **2.2.2 Precautionary saving**

Precautionary saving is motivated by uncertainty about the future. The source of this uncertainty can be manifold. The most important things individuals can be uncertain about, that would motivate higher saving are, future income, the length of ones life and large expenses such as medical expenses. Uncertainty about future income leads to saving in order to maintain the ability to spend at a level close to that allowed by the permanent income, even in the presence of negative income shocks. Uncertainty about the time of ones death complicates the process of saving for retirement, as one does not know how much money one is going to need. Large unavoidable expenses such as medical expenses have an effect similar to that of negative income shocks, with the motivation for saving being to hold the rest of the consumption steady despite the extra expenses. Hubbard et al (1994) finds support for precautionary motive. They create a life-cycle model that includes those uncertainties listed and show that such a model can match the key facts of the wealth distribution. An important fact needed to achieve the correct result is that consumers must be unable to insure against negative income shocks, and cannot be able to effectively annuitize their wealth in order to with certainty achieve the desired level of saving in old-age. Carroll (1997) uses a “buffer-stock” explanation of saving. In this model consumers are impatient and set average consumption growth at the level of income growth, while attempting to maintain an economic buffer to meet adverse economic events. This is not a standard precautionary motive model, but includes some of its reasoning. Fisher and Montalto (2011) examine household saving using the Survey of Consumer Finance, and find an asymmetry in saving behavior. Income below the reference level of the households causes a decrease in saving, whereas income

above does not increase saving. This illustrates that the behavior predicted by the precautionary motive might be partially correct and partially wrong.

### **2.2.3 Life-cycle saving**

Bernheim (1987) shows that the data does not support life-cycle theories in the presence of non-discretionary annuities, e.g. Social Security and other forms of forced pension saving.

By looking at bequest intentions and actual bequests, Hurd and Smith (2001), conclude that there is a close relationship, and that individuals update their view on the probability of leaving a bequest when given new information on their health or economic prospects. Based on this model of actual and anticipated bequest they conclude that people plan to dissave before they die. This is in accordance with life-cycle theories of saving. Kotlikoff and Summers (1981) show that life-cycle models with certainty fail to predict the aggregate wealth pattern seen.

# 3 Theory

## 3.1 Dynastic models of wealth accumulation

One influential theory used to explain saving behavior and wealth accumulation is the dynastic model. In this type of model, the agent has a motivation to hand over wealth to the next generation. This theory can be modeled in various ways. One way to model the theory is the infinitely-lived agents' model. An influential early example of such a model is found in Bewley (1977). Here the dynasty of parents and their heirs is seen as a single economic agent utility function of the form:

$$E \left[ \sum_{t=1}^{\infty} \beta^t u(c_t) \right]$$

Here the household maximizes the discounted sum of expected utilities until the end of time. By specifying an earning process, which often includes exogenous productivity shocks to the earnings of the households, an asset and capital market and a production technology, this type of model can give a household maximization problem and a market equilibrium. This in turns gives a given distribution of wealth when a set of parameters is added. Details on these types of models and their solutions are described in Ljungqvist and Sargent (2000).

Another set of models are those with overlapping-generations. These models use elements from life-cycle models, and add a parental decision problem, where the parents are motivated by altruism towards their children. Becker and Tomes (1994) presents advanced versions of these models where asset accumulation, bequests, investment in human capital, and relative consumption levels influence saving behavior and the distribution of wealth. The model presented below is a much simplified version of those from that book.

### 3.1.1 A simple model of dynastic saving decisions

The purpose of this paper is not to simulate the saving behavior of all agents to reproduce the distribution found in the data. Therefore there is no need to specify a realistic, feature-rich model of the behavior of the agents. Instead what follows is a model that is as simple as

possible to illustrate some predictions of a dynastic model, in order to give an indication of what will be looked for in the data.

An easy way to create a bequest motive is by including the utility of the heir in the utility function of the parent:

$$U_p = U(C_p) + \theta U_h(C_h)$$

Here  $U_p$  is the utility of the parent,  $C_p$  and  $C_h$  is the consumption of respectively the parent and heir,  $U(C_h)$  is the utility the heir gets for consumption  $C_h$ , and  $\theta$  is the weight the parents puts on the utility of the heir. This is a simple static model, similar to one described by Altonji, et al. (1989), but contains the elements necessary to examine many aspects of the parent's choice. To give a proper description of the choice faced, the model would have to take into account the intertemporal nature of the decision faced.

The parent can choose to allocate his total life-time wealth  $W_p$  to his own consumption, and to the bequest given to his heir  $B$ , giving the following budget constraint for the parent:

$W_p = C_p + B$ . The heir has a life-time income of his own,  $I_h$ , so his budget constraint is  $C_h = I_h + B$ .

Here it is assumed that the heir has no children of his own, and therefore will not allocate any part of his total wealth to bequests. This is obviously a large simplification, which would not be tenable if the model were to be used to simulate actual wealth inequality. The combined budget constraint of the parent and the heir is  $C_p + C_h = W_p + I_h$ . If the heir's income is unaffected by the size of the bequest, the parent will choose a consumption level and bequest level such that the marginal utility of his own income equals the discounted marginal utility of the child's income:

$$\frac{\partial U_p}{\partial C_p} = \theta \frac{\partial U_h}{\partial C_h}$$

As long as the income of the heir is independent of the bequest given, the behavior of the parent and the heir maximizes the former's utility subject to the combined budget constraint. According to Altonji, et al. (1989) this outcome holds for other altruistic models as well.

If the consumption level of the heirs enters into the utility function of the parents, the strength of the bequest motive will depend on how the consumption level of the parents and the children compare. If the children are expected to have a higher consumption level than the

parents, the bequest level will most likely be zero, since the marginal utility of consuming extra income exceeds the marginal utility of bequests. More formally, if  $U_p'(W_p) \geq \theta U_h'(I_h)$ , then  $B=0$ . This condition says that if the marginal utility for the parent when the whole wealth is consumed is higher than, or equal to, the discounted marginal utility for the heir when consuming only his own lifetime income, then the parent will not give a bequest. If the heir and the parent gain the same amount of utility from the same level of consumption, such that  $U_p(x) = U_h(x)$  for any  $x$ , and  $\theta \leq 1$ , this condition will be satisfied whenever  $W_p \leq I_h$ . If the  $\theta$  is smaller than one,  $B=0$ , even for some values where the wealth of the parent exceeds the lifetime income of the heir.

Becker and Tomes (1986) and Mulligan (1997) explain the presence of a bequest motive by mean reverting income levels. If the parents have an above average level of lifetime income, mean reversion implies that the children will have a lower level of income than the parents. Mean-reverting income levels can be modeled using a Markow-chain.

$$I_h = a + bI_p + \varepsilon$$

$I_h$ , the life-time income of the heir, is determined by the level of the life-time income of the heir,  $I_p$ , the constants  $a$  and  $b$ , and a random error term  $\varepsilon$ , which is independent from  $I_p$ , with a mean value of zero. The parameter  $b$  can be seen as a measure of the persistence of income differences across generations. If  $b=0$ , then  $a$  indicates the average level of life-time income of in a cohort, and all departures from the average level are due to factors unrelated to the parents income (contained in the error term  $\varepsilon$ ). If  $0 < b < 1$ , then there is a positive correlation between the income of parents and their children, but the children are likely to be closer to the mean of their generation than their parents were to the mean of theirs. This model predicts that the bequest motive will only be relevant for rich households, and that the richer the household the higher the desired level of bequests is. The higher the degree of mean reversion of lifetime income between parents and children, the higher the level of bequest would be. If the economic agents gain utility from their relative position in society, not just from the actual level of consumption, the negative effect economic growth has on the bequest motive would be diminished.

Economic growth would cause parents to in average expect their children to be better off than themselves. If the level of consumption of the children drives the bequest motive, this would indicate that even with reversal to the mean of the income of the children, many parents with

above average income levels would not have a bequest motive. Voluntary bequests would therefore only be common among those so rich that even taking into account the expected level of economic growth, their children's lifetime income would be expected to be lower than their own. Models where the bequest motive depends on the income of the children predict that factors that negatively affect the earning ability of the children will increase the level of bequests. If for example the children have low levels of completed education, this should lead to the parents saving more.

### 3.1.2 Reverse altruism

The altruistic link between parents and children can also run in the opposite direction, where children include the utility of their old-age parents in their utility function. Richer children would then help out their parents in old age. Children then become a saving vehicle for their parents. This effect is prominent in many poorer countries and is used as an explanation of the high level of fertility in many poor countries. Reverse altruism would indicate that individuals with children save less than those who are childless, since they can rely on their children for some of their life-cycle saving. If the altruism of the children is dependent on the consumption level of the parents, the argument about mean reversion of income would indicate that poor parents would save very little for bequests and perhaps reduce other forms of saving, whilst richer parents would still save.

### 3.1.3 Trade-off between education spending and bequests

If parents can through their behavior affect the earning potential of their offspring, this behavior will be a substitute for providing bequests. The most obvious way parents could do this is through spending on education. Parents could conceivably also forgo income through devoting extra time to raising their children, or in some other way face a trade-off between their own consumption and the consumption of their children. Since these trade-offs are hard to identify in the data, and even harder to quantify, this paper will limit itself to look at spending on education. To examine this question it is necessary to look at a model where the permanent income of the heir depends on the education level. It also makes sense to make the simple static model a two-period model to compare the returns. The parents utility function becomes:

$$U_{p,t} = U(C_{p,t}) + \theta U_{h,t+1}[rB + I_{h,t+1}(E_h)] \quad ,$$

where the utility of the parent at time  $t$  depends on the consumption at time  $t$ , and the utility of the heir at time  $t+1$ , discounted by the factor  $\theta$ . The utility of the heir depends on his consumption, which is comprised of the value at time  $t+1$  of the bequest set aside by the parent at time  $t$ , and his income. The level of income of the heir depends on the amount spent on his education,  $E$ .

The parents budget constraint is  $W_p = C_p + B + E_h$ . There is a constant market rate of return  $r$  on the bequest set aside by the parent. The income of the heir increases with the level of spending on education, but with decreasing returns, so that  $\frac{\partial^2 I}{\partial E^2} < 0$ . As long as the return from spending on education is higher than the return on bequest, the level of bequests will be zero, regardless of how the trade-off between present consumption and the future consumption of the heir is. The parent will prefer spending on education rather than saving for bequests until  $\frac{\partial I}{\partial E} = r$ . Once the return on education spending is equal to the market return on bequests, the parent will be setting aside money for the bequest. Allowing for spending that increases the future income of the heir will therefore decrease the level of bequests.

### 3.1.4 The effect of multiple children

In a family with multiple children the parents should want to give a larger bequest to their most dimwitted and uneducated children, since they are likely to have a lower lifetime income. This behavior can disappear if the parents are preoccupied with concerns of equity and want to treat their children equally. How the number of children affects the level of bequests depends on the way the model is constructed. If additional children simply lead to more identical terms being added to the utility function, this will increase the total level of bequests given and thus the saving rate. Alternatively bequests to each child can be perfect substitutes, in which case the number of children will not increase the amount of money set aside for bequests. Individuals with more children might also have different preference parameters, leading to different and unpredictable effects of an increased number of children.

### 3.1.5 Uncertain life-spans

Uncertainty with regards to the time of death will, according to the theory, cause individuals to save extra in order to avoid an undesirably low level of consumption in old age. This can cause the parents to cause bequests that are not planned, so-called accidental bequests. A high

risk aversion leads to a high saving rate in order to avoid an unexpectedly low level of consumption in old age. This could result in the expected level of accidental bequests to be equal to or higher than the desired level of voluntary bequests. If this is the case, then it would not be possible to distinguish between an individual with a bequest motive and one without a bequest motive, since the saving level would be identical. If a portion of the wealth held is in annuities, this reduces the risk of an unacceptably low level of consumption in old age.

Annuities are assets that yield a set annual return as long as the owner is alive, but that are not bequeathable. With perfect markets for annuities, there would be no reason for individuals to engage in precautionary saving when faced with uncertain life-spans, and therefore all wealth held in other asset classes would be an indication of a bequest motive. Most individuals do not annuitize a large proportion of their wealth in old age. This can probably be explained by the fact that the market for annuities is far from perfect, and cannot be taken as proof of a widespread and strong bequest motive. An important source of annuitized wealth is Social Security, and other forms of forced pension saving. Since Social Security covers a smaller proportion of one's pre-retirement income when that income is higher, this should indicate that richer individuals will save more from precautionary reasons than poorer households.

Gokhale and Kotlikoff (2002) propose that the increased annuitized share of resources for the elderly decreases savings and accidental bequests, and that this is an important explanation for the increase in wealth inequality seen during the last decades.

### **3.1.6 Joy of giving**

A bequest motive can also be modeled by an altruistic link between parents and children that is unrelated to the level of the latter's consumption. These models can be called "joy of giving", or "warm glow" models of bequests, and were first introduced in Andreoni (1989). De Nardi (2004) utilizes a model where the giving of bequests is a luxury good, meaning that the share of income devoted to bequests increases as income increases. The problem with the simpler joy of giving models is that they are more ad hoc in their assumptions. Since there are no external factors that influence the desired level of bequests, the models can explain virtually any level of bequests found in the data, simply by varying the level of the key parameters. This detracts from their predictive power. The simplicity of these models is also their virtue, since they are less dependent on the specific choices made in constructing the relationship between the level of consumption of the children and the parents.



### **3.1.7 Bequest motives directed at others than children**

To whom individuals wish to give bequests is an important question. In this paper it is assumed that individuals only wish to give bequests to their children. It is possible that bequests to more distant relatives also enter into the utility functions of individuals, or that there is utility gained from other types of bequests, such as charitable giving. If these factors enter into the utility function of both the childless and those with children, the total desired level of bequests could still be higher for those who have children depending on the form of the utility functions. In this case the use of children as an indicator of the bequest motive will still give results, but will understate the actual magnitude of the bequest motive. However if the preferences of the childless and those with children differed systematically in such a way as to create an equivalent bequest motive directed at others, it is impossible to use children to determine whether there is a bequest motive.

# 4 Empirical strategy and variables

## 4.1 Description of the data

The data used in this study comes from the Panel Study on Income Dynamics. This study is the longest running longitudinal household survey in the world, having started in 1968. This paper uses demographic and income information from the period between 1997 and 2009, and wealth levels from 1999 to 2009. The survey is biennial over this period, and gives detailed information on a wide range of questions. The same several thousand households are surveyed each time, and the data can be broken down to the level of individuals.

According to Davies and Shorrocks (2000), the information gained from surveys on the wealth distribution is often less reliable than comparable information on income, due to the problems of sampling individuals from the far right end of the wealth distribution. Some surveys, such as the SCF deal with this problem by oversampling the wealthy. This approach is not used in the PSID. While the panel nature of the PSID makes it ideal for following individuals over time to identify variables such as the presence of adult children, the lack of accurate information on the wealthiest section of society is a drawback when studying the bequest motive.

## 4.2 Goal of analysis

The main goal of the empirical analysis is to examine whether there is a link between the accumulation of wealth through saving and having children. If there is a significant positive relationship, this would offer support dynastic theories of wealth accumulation. If no relationship is found, or the relationship is negative, such that having children predicts a lower saving rate, this would indicate that the bequest motive does not play a major role in determining the level of wealth of households or the wealth inequality of society as a whole. In addition other variables of interest will be looked at in order to discuss the support found in the data for various theories of saving behavior. The presence or absence of a bequest motive cannot easily be examined by looking at bequests directly. This is because most theories of saving and wealth accumulation predict some level of bequests. As previously discussed both life-cycle saving and precautionary saving can be expected to give rise to accidental bequests

if the time of death is unknown, which it is in the real world, and if insurance markets and markets for annuities are imperfect.

Theories of wealth accumulation that emphasize other motivations, such as wealth being held in order to keep ownership of a business or because the level of wealth itself provides utility, would also predict bequests. These bequests would not be accidental, since they would be predictable for the economic agent, but they would be incidental in the sense that they are not desired.

Both precautionary saving and life-cycle saving models predict increasing dissaving in old age, and smaller and smaller accidental bequests the older the economic agent is. Whilst this prediction makes it possible to examine the extent to which bequests are accidental by looking at the age-profile of bequests, there is no similar way to distinguish between wanted and incidental bequests. In order to examine whether the bequest motive is important in determining saving and wealth levels, it is necessary to compare individuals that have children with individuals that do not have children. Using panel data on wealth levels it is possible to compute saving rates for individuals, and estimate what factors affect the saving rate.

## **4.3 Dependent variable**

### **4.3.1 Defining saving rates**

Saving can be defined in various ways. One way is to define saving simply as the change in wealth. This is the definition used throughout this paper, and it includes changes in the level of housing wealth and increases in the values of financial assets. An alternative way of defining saving would be to look only at income actively set aside for the purpose of saving, and the excluding unrealized capital gains. This could be called active saving. The way to calculate this level of saving would be to look at the difference between ordinary income and consumption. Since the data used does not contain accurate estimates of consumption for the years examined this approach is not used. This approach is used by Dynnan et. al (2002).

The advantage of looking at active saving could be that households do not fully take into account increases or decreases in the values of assets in deciding their level of saving. This could be because of lack of accurate information on the value at any given time of their assets,

because of limited rationality, or because of volatility of the value of assets. If the values of some types of assets vary considerably a measure of saving that relies on the total value of wealth at two points in time might overstate or understate the level of saving for that period. If the asset allocation differs between groups, this could cause the data to erroneously indicate different saving rates. An example of this could be comparing saving rates of richer and poorer households. Richer households generally have a larger proportion of their wealth in the stock market. If the period looked at is one where the stock market did unusually well or especially poorly, this would overstate or understate the saving rate of the rich compared to the poor. Excluding volatile assets from the calculation of saving is unsatisfactory precisely because these assets are an important source of saving for a large number of households. To deal with the effect of volatile assets on estimated saving rates, this paper looks at saving rates for various periods and for periods of different lengths. Specifically the use of panel data in the main analysis means that the short term volatility of asset values should not have a too large effect on the aggregate relationship found between the saving rates and the variables of interest. Furthermore the proportion of the wealth held in the form of stocks is used as a control variable.

### **4.3.2 How the saving rate is calculated**

The basic way the saving rate is calculated is by subtracting the wealth level at the beginning of the saving period from the wealth level at the end of the period and dividing it by a measure of income, which is discussed in more detail below. All dollar values are adjusted for inflation, and are measured in 2007-dollars. The adjustment for inflation uses the values from the St. Louis Fed GDP deflator (<http://research.stlouisfed.org/fred2/data/GDPDEF.txt>). All values are assumed to be from the second quarter of their relevant year, as this is the most common period for the interviews in the PSID. Adjusting for inflation makes saving rates, wealth levels and income levels from different years more easily comparable.

### **4.3.3 Basing saving rates on one-year or multi-year income**

The wealth level is reported at two-year intervals in the data. This means that the saving periods looked at are also two years long. However there is only a single measure of income for each two year period, which is the total household income for the year in between the

wealth measurements. This is because the survey asks for the current level of wealth, but the previous year's level of income and because the survey is biennial.

This means that it is not possible to calculate a “true” saving rate based on the change in wealth over a time period as a proportion of the total income of that period. For example for the period from 2007 to 2009, the PSID contains wealth values for the year 2007 from the 2007 survey, wealth values for the year 2009 from that years survey, and income levels from the years 2006 and 2008. Ideally the income from 2007 would also be available, so that the saving rate could be defined as the ratio between the change in wealth from 2007 to 2009, and the sum of the incomes in 2007 and 2008.

Since this is not possible, two other definitions of the saving rate have been used. The first relies on a measure of permanent income. The average yearly income between the years 1996 (from the 1997 survey) and 2008 is calculated. Since there is data for every other year, the mean is calculated based on seven values. This measure of permanent income, multiplied by two, is then used as the denominator in the saving rate.

Whether this is a good approximation on permanent income depends on the persistence of income shocks. If income shocks are highly persistent, more data would be required to create a good measure of the permanent income. Income for most individuals follows a set life-cycle, with lower incomes when young, increasing incomes towards middle age, and decreasing incomes in old age, especially after retirement. This means that this measure of permanent income is affected by the age of the individual in question. Someone who is either young at the beginning of the measurement period, or old at the end of it, will get an artificially low level of permanent income compared to someone who is in his prime earning years throughout the period.

The second definition of the saving takes the income in the year between the two measurements of wealth, multiplies it by two, and uses it as the denominator when calculating the saving rate. If the income during the “missing” year is more highly correlated with the income the following year, than with the measure of permanent income, implying a high persistence of income shocks, then this second definition will give values for the saving rate closer to the “true” saving rate.

#### **4.3.4 With or without housing equity**

A particularly problematic source of wealth is housing wealth. Housing is a relatively illiquid asset, with high transaction costs, making it less likely that households readjust their wealth portfolios and saving behavior following changes in housing prices. The availability of house equity loans makes the illiquid nature of housing wealth less of an issue. Engelhardt (1996) finds using PSID data from the 1980s that housing appreciation, which as it is an increase in wealth can be seen as a form of saving, does not affect non-housing saving, when the change in housing value is positive, but does affect non-housing saving when the housing value decreases (a form of negative saving). Campbell and Cocco (2005) however find large effects on consumption for some groups of increasing house prices. Recent experiences also show clearly that housing values are more volatile than previously thought. Whether housing wealth should be treated the same as other forms of wealth depends on whether households treat their housing wealth in similar ways as their non-housing wealth, and on how important housing wealth is as a saving vehicle for households.

Housing is not only an asset owned for saving purposes, housing is also a consumption good. When house prices increase, this not only increases the wealth of house owners, but also increases the cost of enjoying a similar level of “consumption of housing” elsewhere. This is especially the case if rents follow house prices, as they can be expected to do in the long term (Gallin 2008). Said differently, when there is a general increase in house prices, as opposed to an increase only of a particular house, a house owner who has experienced an increase in value of his house can only consume that wealth or allocate it to some other asset class if he is willing to consume a lower amount of housing good. Other assets do not have this property.

Excluding the value of housing is not entirely satisfactory either, since households might use their savings on acquiring more expensive houses or on making investments that increase the value of their house. Also, the value of housing might be an important consideration when planning bequests for descendants. Since it is possible to take out loans against the value of housing, it is possible to consume housing wealth without selling. This form of dissaving is important to include when determining whether there is a bequest motive in the saving behavior of the elderly. This paper mainly uses estimates of saving rates based on wealth levels that include housing. However wealth levels excluding housing equity are also examined to determine whether the conclusions are sensitive to the type of saving used.

#### **4.3.5 Saving with or without large inheritance and gifts**

The PSID contains data on inheritance and gifts larger than \$ 10 000 received in the period between measurements of wealth levels. These sums are not included as income. A sudden large gift can be seen as an example of transitory income. Economic theory predicts that such a gift will largely be saved by the recipients. Their effect is therefore to substantially increase the saving rate for the individuals and households who receive them.

If households expect to receive inheritances from their parents, but the timing of the inheritance is unknown, the households can be expected to treat the future expected inheritance like a form of illiquid wealth, and take account of it in their saving behavior both before and after the inheritance is received.

In order to avoid complications related to how gifts and inheritance should be treated, they are not added to the income measures, and are subtracted from the change in wealth in the main analysis.

#### **4.3.6 Eliminating negative income values**

Income levels in the data can be both positive and negative. Negative levels are caused by losses from businesses or farms, alternatively they could be caused by errors in the data. The income can also be zero for some years if the household is living only off previous savings. Because the income enters as the denominator in the saving rate, the saving rate is not defined when the income is zero. When the income is negative, applying the normal definition of the saving rate does not work. A household with negative reported income will erroneously be considered to be saving if the change in wealth is negative and be considered to be dissaving when the change in wealth is positive.

If the measure of income included all income, including capital gains, for the whole saving period, it would not be possible for a household to have negative income and positive saving. However the data in the PSID only contains income levels for every other year. This means that there could be households that have a net positive income for the two year period over which saving is measured, but have a negative income in the year when income is recorded.

In order to avoid spurious saving rates caused by negative income values and undefined saving rates caused by zero incomes, all observations where the income is not strictly positive are dropped from the analysis. This is more problematic for the saving rate calculated with the

one year income, than for the saving rate that uses permanent income. While it is plausible that a household has a negative income one year, an average negative income over a 12 year period is not realistic. If a person has a negative average income there must either be a very large variation in the income, such that losses one or more years are larger than the positive income in the remaining years, or there must be errors in the data.

#### **4.3.7 Removing top-coded incomes and wealth levels**

In the PSID the wealth and income levels are top coded for very high levels. If the wealth level is above \$ 999,999,997, the recorded wealth level is simply recorded as being \$ 999 999 997. Incomes above \$ 9,999,999 are similarly top coded. This is a familiar problem in the literature on income and wealth (e.g. Gottschalk 1997), and is sometimes dealt with by multiplying all top coded values by 1.5 or 2. This is unsatisfactory in general, but is especially so when the values are used to calculate changes in wealth and saving rates. A household with top coded wealth levels in two periods will be registered as having zero saving in all cases. The calculated saving of a household with one wealth level that is top coded will depend entirely on how the top coded values are treated. A person with top coded income will, if the income is not adjusted, be registered as having an artificially high saving rate. This will cause a spurious positive relationship between saving rate and high income. Because of these problems observations with top coded values are dropped. This is not entirely satisfactory. One of the key predictions of many dynastic saving models is that the bequest motive and saving rate is higher for the very richest households. Furthermore explaining the very right-skewed nature of the wealth distribution is important for theories of wealth accumulation.

#### **4.3.8 Eliminating extreme values of saving rates**

When computing the saving rate in the manner described above, some anomalous saving rates appear. While the majority of the saving rates have reasonable values, the values of the saving rate used in the panel data analysis vary between  $-187$  and  $1052$ . It is not plausible that an individual saves more than a thousand times his average income in a given year, perhaps except if he has just won the lottery. If the saving rate used in the analysis included all income in the two year saving period, without any error, then it would be impossible to have a saving rate in excess of 1. However due to imperfections in the saving rate, it is not possible to say with certainty that saving rates in excess of a given value are errors. Nonetheless extremely



high rates are either signs of errors in the data, or that the individuals in question have some extremely unusual feature (such as a propensity for winning lotteries). Because the very large saving rates can have an undue effect on the results, all saving rates above 1 are excluded from the analysis. This corresponds to excluding all values that are above the 92<sup>nd</sup> percentile of the distribution of saving rates.

This is a somewhat arbitrary cut-off point, due to the imperfect nature of the calculated saving rate, but it is the least arbitrary possible cut-off point. There is no theoretical lower limit to how negative the saving rate can be, even if there are no imperfections in the data or calculations. This is because it is possible for someone to consume a large multiple of their income from their wealth. Very high negative values are still suspicious, as they can be caused by errors and will have a large effect on the results. Therefore the most extreme negative values are excluded. In order to make the cut-off symmetric all values below the 8<sup>th</sup> percentile of the distribution of saving rates are eliminated.

One possible source of extreme values is measurement error. Measurement error is fairly common in the PSID and similar surveys. In Pischke (1995) it is proposed that the measurement error found in the PSID comes from underreporting of transitory earnings, and a random component. Underreporting of transitory income would be expected to lead to overrated saving rates. Duncan and Hill (1985) estimate that a little under 20% of the variability of earnings in the PSID is due to errors. Furthermore this error is correlated with many regressors that are frequently used. This is problematic, and adds an extra reason to exclude those observations that are most likely to be affected by errors. If extreme values are more likely to erroneous, as it is proposed here that they are, then they should be excluded.

## **4.4 Key independent variables**

### **4.4.1 Children and adult children**

The primary purpose of the analysis in this paper is to quantify the effect of children on saving rates and wealth accumulation, in order to test the importance of the bequest motive. The theory is that if giving bequests to ones children is important, this would cause the saving rate of parents to be higher than childless individuals.

However individuals with and without children can be expected to differ in more ways than simply whether they are motivated to save for bequests. Most importantly, raising children costs a lot of money, which means that households that raise children have a less income available for saving. If this effect is larger than the effect of a bequest motive, it could lead to erroneously concluding that do not save for bequests. In order to deal with this problem, the key variable is an indicator of whether the individual has adult children. Adult children are defined as children that are older than 18 years old. While it is possible that children still rely on their parents economically after entering adulthood, it is also likely that this dependence becomes smaller and smaller as the children become older. 18 years is a convenient cut-off point between childhood and adulthood. Parents are likely to have lower levels of wealth even after having raised children if the cost of raising children causes lower saving while the children were young. The effect of this on the saving rate of parents with adult children is not obvious. On one hand lower levels of wealth have sometimes been associated with lower saving rates. The level of wealth at the start of the saving period is used as a control variable, and can potentially remove this effect. However, it is also possible that parents with adult children need to engage in catch-up saving when they no longer need to provide for their children. If the wealth level of parents with children that have recently entered adulthood are lower than the parents would choose based purely on life-cycle and precautionary saving motives if they were childless, this could cause extra saving that is incorrectly attributed to the bequest motive. Because of this, even if a strong relationship is found between saving level and the presence of adult children, this does not conclusively show that the bequest motive is important.

Parents and non-parents are likely to differ in other, less obvious ways than whether they have to pay for the upbringing of children or not. As many of these differences as possible are taken into account by including various control variables. It is possible that there are hidden differences that are not accounted for. These differences could cause the conclusion regarding the bequest motive to be wrong. This risk is impossible to avoid entirely.

The indicator for adult children takes two forms in the analysis. In the one that is used for most of the analysis, the indicator indicates that the individual has adult children, and no children below the age of 18. This indicator can be called the exclusive adult children indicator. The second form indicates that the individual has adult children, but does not exclude individuals who have both adult and young children. This indicator will be called the

inclusive indicator. The reason for basing the analysis mainly on the exclusive adult children indicator is that parents who only have adult children have the advantage of being similar to childless individuals in practically every respect, except having offspring that could give rise to a bequest motive. Since the presence of dependents in the household is controlled for, as explained below, the inclusive indicator can nonetheless function in a satisfactory manner. The advantage of the inclusive indicator is that more individuals satisfy its condition. This is especially the case for lower age groups.

The analysis bases itself on the presence or absence of adult children, not the number of adult children. There are several reasons for this. Firstly there is no clear prediction from the theory on bequest motives regarding how the bequest motive changes as the number of children increases. Whether a higher number of adult children leads to more money set aside for bequests depends on the details of the model used. Secondly, even if a higher number of children leads to a higher desired bequest level, it is unlikely that this relationship is linear. If there is a decreasing marginal utility from future bequests, going from one adult child to two, will not double the desired level of bequests regardless of how the bequest to the extra child enters into the utility function. Dealing with a non-linear relationship between the desired level bequest and the number of adult children could be done by creating dummy variables for each number of children. However this could make it difficult to get significant results, without adding much to the quality of the analysis. Quantifying the precise effect of the number of children on the bequest level is beyond the scope of this paper; therefore no attempt is made to use dummy variables for the number of adult children.

Individuals that are expecting to become parents at some point in the future, but are currently childless could be expected to have a similar saving behavior as individuals with adult children. Both groups share the characteristics of potentially wanting to save for bequests and of not having to spend money on raising children. This would have the advantage of including younger individuals in the analysis of the bequest motive. No attempt is made to examine this effect. One reason for this is that it is not possible to identify individuals that expect to have children in the future. Due to the nature of the panel data, it is possible to identify individuals who get children after a saving period. However, whether these children were expected cannot be known. It is also impossible to identify individuals who expect to have children, but for some reason do not manage. The indicators of adult children base themselves on reported live births to individuals and the year these births occurred. This does not control for children who

have died after birth. Since the mortality rate is relatively low until individuals reach a fairly high age, this is not a major problem. As noted previously, spending on education, or other spending that can increase the earning potential of children, is a substitute for giving bequests. This is especially important when the desired level of bequests is low, and the return to education spending is high. Education spending on adult children is not controlled for. This is a potential weakness in the analysis.

#### **4.4.2 Dependents**

Dependents are defined in this analysis as individuals who live in the household, and cannot be expected to provide income. In practice, these are children that live in the household, and are usually the children of others in the household. The number of dependents in the household can be expected to negatively affect the disposable income, and thus the saving rate. Therefore it is important to control for this. Furthermore, when the exclusive indicator of adult children is used, not controlling for the effect of dependents would negatively affect the saving rate of those who do not satisfy the criteria of the indicator, and thus risk overestimating the effect of having adult children. When the inclusive indicator is used, there is a difference within this group between those that still raise underage children, and those who do not. Including the number of dependents in the analysis is therefore important to identify the proper role of the presence of adult children.

#### **4.4.3 Income and wealth**

The income level of the household is an obvious factor contributing to the saving rate. This is both because people with temporarily high incomes can be expected to save more, and because it is common to find in the literature that saving rates increases with measures of permanent income. The log of income is taken to diminish the effect of extreme values. This has the effect of excluding those with negative incomes that are not already excluded through the construction of the saving rate variable. These are those with long-run negative incomes when short run saving rate measure is used, or short-run negative incomes when long-run saving measure is used. This is not necessarily a problem as the cause of negative incomes can be errors in the data. This is especially true when the long-run income is negative, something which is difficult to explain.

When the form of regression allows it the measure of income used is the time-invariant mean income level, with the standard deviation of the income added as an extra explanatory variable to test the greater saving needs of those with highly volatile incomes. When time-invariant income levels cannot be used, the difference between the income in the relevant year and the average income level is included as a variable.

The level of wealth itself is a potentially important factor in determining the saving rate. Here the log is not taken. Negative or zero values of wealth are very common, and excluding all observations where the wealth level is negative would severely impair the quality of the analysis. Alternative ways of transforming the wealth variable, such as setting all negative and zero values to a value close to zero and then taking the log, or using the hyperbolic sine transformation of wealth, as described in Burbidge et al (1988) and Pence (2006), has been considered but not done since this makes it more difficult to interpret the meaning of the result.

#### **4.4.4 Other controlling variables**

The life-cycle theory of saving predicts that saving will vary considerably with age. The relationship between age and saving is not expected to be linear. For young individuals, the income is usually lower than the average income over the lifetime. This should lead to negative saving in order to smooth consumption. Alternatively, if the young individuals are credit constrained, this should lead to very low levels of saving in aggregate, with most of the saving in this age group being done by people with anomalous income-age profiles. As people age, their income usually increases, leading to increased saving, especially in order to prepare for old age. After retirement the income of most individuals falls. This leads to a lower saving rate, and quite possibly dissaving. In order to deal with the expected non-linear nature of the relationship between age and saving, age is included in the analysis as in the form of age dummies. The age distribution is divided into seven categories: those 75 years old or older, those younger than 25, and five groups in between, each consisting of 10 years. Dummies are created for each of those groups except the youngest groups.

The labor market status of the individuals is likely to be a major factor determining their saving rates. Especially whether the individual is unemployed or retired is likely to be important. Whether the individual is married or widowed is also controlled for, as is the

number of years of completed education. The proportion of wealth held in the form of stocks is also used as an independent variable.

#### **4.4.5 Interaction effects**

To see how the effect of having adult children varies with income an interaction variable between income and the indicator of children is used.

#### **4.4.6 Missing variables**

The analysis of this paper does not include every variable that one would wish to include. One variable that would be valuable to include is the spending by the parents on their children's education. As described in the Theory-chapter, spending that increases the income of the heirs can be a substitute for saving money for bequests. The health status and mortality risk of the individuals are also potentially important variables that are not included in the analysis. The health status affects the expected level of spending on health care, an important source of precautionary saving. Mortality risk determines the expected life-time, which is also important for precautionary saving, and for the probability of leaving accidental bequests. A further type of variable that could be included in the analysis is indicators of risk aversion or other forms of preference heterogeneity. Hendricks (2007) uses heterogeneity in the discount rate to account for some of the wealth inequality observed in the data, and to explain the wealth inequality between households with similar earnings. In general there is a great deal of heterogeneity in the data, and a significant proportion of the saving behavior remains unexplained. Behavioral indicators that can account for some of this unexplained variation would enrich the explanations of wealth inequality.

### **4.5 Defining the sample**

In the PSID every individual in every household is recorded as one individual observation. This includes children. Income and wealth is however recorded at the household level, with the values for the household being given to each individual observation. This means that a child would be recorded with the income of the household, and with being himself childless. This is obviously untenable. Therefore all individual observations that are not the head of the household, the wife of the head or the cohabiting partner of the head are excluded. The

reasoning behind including these individuals and only them is that they all take some part in the allocation of labor (in the workplace and the home) and saving decisions, and are therefore relevant. Furthermore the “child-status” of a head and a wife need not be identical. If one has an adult child, while the other does not, this can be expected to contribute to the saving decisions in the same manner as in a household where both have adult children, but to a somewhat smaller extent. Allowing the couple with different child-status to count as two observations with the same income and saving deals with this issue. This does however mean that the income of a household with a head and a wife is “counted twice” when distributions of income are calculated, which could for example change the cut-off points for different quintiles. This is not really a problem for the analysis in this paper since examining the precise distribution of income is not the goal. When income quintiles are used as independent variables, this is to look at the general relationship between income and saving. A slight shift of the cut-off points is not troubling.

Adults that are not heads or wives are also excluded alongside children. These adults can be family-members such as siblings or parents, or simply room-mates. These adults could conceivably contribute to the income of the household, and have unique child-statuses. By that reasoning they should be included. However it is assumed that they are less important economic-decision makers in the household. Their presence could be included as a control variable in the regression, but this has not been done, since the category is too diverse to be useful, elderly parents and room-mates are not really comparable, and the number of individuals is quite small.

## **4.6 Main regression**

The main analysis is based on a panel regression. The panel consists of individual saving rates between the years 1999 and 2001, 2001 and 2003, 2003 and 2005, 2005 and 2007, and 2007 and 2009. Because the individuals in the analysis belong to households and families, there is clustering in the data. This requires the use of robust standard errors. There are several variables in the analysis that are time-invariant, especially permanent income (or rather its proxy, average income between 1997 and 2009) and the variance of income and wealth. In a fixed effect model, these variables cannot be used. This means that a random effect model is preferable. A random effect model is also preferable for the usual reason that it provides a more efficient estimator, and because since it reduces the effect of measurement error through

averaging variable observations. In contrast the fixed effect model can aggravate measurement error since individual intercepts are suppressed and the variation that is looked at is within individuals, which can be contaminated by measurement error (Kennedy 2008).

However a random effect model is only appropriate when it is an unbiased estimator, which in turn requires that the total influence of the unmeasured omitted variables is not correlated with the variables that are included (Kennedy 2008). Saving behavior usually contains a large amount of unobserved heterogeneity. The number of explanatory variables is small, while the underlying variation in saving rates is large. Since the saving rate is defined in this study as the change in wealth relative to a measure of income, there are many unobserved potential factors that could affect the saving rate. Assuming that there are no correlation between the excluded variables and those included is not satisfactory. Therefore it is necessary to test whether a random effects model is appropriate.

Normally the Hausman test would be appropriate for testing whether the random effects estimate is unbiased. The Hausman test requires that one estimate is known to be unbiased. In this case the fixed effect model satisfies this condition. However it is also necessary that the estimator being tested is fully efficient. This condition is not satisfied in the present case because of clustering, which requires robust standard errors.

In order to deal with this a separate set of regressions are run where only observations for current heads of each household are included. This should reduce the clustering of the error terms, meaning that a random effects model is efficient, which again means that a standard Hausman test can be applied.

The results from this test then decide what form of regression to use in the subsequent analysis. The regressions then use the whole sample as defined above and employ cluster robust errors. The various alternative forms of the dependent variable and the adult child variable are used in separate regressions to examine whether the results differ from those found in the main analysis.

## **4.7 Quantile regression of long saving rate**

To supplement the analysis of the panel data, a median regression of a longer saving rate is run, as well as a regression on the 10<sup>th</sup> and 90<sup>th</sup> percentile and an OLS-regression with cluster



robust standard errors. Here the saving rate is defined as the change in wealth over the eight-year period from 1999 to 2007, divided by a measure of the income from this period (the average income described earlier multiplied by eight). The period is chosen to start and end at as similar points in the business cycle as possible, as described in more detail in the Summary Statistics chapter.

Since median regressions are less sensitive to extreme values (Cameron and Trivedi 2010), and since there are fewer extreme values for long term saving rates, this regression does not use data where the top and bottom part of the distribution is removed. The age values are defined as the age at the beginning of the period. In order to be included in the analysis an individual must be either, a household head, a wife, or a cohabiting partner at the beginning of the period. The adult child variable is defined as those that have adult children at the beginning of the period and at no point during the saving period have dependents in the household. The dependents variable is defined as those with dependents at some point during the saving period.

# 5 Summary statistics

## 5.1 Saving rates in different periods

### 5.1.1 Comparing different definitions of the saving rate

Table 1 summarizes the saving rates in all two-year periods from 1999 to 2009. Comparing the different values found for different definitions of the saving rate is interesting in itself, but also gives an indication of which definition is most reliable for the regression analysis.

Comparing saving rate 1 and 2, shows that rate number two, where the saving rate is defined using the income in the middle year of the period, gives more erratic results. This can be seen in the saving rates for 1999 to 2001, 2001 to 2003 and 2007 to 2009, where the mean saving rate is negative, and smaller than the median. This is likely because some households have low incomes in some years, and in those years dissave considerably. With incomes close to zero, this gives very high rates as the income is in denominator. Over time the income level evens out, meaning that the negative values on the saving rate for those same households are smaller, and therefore have a smaller effect on the overall mean. The period from 2007 to 2009 gives a particularly low negative value, with a mean saving rate of -8. This was a period where most households dissaved; the median saving rate is negative regardless of what form of saving rate one looks at. The proportion of households with both large negative wealth changes and low incomes must be large in this period to give such an extremely low value for the mean saving rate.

There are few obvious differences between the first and third measure of saving rates that indicate that one is superior to the other. The mean and median is lower when inheritances received during the saving period are subtracted, which is entirely as expected. The standard deviations are similar.

### 5.1.2 Comparing different saving periods

The general dissaving seen in the period from 2007 form 2009 is most likely due to decreasing house prices and losses on financial assets. That the former plays an important role can be seen by comparing the saving rate that includes housing wealth (nr. 1), with the

equivalent rate without housing wealth (nr. 4). The saving rate is considerably higher for this period when housing is excluded.

The two periods with the lowest median saving rates according to all four measures are the period from 2001 to 2003 and the period from 2007 to 2009. According to the National Bureau of Economic Research the US economy was in recession for 8 months between March 2001 and November 2001<sup>1</sup>, and for 18 months between December 2007 and June 2009<sup>2</sup>. This is clearly seen in the data. The 2001 wave of interviews were carried out between precisely March 2001 and November 2001, with a majority carried out before June. The 2007 interviews were carried out between March and December of that year, and the 2009 interviews between February and December, both of these had the majority carried out before June. This means that for most households surveyed the 2007-2009 saving period was concurrent with a deep and long recession. The 2001-2003 period does not match as well to that recession, but if the households are slightly backwards looking in reporting their wealth to the survey, the low median saving rate for that can easily be explained by the recession.

The strong effect of the business cycle on the saving rate can be explained in two ways. It can be claimed that it shows the effect of fluctuations in asset prices on the saving rate when it is calculated through the change in wealth level. This can be seen as a criticism, if it implies that outside forces rather than economic decisions made by the households that decide the level of the calculated saving rate. This criticism has some validity, but it is met by using panel data, which includes saving rates at many different times, and by using more long term saving rates. Both of these approaches are taken here. Furthermore, there is no reason to assume that the factors that influence the rates are not visible in years when the economy is doing poorly. It is not a good argument for arbitrarily excluding some asset classes from the calculation of wealth levels and saving rates. This can be seen by looking at saving rate 4, which is less affected by the recession in 2007-9, but is considerably more affected by the recession in 2001. The second, more optimistic reading of the statistics is that the effect of recessions on saving rates lends support to precautionary saving theory. Recessions are times of unemployment and decreased income growth; that saving rates are lower in these periods is entirely as expected.

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<sup>1</sup> <http://www.nber.org/cycles/july2003.html>

<sup>2</sup> <http://www.nber.org/cycles/sept2010.html>

<b>Yearly rates</b>		1. Saving rate based on long-term income (incl. house value, excl. inheritance)	2. Saving rate based on short-term income (incl. house value, excl. inheritance)	3. Saving rate based on long-term income (incl. house value, and inheritance)	4. Saving rate based on long-term income excluding housing	Wealth level at the end (*beginning) of the period, in 2007-\$, including housing
From 1999 to 2007	Median	0.015	NA	0.213	0.001	34,274*
	Mean	0.077	NA	0.096	0.043	175,921*
	SD	1.00	NA	1.01	0.95	
From 1999 to 2001	Median	0.018	0.018	0.021	0.000	37,330
	Mean	0.009	-0.351	0.022	-0.013	189,330
From 2001 to 2003	Median	0.008	0.009	0.011	0.000	38,734
	Mean	0.003	-0.252	0.019	-0.021	187,825
From 2003 to 2005	Median	0.021	0.019	0.024	0.000	42,246
	Mean	0.208	1.383	0.223	0.126	226,093
From 2005 to 2007	Median	0.019	0.019	0.022	0.002	43500
	Mean	0.076	1.383	0.093	0.059	255081
From 2007 to 2009	Median	-0.056	-0.060	-0.052	-0.013	27,591
	Mean	-0.104	-8.338	-0.090	0.044	230,029

Table 1: Saving rates and wealth levels in different periods

The effect of recession on saving rates gives a reason to be careful in deciding the periods when studying long-term saving rates. In this study the period from 1999 to 2007 has been chosen in order to match approximately a period between the peaks of business-cycles.

### **5.1.3 General conclusions**

A general conclusion from the saving rates in table 1 is that the mean tends to be higher than the median. This indicates that the distribution of saving rates is right-skewed. This is in accordance with other studies that show that most people save little, while a smaller number save more. The exception to this pattern is in the recession years. For those periods the mean saving rate is lower than the median. This can probably be explained by large losses on financial assets taken by individuals with significant investments in volatile assets.

## **5.2 Long-term saving rates with or without children by income quintiles**

Table 2 gives saving rates broken down by income quintile (long-run income) and by absence or presence of children. The group “with adult children only “ is comprised of those who are registered as having adult children at the beginning and end of the period, and who do not have any dependents in the household during the saving period. The category “with dependent children” includes everyone who has children in the household at any point during the period. The group “without children” is defined as the rest of the sample. The whole sample is every adult that is a head of a household or wife of a head. The income quintiles are calculated based on the average income for the period from 1997 to 2009, with the quintiles being determined by looking only at heads and wives of heads.

<b>Saving rates (definition 1) from 1999-2007</b>		Whole sample	Without children	With adult children only	With dependent children
All quintiles	Median	0.053	0.045	0.076	0.052
	Mean	0.148	0.150	0.165	0.141
	Number of individuals	8964	1335	2020	5705
First income quintile	Median	0.000	-0.001	0.000	0.000
	Mean	0.062	0.032	0.044	0.077
Second income quintile	Median	0.021	0.017	0.033	0.019
	Mean	0.070	0.063	0.084	0.067
Third income quintile	Median	0.045	0.040	0.053	0.041
	Mean	0.134	0.158	0.090	0.132
Fourth income quintile	Median	0.092	0.103	0.127	0.084
	Mean	0.185	0.205	0.196	0.175
Fifth income quintile	Median	0.154	0.236	0.195	0.137
	Mean	0.271	0.325	0.384	0.233
Proportion with negative saving rates across all income quintiles		27.7%	31.6%	37.7%	24.3%

Table 2: Long-term saving rates broken down by income quintiles and “child-status”

### **5.2.1 The effect of children on the saving rate**

Individuals with adult children have a higher mean saving rate and a higher median rate than those without children when all quintiles are looked at simultaneously. This pattern is repeated for the two lowest quintiles, while for the next two quintiles the mean is higher for those without children. For the fifth quintile the pattern is reversed, with a higher mean but lower quintile for those with adult children. Comparing those with adult children and those with dependent children gives similarly erratic results. Those with dependent children consistently have slightly lower saving rates than those without children. All in all the differences between the categories are minor. When the whole sample is examined a consistent pattern between income quintile and saving rate emerges. Both the median and mean saving rate increases monotonically with the income quintile. This pattern is largely repeated if one looks at the different “child-status”-groups.

With median saving rates near, or slightly below zero for the two lowest income quintiles, it is clear that a large number of low-income households are dissaving. This pattern is repeated for the sample as a whole, with over a quarter of the households registering negative saving rates. This is a somewhat surprising result. One would not expect individuals to be able to maintain a negative saving rate over such a long period of time, let alone that it would be so common. There are several possible explanations. The simplest one is of course that the period looked at has been one where many individuals have had a higher consumption than income, and have therefore consumed their wealth or increased their debt. It is also possible that the saving period looked at does not begin and end at similar stages of the business cycle, so that asset values in general are low in 2007 compared to 1999. Since most households were interviewed well before the start of the 2007-2009 recession, and since the top of the previous business cycle occurred well after 1999, this is not a particularly compelling explanation. It should be noted that any inheritance or gifts received during the period are subtracted from the change in wealth. This could be important for some households.

### **5.2.2 Long-term saving rates by age group**

Both the mean and the median saving rates are increasing with age until the age-group 45-54, with lower saving rates thereafter. This is broadly consistent with life-cycle theories of saving behavior. It is worth mentioning that this group is the highest age group where no one is in the typical pension age of 62 to 65 during the saving period. That the median in the two higher

age groups household has no net saving (and even negative saving for the highest age group) is interesting, and supports the findings of e.g. Bernheim (1987). Even though the median household dissaves in old age, the mean saving rate is positive. This is a good reason to carry out quantile regressions on the data, so that the effect on the median can be examined.

Looking at the wealth level at the beginning of the period, one sees that mean is increasing up to the age group 55 to 64, and the median wealth is increasing up to the age group from 65 to 75. The lower wealth level of the oldest group deserves some comment. While it is not unexpected that the wealth level is lower, the magnitude of the reduction from the second oldest group to the oldest group is very large, with mean wealth levels less than half as high. If the saving rates in the preceding period were roughly similar to those seen here for each age group, one would not expect a drop at all. This is a clear indication that there is a cohort effect in the data, with the oldest group having lower wealth levels in part because of unique attributes to them as a group and not just because of their age. Similar cohort effects could exist with regards to the saving rate. The presence of cohort effects makes it advantageous to use panel data in the analysis, as this method will be better at identifying the true effect of age than the quantile regression or other forms of cross-sectional analysis.

Age group (age in 1999)	Saving rates 1999-2007		Wealth level at beginning of period in 2007-dollars	
	Median	Mean	Median	Mean
Age <25	0.022	0.122	4,003	19,019
Age 25-34	0.056	0.146	17,137	72,184
Age 35-44	0.060	0.162	50,310	186,852
Age 45-54	0.086	0.176	108,944	321,079
Age 55-64	0.074	0.157	168,068	544,543
Age 65-75	0.000	0.051	187,530	534,066
Age >75	-0.040	0.063	138,281	264,604

Table 3: Long-term saving rates and wealth levels by age group



## 6 Regression Results

This chapter gives the results of the regressions that have been run, and interprets the results.

### 6.1 Choosing between the FE and RE models

The Hausman test run on the limited sample consisting only of heads strongly rejects the null hypothesis that the random effects model provides consistent estimates.

From the stata output:

$$\begin{aligned}\text{chi2}(18) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 176.83 \\ \text{Prob}>\text{chi2} &= 0.0000\end{aligned}$$

This test shows that the estimators of a fixed effects model, which is known to be consistent, differs from the estimators in the random effects model. Therefore the estimators found using the random effects model are biased and cannot be used. The results from the Hausman test allow the null hypothesis to be rejected with a confidence of above 99 %.

This means that the rest of the empirical analysis must be undertaken using a fixed effects model. As previously noted, a fixed effects model does not allow for time invariant variables, therefore neither the long term income nor the variance of the income can be used as variables.

### 6.2 Summary of results from the main panel regression

Table 4 sums up the most important results from the main regression. The main regression is a fixed effect model regression. More detailed results are reported in table X. The most important result is that the presence of adult children has a strongly significant positive effect on the short run saving rate. This could indicate the presence of a bequest motive, which would lend support to the dynastic theory of saving. Both the theoretical prediction in this and other papers, and the dynastic models used to simulate the wealth distribution between

households (such as in De Nardi 2004) indicate that the bequest motive should be stronger for richer households. However the results for the main regression show the opposite conclusion. The interaction variable between income and children has a negative sign, indicating that the effect of adult children on saving diminishes as the income increases.

Saving measure: Standard					
Based on average income, without inheritance, with housing wealth, observations >92 <sup>nd</sup> and <8 <sup>th</sup> percentile of the distribution of saving rates excluded					
Key independent variable	Adult children, exclusive indicator	Dependents, indicator	Interaction variable, income and children	Log income	Wealth level at beginning of period
Sign	+	+	-	+	+
Significance lvl	>0.99	>0.99	>0.95	>0.99	>0.99

Table 4: Summary of regression results form fixed effect model with standard saving rate definition

The presence of dependent children also has a positive effect on the saving rate, and this effect is statistically significant according to the regression. This is somewhat surprising. Dependents should increase the consumption needs of a household and therefore reduce the amount available to saver. This result can be interpreted as supporting the bequest motive. The bequest motive should also exist for individuals that have children below the age of 18, the results here can be interpreted as showing that this effect is stronger than the presumed negative effect of raising children on the saving rate. Of course the results can just as well indicate that individuals with children share some hidden characteristics that contribute to a higher saving rate.

Both income levels and wealth levels have a positive effect on saving rates according to this regression. This is in accordance with the findings of Dynnan et. al (2000), who looked at earlier saving periods in the PSID.

### 6.3 Details of results from main regression

Tables 5a and b contains more detailed results from the main regression, as well as results from alternative specifications. Other than the results previously mentioned, the difference between the current income and the average income, inheritance, marital status, owning a

business and various age dummies give significant results for regression nr. 1. Having received an inheritance or a large gift during the saving period contributes to a lower saving rate according to the results. It is important to keep in mind that for this specification the value of the inheritance is neither included in the change in wealth, nor in the income value used to calculate the saving rate. The motivation for excluding inheritances is that it is ambiguous whether they should be treated as a temporary income, or as a form of hidden wealth (in the sense that receiving the inheritance was expected and it entered into the decision making of the individual before it was in fact received) that is suddenly made visible. That it has a negative effect on other saving could indicate that the inheritance is treated as a windfall income, and that the households spend more because they are somewhat myopic in their decision-making. This cause the increase in wealth to be smaller than the value of the inheritance, and subtracting the inheritance therefore mean that the saving rate is suppressed.

Being married affects the saving rate positively. This is not surprising, in light of the results reported by Díaz-Giménez et. al (1997), showing the substantial effect of marriage on saving rates. Business owners also have higher rates of saving. This can be explained by the need to save in order to invest in the business if business owners face credit constraints. It can also be explained by precautionary saving if owning a business leads to more variance in the income, which the owner compensates for by saving more on average. In order for this to give a net positive effect the extra income saved when the business does well must exceed the reductions in the saving when the business is doing poorly. Alternatively the saving periods included in the study could be on average periods that were unusually profitable for businesses.

A puzzling result is the effect of the difference between the short and long-term income. Theories of saving would predict that income values in excess of the average income would be saved, and that the effect on the saving rate would be positive. Instead the result is the opposite.

With age dummies for all age groups older than <25-group, the coefficients for the age dummies must be interpreted as the extra effect of being in another age group compared to the baseline age group of those under 25. That no significant result is found for the age group 35-44 indicates that there is no statistically significant difference in the saving behavior of these two groups. The results from the age dummies are broadly in line with life-cycle theories, in the sense that the saving rates first increases with age, then decreases. The surprise is the point

at which saving rates go down. The summary statistics indicated that the long term saving rates is highest for the group between 45 and 54, and that both the median and the mean saving rates were higher for the 55 to 64 year old group than for the youngest group. The difference could be because of the slightly different saving rates looked at (short-term rather than long term, and truncated at the top and bottom rather than the whole sample, but for the last consideration looking at regression 2 indicates that this is not a major concern). However it is more likely that the difference stems from the fact that the summary statistics only compare the overall saving rates, without explaining what drives the differences between the groups. The regression here shows a significant positive effect on saving rates of both higher wealth and higher incomes. Older households have both higher incomes and more wealth compared to younger ones. The regression is able to show that once this is taken into account, there is no separate positive effect of age to account for, quite the contrary.

Several controlling variables are not significant in this regression, or in any of the alternative specifications. These include the education level of the individual, the presence of health insurance, and whether the individual is unemployed or retired. Education has a known effect on both the income and wealth of individuals. That the level of education itself cannot be shown to have an effect once these two variables are accounted for is not surprising. Similarly, unemployment reduces income considerably, removing any separate effect of unemployment in the data. Absence of health insurance should contribute to a higher level of precautionary saving since all medical expenses must then be paid out of pocket. That this effect is not seen in the data could be a sign that it does not exist, perhaps because those without health insurance differ in some other way from the rest of the sample in a manner that decreases their saving, or it could be a sign that the effect is too small to be seen. Over 85 % of the individuals in the sample are covered by some form of health insurance. The effect of retirement on the saving rate is largely what is being measured when one looks at the age profile of saving. Again the lack of a separate effect for the variable is not terribly surprising.

## **6.4 Results with alternative specification**

Comparing the regression results 1 to 6 is useful in order to examine how sensitive the results are to the specifications. The main conclusion is clearly encouraging. For all the most important variables the sign does not vary between regressions. The magnitude of the coefficient is also broadly similar across regressions. Which variables are significant differs,

but all the most important variables are significant for all the regressions. The within model R-squared values are also similar for all the regression models. Choosing as a dependent variable a saving rate with fewer observations removed increases the R-squared value, but this is not surprising as this gives almost a thousand extra observations. It needs to be taken into account why there were removed in the first place: because the saving rate values were too extreme to be plausible.

Measure of saving rate	1. Standard measure of the saving rate (same as in table X)	2. Less truncated, 1 <sup>st</sup> and 99 <sup>th</sup> percentile removed	3. Based on short term income	4. Based on saving rates that include inheritance
Log Income	.094 ***	0.025 ***	0.134 ***	.091 ***
Wealth level	7.59e-07 ***	2.32e-07 ***	7.88e-07 ***	7.74e-07 ***
Diff. btw short and long-term income	-3.61e-07 **	Not significant	-3.66e-07 *	-3.45e-07 **
Adult child	.699 ***	0.376 ***	.606 ***	.728 ***
Interaction btw log income and adult children	-.064 ***	-0.140 ***	-.057 ***	-.067 ***
Dependents	.028 ***	.087 ***	.025 **	.026 **
Inheritance	-.085 ***	-.162 ***	-.088 ***	.091 ***
Widow	Not significant	Not significant	.167 **	Not significant
Married	.033 *	.056 ***	Not significant	.036 **
Unemployed	Not significant	-.281 *	Not significant	Not significant
Business owner	.065 ***	.149 ***	.0514 **	.067 ***
Prop. wealth in stocks	Not significant	-.033 *	Not significant	Not significant
Age: 25-34	.104 ***	.313 ***	.102 ***	0.100 ***
Age: 35-44	Not significant	0.141 ***	Not significant	Not significant
Age: 45-54	-.108 ***	-0.085 *	-.117 ***	-.115 ***
Age: 55-64	-.246 ***	-0.405 ***	-.262 ***	-.253 ***
Age: 65-74	-.364 ***	-0.649 ***	-.382 ***	-.375 ***
Age: >74	-.383 ***	-0.843 ***	-.448 ***	-.368 ***
R <sup>2</sup> -within	0.0715	0.1285	0.0722	0.0741
R <sup>2</sup> -overall	0.0105	0.0154	0.0104	0.0114
Number of observations	48854	57285	48915	48851

Table 5a: Results from fixed effect regressions with different dependent variables

Measure of saving rate	1. Same as in previous table	5. Based on saving rates that excludes housing	6. Same as in 1, with alt. adult child indicator
Log Income	.094 ***	.047 ***	.097 ***
Wealth level	7.59e-07 ***	8.07e-07 ***	8.02e-07 ***
Diff. btw short and long-term income	-3.61e-07 **	Not significant	-3.49e-07 ***
Adult child	.699 ***	.420 ***	.587 ***
Interaction btw log income and adult children	-0.064 ***	-.038 ***	-.060 ***
Dependents	.028 ***	0.020 ***	.025 **
Inheritance	-.085 ***	0.82 ***	-.086 ***
Widow	Not significant	Not significant	.131 *
Married	.033 *	Not significant	.038 **
Unemployed	Not significant	Not significant	Not significant
Business owner	.065 ***	0.054 ***	.067 ***
Prop. wealth in stocks	Not significant	Not significant	Not significant
Age: 25-34	.104 ***	0.043 ***	0.100 ***
Age: 35-44	Not significant	Not significant	Not significant
Age: 45-54	-.108 ***	-0.034 **	-.102 ***
Age: 55-64	-.246 ***	-0.101 ***	-.239 ***
Age: 65-74	-.364 ***	-0.150 ***	-.353 ***
Age: >74	-.383 ***	-0.123 ***	-.367 ***
R <sup>2</sup> -within	0.0715	0.0744	0.0759
R <sup>2</sup> -overall	0.0105	0.0052	0.0119
Number of observations	48854	48761	49161

Tabel 5b: Results from fixed effect regressions with different dependent variables

The regression using the measure of saving rates that include values from the 1<sup>st</sup> to the 99<sup>th</sup> percentile (2), show significant results (at the 90 % level) for unemployment and the proportion of wealth held in stocks, both with negative signs. This is most likely caused by unemployed people being generally in the lowest part of the distribution of saving rates, due to dissaving and low income values. The significance of the proportion of wealth held in stocks can similarly be explained by large losses of a few individuals occupying the lowest

parts of the distribution of saving rates. The effect of income on the saving rates is considerably smaller in this regression. This can be because the extra observations included are individuals who have earnings that fall outside the definition of income in the PSID or that is underreported, which would both lead to extreme values the saving rate and lead to income being less important in the regression.

## 6.5 Result from quantile regression on long term saving rate

Tables 6a and b sum up the results from the quantile regressions as well as the OLS-regression. The most striking result from the median regression is that the effect of adult children and dependents is the opposite as that found in the panel regression. This undermines the conclusion from the previous regressions that the data support the bequest motive. However in this regression the interaction effect between income and adult children is positive. This could imply that for some levels of income the saving rate is higher when for those with children than those without children.

Using the property that quadratic regression estimators are equivariant to monotone transformations, it is possible to calculate at what income level individuals with saving rates at the median level and with adult children have higher saving rates than they would have had without children.

The effect of income on the saving rate is  $\beta_1 \ln(x)$ , while it is  $(\beta_1 + \beta_3 \ln(x)) + \beta_2$ , with  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  are the regression coefficients for log mean income, the adult child indicator, and the interaction between log mean income and adult children respectively, and  $x$  being the mean income level.

From this we can conclude that when  $\beta_1 \ln(x) \leq (\beta_1 + \beta_3 \ln(x)) + \beta_2$ , the presence of adult children contributes positively to the saving rate. The level  $x$  can be calculated:

$$-\beta_2 \leq [(\beta_1 + \beta_3) - \beta_1] \ln(x)$$

$$x \geq e^{-\beta_2 / \beta_3}$$



This gives the result that when the mean income is above \$ 27,744 (in 2007-dollars) adult children no longer reduce the saving rate. This is a fairly low level of income, meaning that many individuals do in fact exhibit saving behavior that indicates the presence of a bequest motive. That the bequest motive is stronger for higher incomes is in line with the theoretical predictions, but is the opposite result from that found using the panel regressions.

Unfortunately no significant results are found for adult children or the interaction effect in the quantile regression for the top quantile of in the OLS-regression. Therefore the results are not terribly robust.

The effect of dependents on saving rate is negative for the median regression, unlike in the panel regressions. Neither the other quantile regressions, nor the OLS-regression get significant results.

An interesting result from the quantile regressions is that the effect of the variance of the income varies with the quantile looked at. At the median of the distribution of saving rates, at the ninth decile of the saving rate distribution, and for mean saving rates (which is what the result from the OLS describe), a higher variance in the income leads to higher saving rates, as precautionary theories of saving predict. This is the opposite of the surprising effect found for the difference between the short term and long term income in the panel regression. That variable was meant to pick up a similar effect without violating the fixed effect models incompatibility with time-invariant regressors. The interesting aspect here is that for the lowest levels of saving, the effect of increased variation in income is negative. A similar reversion of the effects of variables from the highest decile to the lowest decile is seen with the inheritance received from 1999 to 2007 and with the wealth level at the beginning of the period. This could be explained as a story of the spendthrift individuals at the bottom of the distribution that consume whatever wealth they happen to have, as opposed to the misers at the top of the distribution, who always want to save more, regardless of how high the wealth level already is.

Variable	q=0.1	Median (q=0.5)	q=0.9	OLS with cluster-robust standard errors
Log of mean income	.179***	.067***	Not significant	.150***
SD of income	-3.10e-07 ***	5.06e-07 ***	1.76e-06 **	2.08e-06 *
Wealth level in 1999	-1.13e-06 ***	-1.43e-07 ***	3.74e-07 **	-4.43e-07 **
Adult child	-1.82 ***	-.399 ***	Not significant	Not significant
Interaction income and adult children	.162 ***	.039 ***	Not significant	Not significant
Dependents at some point btw 1999-2007	Not significant	-.019 ***	Not significant	Not significant
Inheritance btw 1999-2007	-9.65e-07 ***	Not significant	1.68e-06 **	Not significant
Widow	-.0593 *	Not significant	Not significant	Not significant
Married	.042 ***	.017 ***	Not significant	Not significant
Health Insurance	Not significant	Not significant	-.079 *	Not significant
Unemployed at some point btw 1999-2007	Not significant	Not significant	-.196 ***	-.178 ***
Business owner	Not significant	Not significant	.312 ***	Not significant
Proportion of wealth in stocks	Not significant	.008 ***	Not significant	Not significant
Note: *** indicate that the results are significant to the 99 % level, ** that they are significant to the 95 % level, while * indicates that they are significant to the 90 % level				

Tabel 6a: Results of quantile regression and OLS-regression

Variable	q=0.1	Median (q=0.5)	q=0.9	OLS with cluster robust standard errors
Age: 25-34	Not significant	.020 ***	Not significant	Not significant
Age: 35-44	Not significant	.018 ***	.085 *	Not significant
Age: 45-54	Not significant	.027 ***	.110 **	Not significant
Age: 55-64	Not significant	.037 **	.217 ***	.159 **
Age: 65-74	Not significant	Not significant	.168 *	Not significant
Age: >74	-.346 ***	Not significant	.699 **	Not significant
Pseudo R <sup>2</sup> N=8551	0.3246	0.0295	0.0623	R <sup>2</sup> : 0.1043 N=8551
Saving rate at quintile (descriptive statistic)	-.286	.015	.169	Mean saving rate: 0.148
Note: *** indicate that the results are significant to the 99 % level, ** that they are significant to the 95 % level, while * indicates that they are significant to the 90 % level.				

Table 6b: Results of quantile regression and OLS-regression, part 2

Another interesting observation from the quantile regressions is that demographic variables, such as marital status and widowhood have an effect at the bottom of the saving rate distribution, while variables that predict higher risks have an effect at the top end of the distribution. All these effects are of the type one would expect, widows save less, married couples save more. Owning a business, with the risks that entails, increases saving, as does unemployment and not having health insurance. The individuals at the top of the saving rate distribution therefore seem to be motivated by precautionary saving.

The effects of age on saving are more or less in accordance with positive contributions to the saving rates at the median for all working-age years (the years from 25 to 64), and a saving rate that mostly increases with age. However the relationship is less clear than that seen by looking at the summary statistics alone.

## 7 Conclusions

In this paper we have seen that an example of a dynastic theory of saving predicts that the presence of children should contribute to a bequest motive, but that this motive will mostly be present in richer households. This is because, when the utility of the heirs is what motivates the parents to give bequests, this motivation will only give rise to an actual bequest if the marginal utility for the parents from the bequest is higher than the marginal utility of consumption when the whole income is consumed by the parents. The combination of mean reverting income levels and economic growth indicate that most children will have a higher consumption level than their parents. In addition to this the possibility of spending money on education instead of on bequests will further reduce the bequest level, since no money will be spent on bequests until the marginal utility of spending on education is the same as the return on financial assets. It is possible to construct other models of bequest motivation that give other predictions, such as a joy of giving model. Since this set of predictions is based on a plausible, if very simplified, theory of behavior, and since wealth inequality among the top end of the distribution is what many dynastic models seek to explain, it is a convenient starting point for the empirical analysis. The empirical analysis is based on panel data on wealth and income from the PSID, from the period from 1997 to 2007.

Summary statistics of the data used showed clear indications of a life-cycle pattern in the saving rates. Furthermore the effect of the business cycle was visible, which can be interpreted as supporting a precautionary motive, if the higher saving in boom years and lower saving in recession years were the results of deliberate choices, rather than simply volatility in asset prices.

In the first part of the empirical analysis, the fixed effect model panel regression provided support for the presence of a bequest motive. Both the adult children indicator and the presence of dependents in the household, the majority of which are the children of the economic decision makers in the household, had a statistically significant positive effect on the saving rate. Surprisingly the effect of adult children decreased with income, which is the opposite of what one would expect. The results from this analysis also confirmed the positive effect of income and wealth in general, and gave some indication of a life-cycle pattern in the saving rates.

The analysis of long term saving rates using quantile regressions and a cluster robust OLS-regression gave strikingly different results. Where the effects of adult children and dependents was significant, it had the opposite sign of the one found in the panel analysis. Interestingly the interaction variable between income and adult children was positive in this analysis. This means that for a sufficiently high income, the net effect of having adult children is to increase the saving rate. This is accordance with the theoretical prediction; however this was only seen for the median regression and for the regression of the lowest quintile of the saving rate distribution. The results are therefore largely inconclusive with respect to whether a bequest motive can be identified in the data. This is not entirely surprising as the lack of very wealthy households in the PSID makes this data set less than ideal for identifying a bequest motive.

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