Dynamic altruistic transfers, parent college support and college attainment*

Agustín Díaz Casanueva†

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Abstract

The paper studies how transfer and bequest between old parents and their adult children shape parents' college investment in their children. First, I study how parents adjust consumption when their adult children are richer or poorer relative to them. Second, I build and estimate an altruistically linked overlapping generation model with endogenous college decisions and incomplete markets in which parents and children interact strategically to quantify how future transfers to or from their children shape parents' savings, college support to their children, consumption, and children's college attainment, particularly between the low-skill children with high-income parents.

JEL:

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†University of Pennsylvania, andiaz@sas.upenn.edu, Address: 133 South 36th Street Office 526, Philadelphia, PA, 19104.

1 Introduction

In the United States, parents play a fundamental role in financing their children's college education. Even when, in the year 2017, the government spent $248 billion in college aids[1], the average household with two dependants children, it is expected to contribute $6500 per children each year[2]. The paper studies parents' motives to invest in their children's college education, particularly if college transfers can be rationalized as an investment to avoid future transfers and bequests to their children. Then, I study if financing children's college increases parents' later consumption and affects college attainment.

In the first part, I study how parents' consumption depends on the relative position of their adult children in the income distribution with respect to them. First, I find that parent adjust their consumption depending on their children's relative position. Inter-vivos transfers and bequests partially explain this adjustment. Then, I build and calibrate an altruistic dynamic heterogeneous model with endogenous college decisions. Parents can transfer money to their children conditionally in attending college or save for later consumption, transfer to their adult children, or bequests. Then I use the model to understand how children's education affects parents' consumption and its role in parents' college support and college attainment, particularly in that affluent low-skill children have higher attainment rates than poor low-skill children.

Table 1 shows the fraction of children that graduate from college by parents' wealth and children's ability for the NLSY97 cohort. First, we can observe that graduation rates are increasing in child's ability. Second, conditional on ability, parent wealth increases college graduation rates. Children in the lowest ability quartile with parents in the highest wealth quartile are 74% more likely to graduate from college than children with parents at the bottom of the wealth distribution. For children in the top ability quartile, this difference decreases to 39%, which is still substantial. Belley and Lochner (2007) shows that parent income and wealth are not relevant to high school completion, but it is relevant for college graduation, particularly among low-ability children. Then, they show in a model that credit constraints can explain these facts. Brown et al. (2012) shows that children's college attendance depends

[1] https://research.collegeboard.org/pdf/trends-student-aid-2019-full-report.pdf

[2] https://www.forbes.com/sites/troyonink/2017/01/08/2017-guide-to-college-financial-aid-the-fafsa-and-css-profile/6ee3d28f4cd4

on their parents' willingness to support their college education, and heterogeneity in parents' altruism is a relevant determinant for which kids' college aid would affect college graduation. On the other hand, Heckman and Mosso (2014) argue that the college enrollment of more affluent children might be a consequence of paternalism if education is a normal good and not necessarily a result of borrowing constraints.

In the paper, I study two possible explanations for the higher attainment rates among affluent low-ability kids. The first is that the college return is positive for low-ability children, but they face borrowing constraints that only can be relaxed by their parents. The second is that the return of college is negative for low-skill children; however, parents decrease the cost of attending college for their children to reduce future transfers and bequest. The paper contributes to understanding parents' and children's motives for college enrollment and how this decision is influenced by future interaction.

Table 1. Children College Attainment by Parent Wealth and Child Ability (NLSY97)

Parents' Wealth\Child's Ability	1	2	3	4
1	0.19	0.24	0.33	0.53
2	0.24	0.30	0.42	0.53
3	0.26	0.40	0.51	0.63
4	0.33	0.46	0.62	0.74
$\Delta\%(Q4-Q1)$	74%	91%	87%	39%

Parents play a fundamental role in financing their children's education, and old parents interact with their adult children. As a result, college attainment affects children's and parents' consumption later in life. For this reason, college returns should be analyzed from a household perspective and not only from a student perspective. Changes in college costs and policies that relieve education financial constraints or increase college attainment have different returns once we include the effects on the parents, creating an interaction between two of the most important government programs: College Financial Aid and Social Security Retirement.

Old parents' and adults children's consumption are linked. I find that wealthy parents with low-income kids consume \$3300 less per year than wealthy parents with high-income kids. On the other hand, poor parents with high-income kids consume up to \$5300 more per year than poor parents with low-income kids. To understand how their consumption are related, I study inter-vivos transfers and bequest. The relationship in consumption is explained partially by higher transfers to less well-off children, and consumption increases by lower bequests to wealthier children. However, the amounts reported in the data are insufficient to explain the total variation in consumption. Then, I study transfers from children to parents, finding that children's transfers to their parents are small, suggesting that the return of high-income children for parents is a reduction in transfers and bequests to their children, allowing them to increase their consumption. Then, I study if parents insure their children's consumption. Similar to Attanasio et al. (2018), I do not find evidence that parents provide consumption insurance to income shocks to their children, but a 1% change in child consumption changes his parents' consumption in 0.09%. Finally, using NLSY97 data, I examine how college parents' transfer depends on children's ability and parents' wealth. I find that average parental transfers during college increase with parents' wealth but not with children's ability.

Then, I build and estimate a dynamic model. It is important to note that the children's income distribution position is endogenous to their parent's decisions. For this reason, I use a model to quantify the effect on parent consumption of investment in their children's college education, inter-vivos transfers, and bequest in a non-cooperative and without commitment framework. To do this, I add college decision to a heterogeneous dynamic altruistic model similar to Nishiyama (2002), and Boar (2020). To estimate the model, I use the data's college tuition and credit constraints. Then, I estimate the college premium from the NLSY97 cohort. Finally, I calibrate parents' altruism, the ability return, and the inter-generational persistence of ability targeting college attainment by parents' wealth-ability quartiles, college premium, and income volatility. Finally, I evaluated the model's fit to non-target moments to see if it can explain college parent investment and the difference in college attendance by ability.

The model explains the highest attainment rate among affluent low-income kids, why wealthy parents with poor children consume less but not why poor parents with rich children consume more. The model cannot generate considerable bequests, which is how poor parents with higher-income children increase their consumption in the data. Part of the decrease in consumption of wealthy parents with poor children is a result of parents' educational investment in low-ability children who are more likely to be poorer than their parents in the future. Even when parents' transfer decreases their savings and future consumption, welfare improves as the college return for these children is higher than saving the money and transferring to them later.

Finally, I analyze the difference between a model with dynamic transfers in which parents can transfer each period to a model in which parents are only allowed to transfer when children go to college as in Abbott et al. (2019). I found that in a model with dynamic transfers, agents save less for the moment that they become parents as they give a smaller college transfer. However, parents have more savings as they get older, as it is optimal for them to have assets in case their kids get a negative shock. For this reason, in a model with dynamic altruism, parents consume more when they are young, and their children are not yet in college but consume less after college compared to a model where parents and children only interact when they attend college. As a result, the implications for parents and children of changes in college cost or retirement income depend on dynamic interactions that are important to analyze in future research.

2 Literature

The paper relates to many branches of the literature. First, it is connected to the research that explores the role of parents' investment in children's education, college attainment, and persistence in income across generations. Some examples of the relevance of parents in children's education investment are: Ríos-Rull and Sanchez-Marcos (2002) who study the sex college attainment ratio, Lee and Seshadri (2019) look childhood and college investment role in the inter-generational persistence of wealth and income persistence, Abbott et al. (2019) analyze college attainment and the interaction with government financial aid or Daruich and Kozlowski (2019) who explore the role of the number of children in parents education investment and the inter-generational persistence of income.

Second, it relates to the literature on liquidity constraints and college attendance. Carneiro and Heckman (2002) and Keane and Wolpin (2001) don't find evidence of liquidity constrain for the NLSY79 cohort. However, Belley and Lochner (2007), Bailey and Dynarski (2011), and Lochner and Monge-Naranjo (2011) find that liquidity constraints affect college attendance, particularly for low-ability kids. The parents' role in providing the difference between college cost prices and federal financial aid was studied by Brown et al. (2012). They found that children with parents less likely to provide financial assistance are borrowing constrain, which leads to lower college attainment.

Third, it is related to the literature on consumption insurance within the family. The paper is focused on the insurance provided by parents to their children. The closest works are Altonji et al. (1992) and Hayashi et al. (1996), which reject perfect insurance inside family members using food consumption. More recently, Attanasio et al. (2018) found significant potential insurance between parents and children. Still, individuals' consumption responds differently to their own or family income shocks, which shows that these opportunities are not fully exploited. Choi et al. (2016) find that aggregate family income affects individuals' consumption. However, the effect is considerably smaller than the impact of shocks on their income. McGarry (2016) show that parents transfer a considerable amount to adult children, particularly when they suffer large adverse shocks like unemployment or divorce. Kaplan (2012) shows that parents insure children allowing them to move back home after negative income shocks, and Boar (2020) documents that parents accumulate savings to insure their children against income risk.

My work is also related to the literature on parents' consumption after retirement, inter-vivos transfer, and bequests. Nishiyama (2002) study the role of inter-generational transfers in explaining wealth distribution. The role of bequest motives on saving has been reviewed by Lockwood (2018) and De Nardi et al. (2016), and how parents provide bequest and inter-vivos transfers to their children by (Kopczuk (2007), Barczyk and Kredler (2018) and Barczyk et al. (2019)). Finally, Haider and McGarry (2018) study the effect of college parents' spending in later transfer to their children, not finding evidence that later transfers offset differential college spending within their children.

On the quantitative side, my work is related to the literature that studies family through dynamics models without commitment in noncooperative settings (Attanasio and Ríos-Rull (2000), Nishiyama (2002), Barczyk and Kredler (2014a), Barczyk and Kredler (2014b) and

Boar (2020)). My contribution to this literature is to endogenize college decisions in Nishiyama (2002) dynastic model using Boar (2020) assumptions on the timing of parent-children interactions to simplify the model solution.

3 Empirical Evidence

In this section, I discuss the empirical evidence of how parents' relative position regarding their children affects their consumption after they leave their parents' homes. First, parents' consumption depends on their children's relative position in the income distribution, but it is not affected by children's income shocks. This relation is partially explained by inter-vivos transfer and bequest. Then, I examine how parents invest in children depending on ability and wealth. On average, parents' college transfers are increasing in wealth but not on ability.

3.1 Data

To study how parents' household consumption depends on adult children's income and wealth, I use Panel Study of Income Dynamics (PSID) and the Health Retirement Survey (HRS). To analyze how college attainment and parent support depend on ability, I use The National Longitudinal Survey of Youth 1997 (NLSY97). All my estimations are using nominal variables adjusted by CPI to 2016 real term.

PSID is a panel survey that follows US families and their descendants since 1968. The survey provides detailed information about children's and parents' income and wealth. Additionally, since 1999 PSID has detail information on consumption. On the other hand, HRS is a panel that follows households where the reference person is older than fifty years old since 1992, having particularly detailed information on in-kind transfer, inter-vivos transfer and bequest.

PSID has detail consumption data since 1999. For this reason, I use the sample data from 1999 to 2017. Given that my interest is to analyze how adult children's relative positions affect parent consumption, I only use observation from children older than 26 years old and parents older than 50. Because I will rank individuals, I drop parents and children born during years when less than 100 individuals in the sample were born. Finally, I use the PSID FIMS file to link parents with children. As a result, my sample has 8944 observations corresponding to 2338 parent-child pairs.

HRS has consumption information through the Consumption and Activities Mail Survey (CAMS), which measures household expenditure over the previous 12 months. I use the household consumption measures built by RAND, which is composed of the sum of all household consumption, including durable consumption, housing consumption, transportation consumption, and non-durable spending. I also use household spending, which is defined as the sum of all of the expenses in the household, including durables, non-durables, transportation, and housing spending. The difference between spending and consumption is that the last incorporates durable goods and housing, which are bought in one period but consumed during an extended time. I link the CAMS file with HRS Longitudinal File, which has detail information on parents' demographics, income, wealth and health. Finally, I link this data to the RAND Family Data that has information on adult children's income, in-kind transfers and inter-vivos transfers from 1992-2014. Like before, I only consider children above 26 years old and parents older than 50 and drop parents and children born in years when less than 100 individuals were born. After this, I have a sample size of 19179 parent-child pairs and 98861 observations.

Finally, I use The National Longitudinal Survey of Youth 1997 (NLSY97) to study children's college attainment, parents' support, college tuition and wages after college. The NLSY97 is a sample of Americans born between 1980-84 who were first interviewed in 1997 and are following until today. This survey has detailed information on individuals during their college time. The sample size of students in which data in parents' wealth and children's ability is not missing is 5400 individuals and 97434 observations.

3.2 Parents consumption and the relative position of their children in the income distribution.

In this subsection, I measure the effect in parents' consumption that a child is in a different position in the income distribution than his parents on the wealth distribution. Given that I am studying older parents, I use wealth to rank them with respect to the individuals born the same year. As many of them are retired, they don' report labor income and wealth is a better predictor of their well-being. In the case of children, I rank them by wealth and income, finding that only the child position in the income distribution affects his parent consumption. This result is reasonable as they are young adults who are starting to accumulate assets making income a better predictor of their welfare. For this reason, I would refer to the difference in the position between parents in the wealth distribution and children in the income distribution as the wealth-income distribution difference.

Children's position in the income distribution is endogenous on parents' heritage and investment. I analyze their effect on parents' consumption when children are older than 26 years old. I assume that at this point, parents finished to investment in each child and they cannot directly affect their children's position in the income distribution. However, given the children's position, parents can support them through transfers or bequest, affecting both consumptions.

To measure the difference between parents and children in the wealth-income distribution, I construct a rank-rank variable to gauge the relative distance between them, in the following form:

1. I rank parents in quartiles by wealth, relative to all individuals born the same year.
2. I rank children in quartiles by income or wealth depending on the specification, relative to all individuals born the same year.
3. Then, I construct a variable $T^{Q_i^p - Q_j^c}$, which is the rank-rank difference between the parents and each of their children in a given year.

For example, for a parent in the fourth quartile who has two children in the first quartile, then $T^{(Q_4^p - Q_1^c)=3}$ is equal to two. Then, I estimate the following regression:

$$\text{Parents Household Consumption}_{i,t} = \beta_0 + \sum_{q=-3}^{3} \beta_q T_{i,t}^q + \beta_X \mathbf{X_{i,t}} + \varepsilon_t + \epsilon_{i,t}$$

i is the parent household, $T_{i,t}^q$ is the variable describe before, $\mathbf{X_{it}}$ is a set of controls (parents' total wealth, parents' non-financial wealth, parents' household income, parents' quartile in the wealth distribution, parents household head in the labor force, number of people in the parents household, parents head born year, parents head education years, parents household US state, parents head age four order polynomial, rent or own house, parents' race and parents' religion), and ε_t is a year fixed effect.

Table 2. Parent Consumption Given Kids Transition using PSID data

	(1) Ranking by Children's Wealth	(2) Ranking by Children's Income
	Parent Consumption	Parent Consumption
Child 3 Quartiles Below Parents	718	-1969
	(0.44)	(-0.86)
Child 2 Quartiles Below Parents	-380	-1387
	(-0.34)	(-1.23)
Child 1 Quartiles Below Parents	-246	-1446**
	(-0.30)	(-2.04)
Child Same Quartiles Below Parents	-170	91
	(-0.27)	(0.14)
Child 1 Quartile Above Parent	332	1371**
	(0.50)	(2.25)
Child 2 Quartile Above Parent	1492**	2414***
	(2.18)	(3.60)
Child 3 Quartile Above Parent	1145	3393***
	(1.08)	(2.93)
Constant	-16675	-18993
	(-0.54)	(-0.62)
Observations	7083	7083

t statistics in parentheses, standard error cluster by household

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 2 shows the regressions results. The first column displays the result ranking children by wealth. In this case, the relative position of parents with respect to their children does not affect their consumption. The second column shows the result ranking children by income. Now, the relative position of a child in the income distribution with respect to their parents in the wealth distribution has a significant effect on parents' consumption. A parent in the first quartile with a child in the fourth quartile consumes \$5300 more each year than a parent in the first quartile with a child in the first quartile. On the other hand, a parent in the fourth quartile with a child in the first quartile consume \$3300 less each year than a parent in the fourth quartile with a child in the fourth quartile.

Additionally, the effect on consumption increases with the relative distance between parents and children in the wealth-income distribution. I interpret the fact that children's relative position in the income distribution affects parents' consumption but not the relative position in the wealth distribution, as the result that children are young adults who are starting to accumulate assets, the average age of a child is 32 years old, making the income a better predictor than the wealth of children's well-being and his position in the society.

As a robustness exercise, I realize the same estimation using HRS data, finding similar results than in PSID. Unlike PSID, in HRS, children's household income is reported by parents, which answers in which of eight brackets are their children. Unfortunately, parents do not report their children's income in every survey. For this reason, I take the average income of each child during the observed periods ranking them respective to all other children born the same year. To construct my variable of the relative position of children respect to their parents, I average parent total wealth during the observed sample period. Then I rank them respect to all parents born in the same year. Finally, I estimate the same regression as before.

The results are displayed in Table 3. Column 1 shows the results using RAND consumption measure and column 2 using household expenditure. In PSID, I include the home value if it is rented, but I did not impute durable consumption. However, this is a small fraction of total consumption in HRS. For this reason, the most comparable result is the second. Nevertheless, the conclusion is the same in both measures. Parents with a child three quartiles below them in the income distribution reduce consumption in \$5500 each year (vs. \$3300 in

PSID) with respect to a parent in the same quartile and parents with a child three quartiles above them increase consumption in \$1100 (vs. \$5000 in PSID) with respect to a parent with a child in the same quartile. As in PSID, the effect on parent consumption is increasing in the relative distance between children. The magnitude of the results differs in both surveys, particularly in the fact that in PSID the increase in consumption of poor parents with rich children is higher than in HRS, and in HRS the decrease in consumption of rich parents with poor children is higher. However, the conclusion is the same. The relative position of parents with respect to children in the income-wealth distribution matter for parent consumption and the importance is increasing with the distance between them.

Table 3. Parent Consumption Given Kids Transition

	(1) Total HH Consumption	(2) Total HH Expenditure
Child 3 Quartiles Below Parents	-4636***	-2431*
	(-3.56)	(-1.84)
Child 2 Quartiles Below Parents	-1055*	-457
	(-1.85)	(-0.76)
Child 1 Quartile Below Parents	-44	83
	(-0.12)	(0.22)
Child Same Quartile Parents	914***	906***
	(3.09)	(3.10)
Child 1 Quartile Above Parent	1273***	1469***
	(4.01)	(4.22)
Child 2 Quartiles Above Parents	1325***	1764***
	(3.38)	(3.83)
Child 3 Quartiles Above Parents	2113***	2556***
	(3.49)	(3.98)
Observations	19033	19033

t statistics in parentheses, standard error cluster by household

* $p < .10$, ** $p < .05$, *** $p < .01$

Figure 1 explores how behaves the gap in consumption between parents with children richer than them with respect to parents with children poorer than them across age using

PSID data. To do this, I interact a third-order polynomial with the relative position between parents and child, as is shown in equation 1. Subfigure 2 plots the marginal effect of having a child two quartile above or below the parent quartile with respect to a parent with a child in his same quartile. Subfigure 3 shows the same estimation, classifying kids if they are above or below their parents in the wealth-income distribution but not differentiating by the number of quartiles. In both cases, the relative position of a child in parent consumption is not significant until 60. After that, the gap starts to increase as parents with poor children relative to them considerably decrease consumption with respect to parents with children in the same quartile. On the other hand, the difference in the consumption of parents with children richer than them with respect to parents with children in the same quartile is very stable across age.

$$\text{Parents Household Consumption}_{i,t} = \beta_0 + \sum_{q=-3}^{3} \beta_q T_{i,t}^q f(Age_t) + \beta_X \mathbf{X_{i,t}} + \varepsilon_t + \epsilon_{i,t} \qquad (1)$$

3.3 Inter-vivos transfers, bequest and income distribution.

To understand the underlying mechanism behind why parents with rich kids consume more than parents with poor kids, I use HRS to analyze how monetary transfer, in-kind transfer, and bequest depend on the relative position of children in the income distribution. HRS is more detailed than PSID in transfers and has observations on older children-parent populations than PSID, which is necessary to look bequest.

To assess the mechanisms behind the dependence of parent consumption on the children's position in the income distribution, I examine the effect on inter-vivos transfers and bequest. To evaluate the impact of the relative position of children on inter-vivos transfers, I estimate the difference in transfers between siblings using within-family variation as is shown in the following specification:

$$\text{Inter-vivos Transfer}_{ijt} = \beta_0 + \sum_{q=-3}^{3} \beta_q T^q_{ij,t} + \beta_X \mathbf{X_j} + \varepsilon_i + \epsilon_{jt} \tag{2}$$

where i is the parent household, j is the child, $T^q_{ij,t}$ is the relative position of the child i to his parents j, $\mathbf{X_j}$ is a set of controls (the year that child born and child blood relationship) and ε_t is a family fixed effect.

The estimation results are shown in table Table 3. In column 1, we can see that children above their parents in the income distribution transfer more compare with children in the same position than their parents. However, these amounts are not economically significant. For example, on average, a child in the fourth quartile with a parent in the first quartile transfer \$100 more each year than a child in the fourth quartile with parents in the fourth quartile. On the other hand, parents with children below them in the income-wealth distribution transfer more. For example, a parent in the fourth quartile transfers \$500 more each year to a child in the first quartile than a parent in the fourth quartile with a child in the fourth quartile. However, these amounts are not enough to explain the changes in parent consumption.

In figure 4, I explore how transfers increase across time, interacting a third-order polynomial with the parent-child relative position in the same form than in subsection 3.2. In subfigure 5, we can see transfers from parents to children. The difference in transfers from rich parents toward poor children is flat between 50 and 70 and starts to increase after that age. The difference in transfer from poor parents to rich children increase across age, but there is a small decrease after 70. On the other hand, in subfigure 6, we can see transfers from children to parents, the difference in transfers from rich children to poor parents is increasing after 70. The difference in transfer from poor children to rich parents is flat across time and not significantly different from zero. Both results are consistent with the fact that parents with poor children consume less than parents with rich children and the difference increases with age. However, the magnitudes of the transfers cannot explain the gap by itself.

Appendix A explores if parents receive other types of support from kids depending on the relative position between them in wealth-income distribution. I found that children above their parents in the income distribution are slightly more likely to help with a health cost and less likely to help them in daily life activities than children in the same position than their parents. On the other hand, parents expect more help from children above them in the wealth-income distribution than from children in the same position.

Finally, I estimate the effect of the relative children's position in the amount of parents assets in the last survey before death as a proxy for bequests. Results are shown in table 4 column 3, parents with a child above them in the income distribution have fewer assets in the last survey before dying than parents with a child in the same quartile. However, the results are less statistically significant than before. These results can partially explain the increase in consumption. For example, a parent with a child one quartile above their parents has $25000 less on assets in the last survey.

Table 4. Parent Transfers and bequest by Relative Position in the Income Distribution

	(1)	(2)	(3)
	Annual Transfer Kids to Parents US$	Annual Transfer Parents to Kids US$	Total Wealth Last Period US$
Child 3 Quartiles Below Parents	-32***	512***	-31175
	(-2.73)	(6.18)	(-0.97)
Child 2 Quartiles Below Parents	-21***	306***	19839
	(-5.28)	(7.77)	(1.20)
Child 1 Quartile Below Parents	-18***	90***	5838
	(-4.26)	(2.93)	(0.28)
Child Same Quartile Parents			5052
			(0.56)
Child 1 Quartile Above Parents	14***	-94***	-25682***
	(4.27)	(-6.56)	(-3.43)
Child 2 Quartile Above Parents	51***	-127***	-17497*
	(7.17)	(-7.78)	(-1.85)
Child 3 Quartile Above Parents	105***	-179***	-13380
	(6.40)	(-8.85)	(-1.61)
Observations	76374	79136	5197

t statistics in parentheses, standard error cluster by household

* $p < .10$, ** $p < .05$, *** $p < .01$

Even when parents increase transfer to less wealth off children and decrease bequest to wealthy children, the amounts are not enough to explain the magnitudes of the consumption changes observed in the data. There are many possible explanations for this result. One possible reason is that parents forgot transfers to and from children when they reported them in the biannual survey, given that the question is how much they had transferred to and received from each child in the last two years. Another explanation is that parents and children realize other kinds of transfer that they do not consider as transfers when reporting them in the survey, which affects parents' consumption as gifts.

A more interesting explanation of the difference in consumption between parents with poor or rich kids that is suggested by my model is that part of the decrease in parent consumption come from the fact that parents spend more in the college education of low-skill children, which are going to be in a lower part of the wealth-income distribution than parents in the future, decreasing parents' saving and future consumption. This result explains that only part of the consumption difference is accounted for inter-vivos transfers and bequest. Below on the paper, I explore how parents spend in college education, and I do not find that parents spend more on low-skill children, at least in NLSY97. However, the data is limited, and I believe that is a hypothesis that I should continue exploring.

3.4 Transmission of Children Income Shocks to Parent Consumption

Now I analyze how parents' consumption reacts to children's income shocks. I do this using Blundell et al. (2008) framework to measure the transmission of children's income shocks to parent consumption. First, I regress parents' and children's log income and log consumption in predictable individual components.

$$\hat{c_{jt}} = \log c_{jt} - \beta_t \mathbf{Z_{jt}} \qquad \hat{y_{jt}} = \log y_{jt} - \beta_t \mathbf{Z_{jt}}$$

j is the individual (parent or child), $\mathbf{Z_{jt}}$ are education, born year, gender, number of members on the household, race, labor force status, states and parents, and interactions of year dummies with education, race, employment, labor force status and parents fix effects. I include a parent-year dummy in children and parent income regression to capture family common income shocks. Then using the unpredictable part of consumption and income, I estimate the effect of income shock in parent consumption, using the following regression:

$$\Delta \hat{c_{pt}} = \delta_p \Delta \hat{y_{pt}} + \delta_k \Delta \hat{y_{kt}} + \epsilon_{it}$$

p are parents, k are children, $\Delta\hat{c}$ is the first difference in the consumption residual, and $\Delta\hat{y}$ is the first difference in the income residuals. Following Kaplan et al. (2014), I use future differences in income residuals as instruments.

The estimation results are displayed on table 5, where we can see that children's incomes shock does not affect parent consumption. On the other hand, parent income shocks affect parent consumption with an income-consumption pass-through of 0.11. The previous result is consistent with Attanasio et al. (2018) who find that individual's consumption responds equally to their own or family income shocks in PSID data between 1999-2008, where families are defined as parents and the children who have left the parent household unit. Finally, in column 3, I add the unpredictable changes in children's consumption controlling by parents' income shocks finding that the correlation between changes in children's consumption and parent consumption is 0.09, meaning that an increase or decrease of 1% in child consumption increase or decrease parent consumption on 0.09%. Even when parents' consumption does not directly respond to children's income shocks, both consumptions are related, consistent with the fact that the position of child income distribution affects parent consumption.

3.5 Parents support during college

Table 6. Total non-expected to repay college transfers plus allowances by income and ability quartile (NLSY97 Data)

Parents' Wealth Quartile\ Child's Ability Quartile	1	2	3	4
1	2122	3252	4646	2332
2	2070	3311	6579	5478
3	2870	4924	5901	5699
4	5762	5830	8650	8755

Table 5. Consumption Pass-Through of Children Income Shocks

	(1)	(2)	(3)
	Δ Consumption Parents	Δ Consumption Parents	Δ Consumption Parents
Δ Income Parents	0.11***	0.11***	0.10***
	(5.26)	(5.29)	(3.80)
Δ Income Children		-0.01	-0.03
		(-0.89)	(-1.44)
Δ Consumption Children			0.09***
			(6.55)
Constant	-0.00	-0.00	0.00
	(-0.39)	(-0.13)	(0.47)
Observations	7945	7945	5499

t statistics in parentheses, standard error cluster by household

* $p < .10$, ** $p < .05$, *** $p < .01$

This subsection analyzes if parents invest differently in children's college education, given their abilities. Ability is proxy by the Armed Forces Qualification Test (AFQT). I focus on children who attend and graduated from college abstracting from dropout consideration. For this reason, I drop from the sample children that are college dropout. Wealth is defined as the total net household worth reported by parents in the 1997 survey. I rank ability and wealth in four quartiles, calculating the yearly average transfer from parents to a child in college not expected to be repaid later. This transfer is defined as the total amount non-expected to be repaid received by children during college to finance their college expenses plus allowances. The results are shown in table 6. The average amount of transfers is increasing in parents' wealth and ability. To understand how transfers depend on parents ability, I estimate the following regression:

$$\text{Altruistic Transfer}_{it} = \beta_0 + \beta_1 \ln(\text{AFQT})_i + \beta_X \mathbf{X_i} + \varepsilon_t + \epsilon_{it}$$

i is the child, t is the year, AFQT is the AFQT test percentile and $\mathbf{X_i}$ is a set of controls (high school GPA, college GPA, parents' household net worth, kid gender, kid race, parents education attainment, census region and college type) and ε_t is a year fixed effect.

Table 7. SAT and AFQT on Parent Support (NLSY97 Data)

	(1)
	Altruistic Transfers US$
Log AFQT	151.72
	(0.16)
Female	-876.37
	(-0.91)
Parents Household Wealth 1997	0.01*
	(1.89)
Private not-for-profit institution	3397.94**
	(2.55)
Private for-profit institution	272.35
	(0.15)
Constant	7429.25
	(1.11)
Observations	182

t statistics in parentheses, Robust Standard Errors

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 7 shows that the differences in college transfers are significant in parents' wealth but not in children's ability. Then parents seem to support all children with the same amount. However, the sample size of children which report all the variables necessary for the regression is just 182 observation. In future work, I plan to see if PSID has better data to understand how parents' college transfers depend on children's abilities.

4 The model

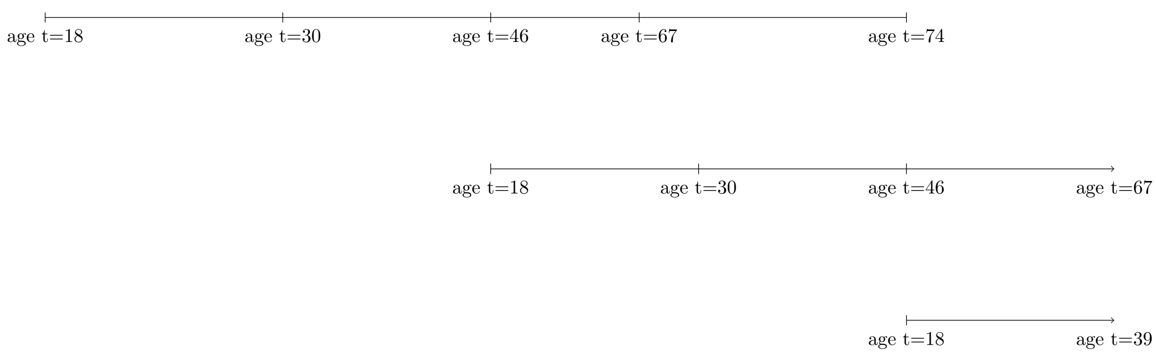
Children's position in the income distribution is endogenous to parents' college investment. For this reason, I model the interactions between parents and adult children in a noncooperative and with-out commitment setting, from the moment that children decide if attending or not college until their parents' death. The goal is to understand how parents invest in children's education when their children's future income is going to directly affect their future consumption after children leave the household, particularly during parents' retirement. Hence, I calibrate a dynamic heterogeneous altruistic model with endogenous college decisions to see if I can replicate the previous finding on parent consumption and college investment.

I build an overlapping generation heterogeneous agent model similar to Nishiyama (2002), adding it a college education decision. The model is composed of a dynasty form by one parent and one child. Parents are altruistic to their children's current and future utility. The dynasty decides consumption, saving, transfer, bequest and college separate. Parents can realize monetary transfer each period and leave a bequest in the last period. As a result, parents and kids behave strategically.

The equilibrium properties are derivated in appendix B. Parents and children have incentives to over-consume as children saving reduce future transfer and parent saving reduce children saving. Barczyk and Kredler (2014a) called this the *dynamic Samaritan's dilemma*, as in Barczyk and Kredler (2014a) and Boar (2020), the donor can limit the strategic behavior transferring only when the receiver is borrowing constrained. In this case, parents only transfer to children when they are borrowing constrained. The rationality of this restriction is that children always save less and consume more than in the case without strategic interactions, as saving reduces transfer tomorrow. As a result, the only case in which the child could consume below the parent's desire amount is when the child is borrowing constrained.

4.1 Model Demographics

Figure 7. Family time line



The economy consists of periods of four years. Each agent overlap with their parents between 18 and 46 years old, as it is shown in figure 7. At 46, each child becomes in a parent and has an 18-year-old child. The agent retires at 67, and after this, he receives social security until his death at 74 with probability one. In every period, the parent can transfer money to his child. To keep the state space treatable, parents' income between 46 and 67 only depends on their education. In each moment, half of the population are parents, and the other half are children. Households face incomplete markets, are borrowing constrain and only can save in a non-contingent bond. Parents can transfer money to his child every period and decide a bequest before he dies. The child receives the bequest in the next period, which is the period he becomes a parent.

4.2 Model decision timing

Parent-child pairs play the following stage game. In the first period, the game has three stages: In the first stage, the child decides if to enroll or not in college. In the second stage, the parent knowing the child's decision decides consumption, saving and the monetary transfer. Finally, in the third and last stage, the child decides to consume and save given his parent consumption and saving choice. During the other periods, there is no college attendance decision, and the game is the following: parent and child both observe the child's income realization. Then, in the first stage, the parent decides to save, consume, and the monetary transfer to the child. Parent savings during the last period are bequest for the child. In the second stage, the child decides consumption and saving, given the parent choices.

I follow a stage game similar to Boar (2020) in contrast to a simultaneous game like Nishiyama (2002) or Barczyk and Kredler (2014a) to simplify the computational solution. Nishiyama (2002) solve a problem with only two periods, each one representing 15 years, which does not allow to capture the college period and Barczyk and Kredler (2014a) use a continuous-time model which simplify the solution making child and parent decision independent of contemporaneous decision when the players are unconstrained. This assumption seems reasonable as children decide how much to consume conditional on how much support they expect from their parents and parents can not force kids to attend college and cannot commit not to support them if they make a college decision different from the parent optimum.

4.3 Parent-Child Decision Problem

4.3.1 Parent-Child problem in last parent period

In last period of the parent-child pair is when the parent is in period 14 and the in period 7. In this period, they also solve a two-stage game with the difference that the parent knows that he dies this period with certainty and the child the next period becomes a parent and receive his parent bequest. The child in the second stage solve:

$$V_7^c(a_c, e_c, e_p, h_0, z, t_p, a_p') = \max_{c_c, a_c'} \{u(c_c) + \beta \int V_8^c(b_p + a_c', 0, e_c', e_c, h_0', 0) f(h_0'|h_0) dh_0'\}$$

$$s.t: \ a_c' + c = wh + (1+r)a_c + t_p$$

$$\log h = \log(\alpha_e h_0^{\beta_e} + \gamma_{e_c,7} + z$$

$$\log h_0' = \rho_h \log h_0 + \epsilon_h$$

$$\epsilon_h \sim N(0, \sigma_{h_0}), a_c' \geq \underline{a_e}$$

b_p is the parent bequest decided in the first stage and j represent each cohort. In the first stage the parent solve:

$$V_{14}^p(a_p, a_c, e_c, e_p, h_0, z) = \max_{c_p, b_p, t_p} \{u(c_p) + \eta u(c_c^*(a_p, a_c, e_c, e_p, h_0, z, t_p, b_p))$$

$$+\eta_d \beta \int V_8^c(b_p + a_c^{'*}(a_p, a_c, e_c, e_p, z, h_0, t_p, b_p), a_c', e_c', e_c, h_0', z') f(h_0'|h_0') dh_0'\}$$

$$s.t: \; c + b_p = \mathrm{SS}(e_p) + (1+r)a_p - t_p$$

$$\log h_0' = \rho_h \log h_0 + \epsilon_h$$

$$\epsilon_h \sim N(0, \sigma_{h_0}), b_p \geq 0$$

$$a_c' = 0, z' = 0$$

where η_d is the parent altruism through their child after his death and e_c', h_0' are education and the ability of his grandchild.

4.3.2 Parent-Child problem after college and before parent last period

The parent-child dynasty during periods in which the child is between $22 - 42$ and the parent $50 - 74$ plays a two-stage game. In the first stage, the parent decides consumption, transfers and saving. In the second stage, the child decides saving and consumption, given the parent decisions. The problem of the child, in the second stage, is the following:

$$V_t(a_c, e_c, e_p, h_0, z, t_p, a_p') = \max_{c_c, a_c'} \{u(c_c)$$

$$+\beta \int V_{t+1}(a_c', e_c, e_p, h_0, z', t_p^{'*}(a_p', a_c', e_c, e_p, h_0, z'), a_p^{*''}(a_p', a_c', e_c, e_p, h_0, z')) f(z'|z) dz'\}$$

$$s.t: \; a_c' + c_c = wh + (1+r)a_c + t_p$$

$$\log h = \log(\alpha_e h_0^{\beta_e}) + \gamma_{e_c,t} + z$$

$$z' = \rho_z z + \epsilon_z, \epsilon_z \sim N(0, \sigma_{z,e_c}), a_c' \geq \underline{a_e}$$

where t_p and a_p' are the parent transfer and saving decided in the first stage and $t_p^{'*}$ and

$a_p^{''*}$ are the parent transfer and saving policy functions the next period. The parent in the first stage solve:

$$V_t(a_p, a_c, e_c, e_p, h_0, z) = \max_{c_p, a'_p, t_p} \{u(c_p) + \eta u(c_c^*(a_c, e_c, e_p, h_0, z, t_p, a'_p))$$

$$+\beta \int V_{t+1}(a'_p, a_c^{'*}(a_c, e_c, e_p, h_0, z, t_p, a'_p), e_c, e_p, h_0, z') f(z'|z) dz'\}$$

$$s.t: \; c_p + a'_p = wy(e_p, t) + (1 + r)a_p - t_p$$

$$y(e_p, t) = \begin{cases} y(e_p, t) & \text{age} < 67 \\ \text{SS}(e_p) & \text{o.w} \end{cases}$$

$$a'_p \geq \underline{a_e}, z' \sim N(0, \sigma_{z,e_c})$$

4.3.3 Parent-Child problem at college decision

In the first child period the parent is on period 8 and the timing is the following: first, the child decides to attend or not college, then the parent decides consumption, saving and transfer, and finally, the child decides consumption and saving. Below, the problem is described backward.

In the third stage, the child decides consumption and saving. The child endogenous states variables are: $a_c \in A$ the child wealth, the parent and children education $e_p, e_c \in E = \{\text{HS}, \text{C}\}$ where HS is high-school and C college. The exogenous state variable is the child's ability $h_0 \in H$ and income shock $z \in Z$. Finally, the child's decision depends on parent saving $a'_p \in A$ and transfer t_p decided in the second stage. Then, the child solve:

$$V_1(a_c, e_c, e_p, h_0, z, t_p, a_p') = \max_{c_c, a_c'} \{u(c_c)$$

$$+\beta \int V_2(a_c', e_c, e_p, h_0, z', t_p^{'*}(a_p', a_c', e_c, e_p, h_0, z'), a_p^{*''}(a_p', a_c', e_c, e_p, h_0, z'))f(z'|z)dz'\}$$

$$s.t: \; a_c' + c_c = \tau(e_c)wh - \phi 1_{e_c=C} + t_p$$

$$\log h = \log(\alpha_e h_0^{\beta_e}) + \gamma_{e_c,1} + z$$

$$z' \sim N(0, \sigma_{z,e_c}), a_c' \geq \underline{a_{e,1}}, c_c \geq 0$$

$$a_c = 0, z = 0$$

where $t_p^{'*}$ and $a_p^{''*}$ are the parent transfer and saving policies functions the next period, $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, $\underline{a_e}$ is the maximum amount of debt that can borrow an individual at 18 which depend on his college decision, ϕ is the college cost, γ is a parameter that captures life cycle effects on wages, $\tau(e_c)$ is the percentage of hours that a college student can work as a high-school graduate, α_e and β_e are the parameters that shape college return on ability and z is an income shock that depends on the education level. In this period, all kids start with the mean productivity $z = 0$.

In the second stage the parent decide saving and consumption given his child education decision. The parent endogenous states variables are: $a_p \in A$ the parent wealth, $a_c \in A$ the child wealth, the parent and children education $e_p, e_c \in \{\text{HS}, \text{C}\}$ and the exogenous state variables are the child ability $h_0 \in H$ and the child income shock $z \in Z$. Given this the parent solve:

$$V_8(a_p, a_c, e_c, e_p, h_0, z) = \max_{c_p, a_p', t_p} \{u(c_p) + \eta u(c_c^*(a_c, e_c, e_p, h_0, z, t_p, a_p'))$$
$$+\beta \int V_9(a_p', a_c^{'*}(a_c, e_c, e_p, h_0, z, t_p, a_p'), e_c, e_p, h_0, z') f(z'|z) dz'\}$$
$$\text{s.t: } c_p + a_p' = wy(e_p, 8) + (1+r)(a_p + b_p) - t_p$$
$$z = 0, a_p' \geq \underline{a_e}, z' \sim N(0, \sigma_{z,e_c})$$

where c_c^* and $a_p^{'*}$ are the child policy function in the third stage and $y(e_p, 8)$ is the average income given age an education. The reason of this assumption on income is to do not keep track of two additional state variables, parents younger than 67 years old receive $y(e, j)$, the average income for their education and age group and after 67, they receive a fixed social security amount conditional on education until his death. This assumption creates an excess of insurance which I hope to relax in a future version. Finally, in the first stage the child decide if attend college or not solving:

$$V_{18}^*(a_p, a_c, e_p, h_0, z) = \max_{e_c \in [HS, C]} \{V_{22}(a_c, e_c, e_p, h_0, z, t_p^*(a_p, a_c, e_c, e_p, h_0, z), a_p^{*'}(a_p, a_c, e_c, e_p, h_0, z))\}$$

where t_p^* and $a_p^{*'}$ are the transfer and saving policies of the parent in the second stage, then the child college decision is not only a function of his ability, it is also a function of his parent saving and support.

4.4 Equilibrium definition

The recursive equilibrium, which is also a Markov-Perfect equilibrium, is the set of value functions $\{V_t(s)\}_{t=1}^T$ and policy functions $\{c_p^t(s), a_p'^t(s), t_p^t(s)\}_{t=1}^T$, $\{c_c^t(s), a_c'^t(s)\}_{t=1}^T$ and $e_c^1(a_p, a_k, e_p, h_0, z)$, where T is the number of periods that a cohort live and $s = (a_p, a_k, e_p, e_c, h_0, z)$ are the dynasty state variables, such that in each repetition of the parent-child stage game:

- In period $t = 1$ when the children decide if attend or not college:

  1. Solve the child college attendance decision problem.
  2. Solve the parent optimization problem given the child and his state variables.
  3. Solve the child optimization problem, given his parent and his state variables, after seeing his parents' decisions and receiving the transfer.

- In period $t = 2$ to $t = J - 1$, there is not college decision, then:

  1. Solve the parent optimization problem, given the child state variables and his state variables.
  2. Solve the child optimization problem, given his parent and his state variables, after seeing his parents' decisions and receiving the transfer.

- In period $t = J$ the parent dies with certain:

  1. Solve the parent optimization problem, given the child state variables and his state variables.
  2. Solve the child optimization problem, given his parent and his state variables, after seeing his parents' decision about bequest and receiving the transfer.

4.5 Solution algorithm

To solve the computational problem I adapt Boar (2020) solution algorithm to my model:

1. Set a grid on assets, ability, education and income. Then the size of the state space is given by $T \times A^2 \times H \times E^2 \times Y$. The ability and income process are discretized using the algorithm in Rouwenhorst (1995). I also use exponential spacing on the asset grid to have more points close to the asset constraint. I set the number of points to $T = 14$, $A = 20$, $H = 9$, $Y = 9$, $E = 2$, this imply solve 1814400 points by dynasty.
2. Solve the problem for generation J which is not altruistic $V^T(a_p, a_c, e_c, e_p, h_0, z)_{t=1}^{T}$.
3. Starting from the previous generation solve the problem backward over the parent-child pairs to obtain $V^{J-1}(a_p, a_c, e_c, e_p, h_0, z)_{t=1}^{T}$. I do this solving the problem backward

$(T, T-1, ..., 1)$ using the previous solution as a continuation value for the next cohort in T:

(a) Solve the child optimization problem $c_c^{'**}(t, a_c, e_c, e_p, h_0, z, a_p')$, $a_c^{'**}(t, a_c, e_c, e_p, h_0, z, a_p')$ without parent transfers.

(b) Solve the parent optimization problem in two steps to get the policy functions $c_p^*(t, a_p, a_c, e_c, e_p, h_0, z)$, $a'^*_p(t, a_p, a_c, e_c, e_p, h_0, z)$ and $t_p^*(t, a_p, a_c, e_c, e_p, h_0, z)$: First solve the optimal transfer t_p conditional on a_p. The transfer is set as follows: i) if $a_c^{'**} > \underline{a_{e,t}}$ then $t_p^{**} = 0$ and ii) if $a_c^{'**} = \underline{a_{e,t}}$ then t_p^{**} solve $max\{0, \hat{t_p}\}$ where $\hat{t_p}$ solve $u'(c_p = wy(e_p, j) + (1+r)a_p - \hat{t_p} - a_p') - \eta u'(c_c^{**}(t, a_c + \hat{t_p}/(1+r), e_c, e_p, h_0, z, a_p')) = 0$. Second, solve the optimal parental policy saving a_p' given the optimal transfer $t_p^{**}(t, a_p, a_c, e_c, e_p, h_0, z, a_p')$. Then using linear interpolation recover $t_p^*(t, a_p, a_c, e_c, e_p, h_0, z)$ and child policies $c_c^*(t, a_p, a_c, e_c, e_p, h_0, z)$, $a_c^{'*}(t, a_p, a_c, e_c, e_p, h_0, z)$.

(c) Then if $V^{T-1}(18, a_p, a_c, C, e_p, h_0, z) > V^{T-1}(18, a_p, a_c, HS, e_p, h_0, z)$ we have that $e^*(a_p, a_c, e_p, h_0, z) = C$ and $e^*(a_p, a_c, e_p, h_0, z) = HS$ otherwise.

4. Solve the problem backward until the difference between V^{T-j} and V^{T-j-1} is small enough.

5 Estimation

To estimate the model I follow Abbott et al. (2019) and Daruich and Kozlowski (2019). I choose the parameters in three different forms: those that I take directly from the literature as preferences, the income process that I estimate separate from the data, and the calibrated parameters that I get from matching data moments. The first two groups are in table 8 and the latter in table 9.

Then, I evaluate if the model can replicate parent investment in children's college education, college attainment conditional in children's ability and parent wealth, parent consumption, and the difference in parent consumption conditional on their child position in the income distribution. The goal is to have a model that allows us to analyze if college education has an insurance role for future parents consumption and how college costs and college premium affect parents saving and retirement consumption when their consumption depends on their children's consumption.

Table 8. Parameters from the data or estimated outside the model

Parameter	Description	Value	Source
	Preferences		
β	Discount Factor	0.96	Daruich and Kozlowski (2019)
r	Interest Rate	0.03	Daruich and Kozlowski (2019)
γ	Risk Aversion	2	Boar (2020)
	College Cost		
ϕ_C	Annual College Cost	\$12200	NLSY97
$\tau(e_c)$	Fraction of Time Work In College	0.56	Census
	Financial Markets		
$a_{C,18}$	Max. College Debt	\$32300	Stafford Loans
$a_{HC,18}$	Max. Debt High School Graduate at 18	$\underline{a_{HC}}$	SCF
$\underline{a_{HC}}$	Max. Debt High School Graduate	\$33800	SCF
$\underline{a_C}$	Max. Debt College Graduate	\$47800	SCF
	Income Process		
ρ_c	College Graduate Income Persistence	0.90	NLSY97
σ_c	College Graduate Income Variance	0.049	NLSY97
ρ_{HC}	High School Graduate Income Persistence	0.93	NLSY97
σ_{HC}	High School Graduate Income Variance	.032	NLSY97
$\overline{W_{38-42}}$	Average Income at 38-42	\$86000	PSID
	Retirement Income		
SS_C	Retirement Income College Graduate	\$25500	HRS
SS_{HC}	Retirement Income High-School Graduate	\$31200	HRS

5.1 College Cost and Borrowing Limit

All the nominal quantities are converted to 2016 dollars using CPI. The annual college cost in the model is \$12.200, which is the average tuition cost after grants and scholarships reported by college students at the NLSY97 survey. I did not find a significant difference in the net cost of attending college given parent income, which is consistent with the findings of Abbott et al. (2019) using data from the National Center for Education Statistics. The reason is

Table 9. Calibrated Parameters

Parameter	Description	Value
	Parent Altruism	
η	Parent Altruism Before Death	0.25
η_d	Parent Altruism After Death	η
	Return to Ability	
α_c	College Level	1
α_{HS}	High School Level	0.44
β_c	College Concavity	0.13
β_{HS}	High School Concavity	0.07
	Intergenational Transmision of Ability	
ρ_H	Human Capital Persistence	0.39
σ_H	Human Capital Standard Deviation	1.88

that high-income children receive more merit aid compensating for higher tuition costs. The borrowing limit for college students is \$32.300 that corresponds to the Stafford loan limit in 2000 when the NLSY97 cohort attended college. After college, the borrow limits are \$33.800 for a high-school graduate and \$47.800 for a college graduate. These borrowing limits are estimated from the 2001 Survey of Consumer Finances (SCF) by Daruich and Kozlowski (2019).

5.2 Income Process

The model income process is given by $\log h = \log(\alpha_e h_0^{\beta_e}) + \gamma_{e,t} + z$. I estimate this process following Abbott et al. (2019). I use NLSY97 households' labor earnings of college and high-school graduates. Because the sample is comprised of young individuals (the older is 37 years old in the last survey), I estimated the income age profile using a second-order polynomial in PSID data for households where the head is between 18-67 for high-school graduates and 23-67 for college graduates. Table 10 shows the results. Then I regress the part of household income not explained by the age profile on the AFQT test score. Then I use the residual to estimate income shocks. For this, I assume that the process follows by the log income residual is the following:

$$z^e_{iat} = \log y_{it} - \widehat{f^e(a_{it})} - \hat{\beta}_0 - \hat{\beta}_1 \mathrm{AFQT}_i$$

$$z^e_{iat} = \rho_e z^e_{i,a-1,t-1} + \eta^e_{iat}$$

$$\eta^e_{iat} \sim N(0, \sigma^e_\eta), \quad z^e_{i0t} \sim N(0, \sigma^e_{z_0})$$

where z is the income shock, y is income, $\widehat{f^e(a_{it})}$ is the age profile estimated previously from PSID, η is an innovation of the income shock and ρ is the persistence of the income shock. Then the parameters ρ_e, σ^e_η and $\sigma^e_{z_0}$ are estimated using the Minimum Distance Estimator for the co-variance of wage residual for all possible lags by age and education group. Table 11 displays the estimated result. The income process persistence is lower, and the shocks and initial dispersion is higher for my sample than what is found by Abbott et al. (2019) and Daruich and Kozlowski (2019). I attribute the difference to the fact that they use the NLSY79 sample, which is an older cohort than the one that I am analyzing.

Table 10. Income Age-Profile

	High-School	College Graduate
Age	0.067	0.115
Age^2*1000	-6.831	-11.97

Table 11. Income Process

	High-School	College Graduate
ρ_z	0.93	0.90
σ_{eta}	0.032	0.049
σ_{z_0}	0.14	0.16

5.3 Return to Ability

I have $\gamma_{e,t}$ and the exogenous shocks z process estimation from the previous subsection. To estimate the ability return by education group $\alpha_e h_0^{\beta_e}$, I follow Daruich and Kozlowski (2019) and I calibrate α_e and β_e targeting the college premium and income volatility for high-school and college graduate between 38-42 years old. As the NLSY97 participants, today are between 36 and 40. I assume that they have the same college premium and income variance than PSID data. The parameters that result from the calibration are shown in table 9.

5.4 Ability and Parent Altruism

The ability process is given by $\log h_0^c = \rho_{h_0} \log h_0^p + \epsilon_{h_0}$ and $\epsilon_{h_0} \sim N(0, \sigma_{h_0})$. I use η, ρ_{h_0} and σ_{h_0} to target the college attainment between different child ability-parents incomes group. The calibration results are shown in table 9.

5.5 Retirement Income

I estimate the retirement income as the average of the sum of Retirement Social Security Income, Supplemental Security Income, Disability Income, and Employers Pension programs by education group in households where the respondent is older than 67, and it is retired. The results are shown in table 8.

6 Model Results

Now I discuss the model results. The model can achieve higher college attendance between affluent low-skill children, but parents spend more on low-ability children, which is not observed in the data. With respect to parent consumption and assets is able to fit the consumption and assets of the highest two quartiles but fail in the lowest two. With respect to inter-vivos transfers and bequests, the model cannot generate enough bequests or transfers during the last parent years. Finally, the model can replicate the difference in consumption between a rich parent with a rich child with respect to rich parents with poor child, but is not able to replicate the increase in consumption of a poor parent with rich child respect to a poor parent with a poor child. The reason for this is because the model does not generate enough bequests from parents to children which is the mechanism through poor parents' increase consumption.

Table 12. Targeted Moments

College Attainment by HH Wealth and AFQT Quartile (NLSY97) v/s Model College Attainment				
Parents' Wealth Quartile\ Child's Ability Quartile	1	2	3	4
1	0.19	0.24	0.33	0.53
	(0.00)	(0.00)	(0.08)	(1.00)
2	0.24	0.30	0.42	0.53
	(0.00)	(0.35)	(0.98)	(1.00)
3	0.26	0.40	0.51	0.63
	(0.00)	(0.29)	(1.00)	(1.00)
4	0.33	0.46	0.62	0.74
	(0.37)	(0.93)	(1.00)	(1.00)
Targeted Income Moments				
	Model	Data		
High-School/College mean Income Ratio	0.63	0.57		
High-School HH Income S.D	11691	39600		
College HH Income S.D	30524	60000		

The values without parenthesis are the attainment rates in the data the values in parenthesis are the attendance rates in the model.

The upper part of table 12 shown the results of college attainment in the model compare to the data. In the table, the data values are without parenthesis, and the model results are in parenthesis. The model can achieve higher attendance rates for affluent low-ability children. The 37% of the low-ability child from parents in the fourth wealth quartile attain college v/s 0% in the other wealth quartiles. However, the model is far from match the data as it cannot explain why some wealthy high-skill kids do not attend college, or some poor low-skill attend. For example, in the model, all the high ability children attend college independent of their parent's wealth. In the next version, I would like to explore introducing college taste to improve the fit with the data. In the bottom part of table 12, we can see that volatility and college premium in the model is lower than in the data (63% v/s 57%), the high-school and college graduate income volatilities are also lower (11691 v/s 38600) and (30524 v/s 60000).

Table 13. College Transfers by Ability and Parent Wealth

College Transfer + Allowances Yearly, Model v/s Data (NLSY97)

Parents' Wealth Quartile\Child's Ability Quartile	1	2	3	4
1	2122	3252	4646	2332
	(Nan)	(Nan)	(8825)	(983)
2	2070	3311	6579	5478
	(Nan)	(13630)	(5530)	(1644)
3	2870	4924	5901	5699
	(Nan)	(14619)	(7669)	(5814)
4	5762	5830	8650	8755
	(30022)	(18408)	(15890)	(13240)

The values without parenthesis are the attainment rates in the data the values in parenthesis are the attendance rates in the model.

Table 13 shows parents transfer during college in the model compare with the data. As before, the data values are without parenthesis, and the model results are in parenthesis. The Nan results are because there is no college attendance at that wealth-ability quartile, then there are no transfers in the simulation. The model overstates transfers for high-income parents with high ability children and understates for low-income parents with high-ability children. The major failure in the model results with respect to NLSY97 data is that parents in the model transfer substantially more money to low-ability than high-ability children during college, which is not observed in the data. However, as I explained before, this data is very limited to understanding parent investment given ability as there are not many individuals who report all necessary information. Haider and McGarry (2018) using HRS data fins that parents invest more in younger siblings, however, this dataset has not information on ability. Two possible explanations in the literature for this, given by the authors, are that the firstborn child has higher ability than younger brothers and older siblings receive more merit base-aid, which would be consistent with the model. However, they can not rule out that the higher transfers are because parents are more borrow constrained when they are younger or because the increase in college price has made parents support more their children across time.

Now in figure 8, I compare the consumption in the model respect to the data. The consumption is higher than in the data for the first three quartiles, particularly for the first two. Two possible reasons are that the model has over insurance given that after 46 individuals receive an average income given their education and the calibration generates less volatility in income than in the data. Figure 11 compares the last 16 years before the exit of an individual in HRS and the model. In the model, parents accumulate assets until retirement, where we can see a kink, and then they decrease assets to keep consumption during retirement. On the other hand, in the data, parents keep a very stable amount of assets until their death. The fact that parents over-consume and decrease assets faster than in the data is probably explained because the model does not have longevity risk or health risk.

Figure 14 shows parent transfer across child age. Similar to the data, transfers are higher at children's college-age and then decrease. However, in the model, parents realize most of the transfers during the first years. The average parent transfer is minimal at the end of parents' life compare with the data; this happens as not many children are borrowing constraints in the model when they are in their late thirties.

Finally, table 17 analyses the consumption difference between parents with rich or poor children. First, I define the consumption gap as the difference between the consumption of a parent with a child in the fourth income quartile respect to a parent with a child in the first income quartile. The average difference is \$1200, but this difference is driven for parents in the fourth quartiles. For parents in lower quartiles, the differences are most of the time, less than \$1000. In the model the gap seems constant across time and is not increasing as in the previous estimations, as we can see in the left subfigure. The model can replicate the gap for wealthy parents as they are the ones who spend more in college education and later transfer more to poor children. However, it cannot explain the increase in the consumption of lower quartiles when they have a rich child because this should be driven in the model by lower bequest. However, parents leave small bequests to their children, contributing to higher consumption and faster asset dissacumulation. For example, the parents in the first income quartile leave \$200 v/s \$16000 in HRS data. Then, poor parents with rich kids can not increase consumption through lower bequests. In a future version, I would like to explore introduced an additional bequest motive or longevity risk in order to be able to generate higher bequest and improve the fit with the data.

7 Comparison with a model without dynamic altruism

In this section, I compare the model with a model without dynamic interactions after the college decision. Here, parents only can make a transfer during the first period. In this version, the parent and child solve each period the same problem than before, except that the parent is allowed only to transfer during the first period when the child decides college and he does not leave a bequest, then the parent solves the following problem when the child is 18:

$$V_{46}(a_p, a_c, h_0^c, e_p) = \max_{c, a_p', t_p} \{u(c) + \eta V_{18}^*(a_c, h_0^c, t_p) +$$

$$\beta V_{50}(a_p', e_p)\}$$

$$s.t: \ c + a_p' = wy(e_p, 46) + (1+r)a_p - t_p$$

$$a_p' \geq \underline{a_{e_p}}$$

To estimate the model, I use the same exogenous parameters than before, and the endogenous parameters are calibrated to the same targets. The model without strategic interaction after college is also able to create higher attendance between affluent high-income kids. However, the model with strategic interaction achieves a better fit with the data. In the model without interaction, children achieve higher college attainment as parents over-invest in children's education as they can not keep their money to transfer to low ability kids with bad shocks latter. The value of the loss function that I minimize in the calibration for the model with dynamic interactions is 4.38 v/s 4.98 in the model without dynamic interactions, the college attainment rate in each model is on table 14.

The most important difference between both models is the transfer that parents realize during the college period, which is shown in figure 20. Without dynamic interaction, parents

Table 14. College Attainment Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

College Attainment Non-Dynamic Altruism Model				
Parents' Wealth Quartile\ Child's Ability Quartile	1	2	3	4
1	0.00	0.00	1.00	1.00
2	0.00	0.34	1.00	1.00
3	0.14	1.00	1.00	1.00
4	0.61	1.00	1.00	1.00
College Attainment Dynamic Altruism Model				
Parents' Wealth Quartile\ Child's Ability Quartile	1	2	3	4
1	0.00	0.00	0.08	1.00
2	0.00	0.35	0.98	1.00
3	0.00	0.29	1.00	1.00
4	0.37	0.93	1.00	1.00

transfer considerable more to college. However, when parents have the option of transfer later, they reduce college transfers and keep saving for later in case of being necessary. The implications for children and parent consumption and welfare analysis are interesting. First, as we can see in figure 23, children consume less during the first periods but more in the later periods in the dynamic model as they start with less saving but also accumulate less saving as they transfer less in the case of having a low ability child. On the other hand, parents consume more on average in the model without interactions, as we can see in figure 26. In this model, parents arrive at the moment of becoming a parent with more assets in case of having a low-ability child. However, they keep this saving in the case that their child is high-ability and they do not transfer to children with bad shocks later, which implies a higher consumption during the time as parents. However, have a low-ability child when parents are not allowed to transfer after college and income uncertainty is revealed is more costly in terms of consumption. The consumption gap between a parent with a high-ability child with respect to a parent with a low ability child is higher, as we can see in figure 32, the reason is that in the model without later interactions parents need to transfer all the money in one period and they cannot adjust the transfer in case that the child gets good shocks.

Even when my results are preliminary, parents' and children's dynamic interactions are important from the perspective of life cycle models as they can affect how parents save and consume, particularly when they save to invest in their children's education and insure them later on life.

8 Conclusion

This paper investigates how parents-children interactions after college affect parent's education investment in children and their role in the highest college attainment between affluent kids.

The first part measures the effect on parent consumption of having richer or poorer kids relative to them, finding that parents with children above them in the wealth-income distribution consume more than parents with children in the same quartile. These consumption changes are partially explained because parents increase inter-vivos transfer to poor children and decrease inter-vivos transfer to rich children. Additionally, parents with rich kids reduce bequest, helping to explain the increase in consumption, particularly for poor parents. However, the magnitude of the changes in inter-vivos transfers and bequests are not enough to explain the changes in consumption between parents given children's position in the wealth-income distribution, and a full explanation needs further research. Second, the paper explores how parents invest in college depending on their child's ability, not finding a significant difference between low or high skill children conditional on parents' wealth.

The quantitive part studies if the previous findings can be replicated in a quantitative dynamic altruistic model with endogenous education investment where parents can transfers to children each period, explain the higher attainment between affluent low-skill children, and improve the understanding about how parents investment in college education. Under the college cost and borrowing constraints faced by the NLSY97, only high-income parents with low-ability children transfer enough to make them attend college, which creates an attendance gap. However, this implies that college support is decreasing on ability, which I do not find in the data. The model can explain why rich parents with poor children consume less, but not why poor parents with rich children consume more. The current model cannot generate considerable bequest, which is the mechanism through which poor parents with a rich child seem to increase their consumption in the data. In a future version, I would explore how to generate bequest in the model.

Finally, the paper examines the different implications of a model with children and parents interacting after college with respect to a model in which parents only transfer during the period that children attend college. In the last case, children consume less and save more to increase transfer to their children in college when they become parents. However, parents have higher consumption with respect to the first model because when parents and children interact after college, parents keep part of the transfers in case their children do poorly, which implies a lower need for saving and higher consumption when parents are young.

The paper needs a lot of work to understand how parents spend in their children's education, depending on their ability and improving the model fit with the data. However, parents' interactions with adult children have significant and different implications for two of the most relevant public programs like retirement social security and federal education aid, which I believe is worthy of exploring.

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A In-Kind Transfer

This appendix analyses how children's relative position in the wealth-income distribution affects in-kind transfers from children to parents. To quantify the effect of the relative position of children in the income distribution, I estimate the following model:

$$\mathrm{y}_{i,t} = \beta_0 + \sum_{q=-3}^{3} \beta_q T_{i,t}^{q} + \beta_X \mathbf{X_{i,t}} + \alpha_p + \varepsilon_t + \epsilon_{i,t}$$

where y is a discrete variable if parents receive a particular type of help (except in the case of the number of hours helped) from child i, $T_{i,t}^{q}$ is the child position respect to the parent in the income wealth-distribution, $\mathbf{X_{it}}$ is a set of controls (parents's total wealth, parents's non-financial wealth, parents's household income, parent's household head is in the labor force, number of people in parents's HH, the state where the parents's household is located, parents's household head age four order polynomial, parents's household household rent or own house, child's education degree, child's marital situation, parent contact frequency with the child, child gender, child blood relationship), α_p is a parent fix effect and ε_t is a year fixed effect.

The estimation results are shown in table 15. In the case of the coefficients that represent probabilities are multiply by one hundred. In column 1, similar to what is founded previously, children above their parents in wealth-income distribution are more likely to transfer money than children in the same quartile. In column 2, we can see that wealthy children are slightly more likely to help their parents cover health costs. In columns 3 and 4, we see that there is no difference in help with daily activities. In column 5, we can see the most significant difference; parents expect more support from wealthier kids. Finally, column 6 shows that less well-off children spent more hours helping their parents. A child one quartile below spends 20 hours more each month, which could indicate that parents transfer more to poorer children in retribution for care. However, these results are slightly statistically significant.

B Equilibrium Properties

In this section, I discuss the household problem's equilibrium properties to characterize parents' and children's decisions.

B.1 Parent-Child problem when the child decides college

This subsection characterizes the household problem in the period that children decide college attendance. This period has three-stage. First, the child decides college attendance conditional on parent's transfer and saving. In the second stage, the parent decides his consumption, saving and transfer conditional on his child's education. Finally, given his previous parent's decision and college decision, the child decides his saving and consumption. I assume an interior solution to be able to use the first-order condition to characterize the strategic interactions between parents and children. I will characterize the optimization problem backward.

Child problem

The child in the first period born with zero assets and solve the following problem, in the third and last stage, conditional on his parent decision and his previous education decision. Then, the child solve:

$$V_{18}(a_c, e_c, e_p, h_0, z, t_p, a'_p) = \max_{c_c, a'_c} u(c_c)$$

$$+\beta E\left[V_{22}(a'_c, e_c, e_p, h_0, z', t'^{*}_p(a'_p, a'_c, e_c, e_p, h_0, z'), a^{*''}_p(a'_p, a'_c, e_c, e_p, h_0, z'))|z\right]$$

$$\text{s.t: } a'_c + c_c = \tau_e y(t, 0, h_0) - \phi 1_{e_c=C} + t_p$$

$$z = 0, a_c = 0$$

$$a'_c \geq \underline{a_{e,18}}, c_c \geq 0$$

where $*$ denote the policies that are equilibrium objects and E is the expectation for future child income productivity conditional on income productivity today. Then the F.O.C are:

$$c_c : u'(c_c) - \lambda = 0$$

$$a'_c : \beta E V^{t+1}_{a'_c} + \beta E V^{t+1}_{t'^*_p} \frac{\partial t'_p}{\partial a'_c} + \beta E V^{t+1}_{a''^*_p} \frac{\partial a''^*_p}{\partial a'_c} - \lambda = 0$$

Using the envelope theorem:

$$V^{t+1}_{a'_c} = (1+r)u'(c'_c)$$

$$V^{t+1}_{t'_p} = u'(c'_c)$$

$$V^{t+1}_{a''_p} = \beta E[V_{a''_p}{}^{t+2}] = 0$$

Finally we can rearrange this and get the child Generalize Euler Equation:

$$u'(c_c) = \beta(1+r)E[u'(c'_c)] + \beta E[u'(c'_c)\frac{\partial t'_p}{\partial a'_c}] \tag{3}$$

we have an extra term in the Euler Equation, which represents the cost of future saving. As $\frac{\partial t'_p}{\partial a'_c} < 0$, saving decrease future parent transfers and reduce future consumption. Then, the child has incentives to under-save each period compared to the solution with full commitment.

Parent problem

In the period that child decides college attendance parents solve the following problem:

$$V_{46}(a_p, a_c, e_p, h_0, z) = \max_{c_p, a_p', t_p} u(c_p) + \eta u(c_c^*(a_c, e_c, e_p, h_0, z, t_p, a_p'))$$
$$+\beta E\left[V_{50}(a_p', a_c^{'*}(a_c, e_c, e_p, h_0, z, t_p, a_p'), e_c, e_p, h_0, z')|z'\right]$$
$$\text{s.t } a_p' + c_p = y(t, e_p) - t_p + (1+r)a_p$$
$$z = 0, a_c = 0$$
$$a_p' \geq \underline{a_e}, c_p, t_p \geq 0$$

Parents decide to transfer when children have decided if attending or not college. Then, the child education level is given to the parents, so the first-order conditions are:

$$c_p : u'(c_p) - \lambda = 0$$
$$a_p' : \eta u'(c_c^*)\frac{\partial c_c^*}{\partial a_p'} + \beta E V_{a_p'}^{t+1} + \beta E V_{a_c^{'*}}^{t+1}\frac{\partial a_c^{'*}}{\partial a_p'} - \lambda = 0$$
$$t_p : \eta u'(c_c^*)\frac{\partial c_c^*}{\partial t_p} + \eta\beta E V_{a_c^{'*}}^{t+1}\frac{\partial a_c^{'*}}{\partial t_p} - \lambda = 0$$

Using the Envelope Theorem we get:

$$V_{a_p'}^{t+1} = (1+r)\lambda' = u'(c_p')(1+r)$$
$$V_{a_c^{'*}}^{t+1} = \eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}$$

Then we can rewrite the equation system as:

$$u'(c_p) = \eta u'(c_c^*)\frac{\partial c_c^*}{\partial a_p'} + \beta E[u'(c_p')(1+r)] + \beta E[\eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}]\frac{\partial a_c^{'*}}{\partial a_p'} \tag{4}$$
$$u'(c_p) = \eta u'(c_c^*)\frac{\partial c_c^*}{\partial t_p} + \eta\beta E[\eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}]\frac{\partial a_c^{'*}}{\partial t_p} \tag{5}$$

equation 4 is the parent Euler Equation. Note that from the derivative of the child budget constrain: $\frac{\partial c_c^*}{\partial a_p^{*'}} = -\frac{\partial a_c^{'*}}{\partial a_p^{'}}$ and $\frac{\partial c_c^{'*}}{\partial a_c^{'*}} = (1+r) - \frac{\partial a_c^{''*}}{\partial a_c^{'*}}$ then we can rewrite as:

$$u'(c_p) = \beta E[u'(c_p')(1+r)] - \eta \frac{\partial c_c^*}{\partial a_p'} \left(u'(c_c^*) - \beta E \left[\left(1 + r - \frac{\partial a_c^{''*}}{\partial a_c^{'*}} \right) u'(c_c^{'*}) \right] \right)$$

the first term on the right side is the standard trade-off between parent consumption today and tomorrow in the parent Euler Equation. The second term is the trade-off that faces parents from saving. If the parent increases saving receive an additional utility today as the child increases consumption today through a decrease in savings, which reduces consumption tomorrow.

Equation 5 represent the trade-off that face parent to realize transfers, using again the child budget constrain we have that $\frac{\partial c_c^*}{\partial t_p} = 1 - \frac{\partial a_c^{'*}}{\partial t_p}$, the equation can be rewrite as:

$$u'(c_p) = \eta u'(c_c^*) - \eta \frac{\partial a_c^{'*}}{\partial t_p} \left(u'(c_c^*) - \beta E \left[\left(1 + r - \frac{\partial a_c^{''*}}{\partial a_c^{'*}} \right) u'(c_c^{'*}) \right] \right)$$

The first term represents the marginal benefit for the parent of an additional unit of child consumption. The second term is the trade-off between lower child consumption today as the child increase saving but higher consumption tomorrow, given higher savings.

Child College decision

When the child is 18, there is an additional stage at the beginning of the game, the college attendance decision. The child solves the following problem:

$$V_{18}^*(a_p, a_c, e_p, h_0, z) = \max_{e_c \in [HS, C]} \{ V_{22}(a_c, e_c, e_p, h_0, z, t_p^*(a_p, a_c, e_c, e_p, h_0, z), a_p^{*'}(a_p, a_c, e_c, e_p, h_0, z)) \}$$

The optimization problem implies that the child decides college not only taking into account the effect of college in his consumption but also considers the effect on his parent transfer and wealth. Then, college attendance is affected by parent altruism.

B.2 Parent-Child problem when child is 22-42 and parent 50-74

This subsection characterizes the problem solution of the first and second stages between the college decision and the parent last period. The parent always decides first his consumption, saving and transfer. Then, given his previous parent decision, the child decides his saving and consumption. Then, the parent and the child optimization problem is the same as in the second and third stages of the game played when the child decides college attendance. Then the trade-offs between consumption, saving and transfers are the same. The reader can skip this subsection as the results are identical to the previous second and third stages. As before, I assume an interior solution to be able to use the first-order condition to characterize the trade-off face by parents and children.

Child problem

Each period the child solve the following problem:

$$V_t(a_c, e_c, e_p, h_0, z, t_p, a_p') = \max_{c_c, a_c'} u(c_c)$$

$$+\beta E\left[V_{t+1}(a_c', e_c, e_p, h_0, z', t_p'^{*}(a_p', a_c', e_c, e_p, h_0, z'), a_p^{*''}(a_p', a_k', e_c, e_p, h_0, z'))|z\right]$$

$$\text{s.t: } a_c' + c_c = y(t, z, e_c) + (1+r)a_c + t_p$$

$$a_c' \geq \underline{a_e}, c_c \geq 0$$

Then the F.O.C are:

$$c_c : u'(c_c) - \lambda = 0$$

$$a'_c : \beta E V^{t+1}_{a'_c} + \beta E V^{t+1}_{t'^*_p} \frac{\partial t'_p}{\partial a'_c} + \beta E V^{t+1}_{a''^*_p} \frac{\partial a''^*_p}{\partial a'_c} - \lambda = 0$$

Using the envelope theorem:

$$V^{t+1}_{a'_c} = (1+r)u'(c'_c)$$

$$V^{t+1}_{t'_p} = u'(c'_c)$$

$$V^{t+1}_{a''_p} = \beta E[V_{a''_p}{}^{t+2}] = 0$$

Finally we can rearrange this and get the child Generalize Euler Equation:

$$u'(c_c) = \beta(1+r)E[u'(c'_c)] + \beta E[u'(c'_c)\frac{\partial t'_p}{\partial a'_c}] \tag{6}$$

this is the same Generalize Euler Equation than in the period that the child decides college. Then each period, the child has incentives to under-save as saving decreases future savings.

Parent problem

Parent at age t solve the following problem:

$$
\begin{aligned}
V_t(a_p, a_c, e_c, e_p, h_0, z) = \max_{c_p, a'_p, t_p} \; & u(c_p) + \eta u(c_c^*(a_c, e_c, e_p, h_0, z, t_p, a'_p)) \\
& + \beta E\left[V_{t+1}(a'_p, a_c^{'*}(a_c, e_c, e_p, h_0, z, t_p, a'_p), e_c, e_p, h_0, z')|z'\right] \\
& \text{s.t: } a'_p + c_p = y(t, e_p) - t_p + (1+r)a_p \\
& a'_p \geq \underline{a_e}, c_p, t_p \geq 0
\end{aligned}
$$

which is the same problem during the period that the child decides to attend college. Then the F.O.C are:

$$
\begin{aligned}
c_p &: u'(c_p) - \lambda = 0 \\
a'_p &: \eta u'(c_c^*)\frac{\partial c_c^*}{\partial a'_p} + \beta E V_{a'_p}^{t+1} + \beta E V_{a_c^{'*}}^{t+1}\frac{\partial a_c^{'*}}{\partial a'_p} - \lambda = 0 \\
t_p &: \eta u'(c_c^*)\frac{\partial c_c^*}{\partial t_p} + \eta\beta E V_{a_c^{'*}}^{t+1}\frac{\partial a_c^{'*}}{\partial t_p} - \lambda = 0
\end{aligned}
$$

Using the Envelope Theorem we get:

$$
\begin{aligned}
V_{a'_p}^{t+1} &= (1+r)\lambda' = u'(c'_p)(1+r) \\
V_{a_c^{'*}}^{t+1} &= \eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}
\end{aligned}
$$

Then we can rewrite the equation system as:

$$
u'(c_p) = \eta u'(c_c^*)\frac{\partial c_c^*}{\partial a'_p} + \beta E[u'(c'_p)(1+r)] + \beta E[\eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}]\frac{\partial a_c^{'*}}{\partial a'_p} \tag{7}
$$

$$
u'(c_p) = \eta u'(c_c^*)\frac{\partial c_c^*}{\partial t_p} + \eta\beta E[\eta u'(c_c^{'*})\frac{\partial c_c^{'*}}{\partial a_c^{'*}}]\frac{\partial a_c^{'*}}{\partial t_p} \tag{8}
$$

the equation 7 is the parent Generalize Euler Equation, that as before we can rewrite as:

$$u'(c_p) = \beta E[u'(c_p')(1+r)] - \eta \frac{\partial c_c^*}{\partial a_p'} \left(u'(c_c^*) - \beta E \left[\left(1 + r - \frac{\partial a_c''^*}{\partial a_c'^*} \right) u'(c_c'^*) \right] \right)$$

the equation 8 represent the trade-off that faces parent to realize transfers, using the child budget again constrain we can rewrite the equation as:

$$u'(c_p) = \eta u'(c_c^*) - \eta \frac{\partial a_c'^*}{\partial t_p} \left(u'(c_c^*) - \beta E \left[\left(1 + r - \frac{\partial a_c''^*}{\partial a_c'^*} \right) u'(c_c'^*) \right] \right)$$

then parents face the same trade-off that during the first period.

B.3 Parent-Child problem during parent last period before dying

In this subsection, I characterize the last period in which the parent is alive, where he knows he dies with certain.

Child Problem

This period is the last period of the child as a child before becoming a parent. He solves the following problem:

$$V_{42}^j(a_c, h_0^j, e_c, e_p, z, t_p, a_p') = \max_{c_c, a_c'} u(c_c) + \beta E \left[V_{46}^j(b_p^* + a_c', 0, h_0^{j+1}, e_c^{j+1}, e_c, 0) | h_0^j \right]$$

$$\text{s.t. } a_c' + c_c = y(42, e_c, z) + t_p + (1+r)a_c$$

$$a_c' \geq \underline{a_e}, c_p \geq 0$$

where j denote a particular generation, then $j+1$ are the variables of the child of the child. This period is the last one for the parent and the child decides after him, so the child's decisions do not affect future transfers. Then the F.O.C are:

$$c_c : u'(c_c) - \lambda = 0$$
$$a'_c : \beta E[V^{j,46}_{a'_c}] - \lambda = 0$$

Using the Envelope Theorem we have $V^{j,46}_{a'_c} : (1+r)\lambda' = u'(c'_c)(1+r)$. Then the child have the standard Euler Equation which imply that his saving is not distort by future parent decisions.

Parent Problem:

The parent during the last period solve the following problem:

$$V^{j}_{74}(a_p, a_c, e_c, e_p, h_0, z) = \max_{c_p, b_p, t_p} u(c_p) + \eta u(c^*_c(a_p, a_c, e_c, e_p, h_0, z, t_p, b_p))$$
$$+\eta_d \beta E\left[V^{j+1}_{46}(b_p + a^{'*}_c(a_p, a_c, e_c, e_p, h_0, z, t_p, b_p)), 0, e^{j+1}_c, e_c, h^{j+1}_0, 0)|h^j_0\right]$$
$$\text{s.t: } c_p + b_p = \text{S.S.}(e_c) - t_p + (1+r)a_p$$
$$t_p, b_p, c_p \geq 0$$

Then the F.O.C. are:

$$c_p : u'(c_p) - \lambda = 0$$
$$b_p : \eta u'(c_c)\frac{\partial c^*_c}{\partial b_p} + \eta_d \beta E[V^{46,j+1}_{b_p}(1 + \frac{\partial a^{'*}_c}{\partial b_p})] - \lambda = 0$$
$$t_p : \eta u'(c^*_c)\frac{\partial c^*_c}{\partial t_p} + \eta_d \beta E[V^{46,j+1}_{b_p}\frac{\partial a^{*'}_c}{\partial t_p}] - \lambda = 0$$

Using the envelope theorem we get $V^{46,j+1}_{b_p} : (1+r)\lambda' = u'(c^{'}_c)(1+r)$, then we have the following equation system:

$$u'(c_p) = \eta u'(c_c^*)\frac{\partial c_c^*}{\partial b_p} + \eta_d \beta E[u'(c_c')(1+r)(1+\frac{\partial a_c'}{\partial b_p})] \tag{9}$$

$$u'(c_p) = \eta u'(c_p)\frac{\partial c_c^*}{\partial t_p} + \eta_d \beta (1+r) E[u'(c_c')\frac{\partial a_c'^*}{\partial t_p}] \tag{10}$$

the equation 9 shows the trade-off that faces the parent to leave a bequest, the first term in the right is the increase in utility through higher children consumption today given the bequest and the second represent the trade-off between higher tomorrow consumption given the bequest received and lower tomorrow consumption as the child decrease saving. The equation 10 represents the trade-off that the parent face when he transfers the last period. The first term on the right side is the higher utility today through child consumption, and the second term is the decreased utility through lower consumption tomorrow because of the decrease in child savings.

B.4 Properties of the transfer function

As pointed by Boar (2020) in this model as we can see in equations 3 and 6 children over-consume as saving distort future transfer. Then, parents want to set $\frac{\partial a_c'^*}{\partial t_p} = 0$ such that they do not distort the children saving. The only case when child consumption could be below the parent's desire is when the children are borrowing constraints. Then parents only transfer to children when $a_c'^* \geq \underline{a_e}$.

C Education, Consumption and Transfer

C.1 Education and Consumption

Table 16. Transfer and Education

	(1)	(2)	(3)
	Parent Consumption	Parent Consumption	Parent Consumption
Child High School	1138	142	
	(0.75)	(0.09)	
Child College DropOut	2061	747	
	(1.41)	(0.50)	
Child College	4044**	1728	
	(2.34)	(1.00)	
Child More Than College	5693***	3406*	
	(2.86)	(1.74)	
Child 3 Quartile Below		-1439	-1969
		(-0.63)	(-0.86)
Child 2 Quartile Below		-1136	-1387
		(-1.00)	(-1.23)
Child 1 Quartile Below		-1306*	-1446**
		(-1.84)	(-2.04)
Child Same Quartile		78	91
		(0.12)	(0.14)
Child 1 Quartile Above		1242**	1371**
		(2.07)	(2.25)
Child 2 Quartile Above		2174***	2414***
		(3.28)	(3.60)
Child 3 Quartile Above		2949**	3393***
		(2.58)	(2.93)
Observations	7173	7083	7083

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

C.2 Education and Transfers

Figure 1. Effect of children position in the income distribution across age

.5

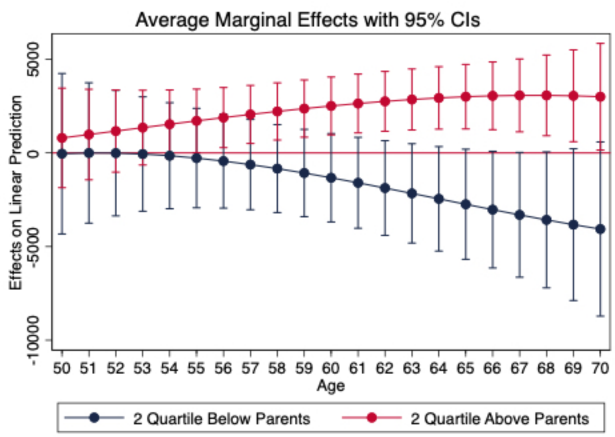

Figure 2. Effect of children position in the income distribution across age (2 Quartiles Above or Below)

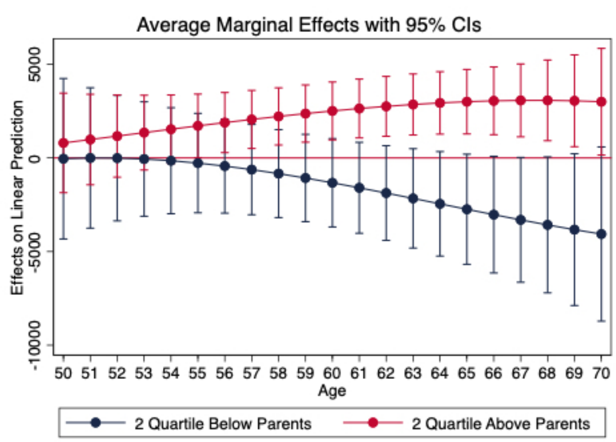

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Figure 3. Effect of children position in the income distribution across age (Above or Below)

Figure 4. Effect of children position in the income distribution in transfer from parent to child and child to parents

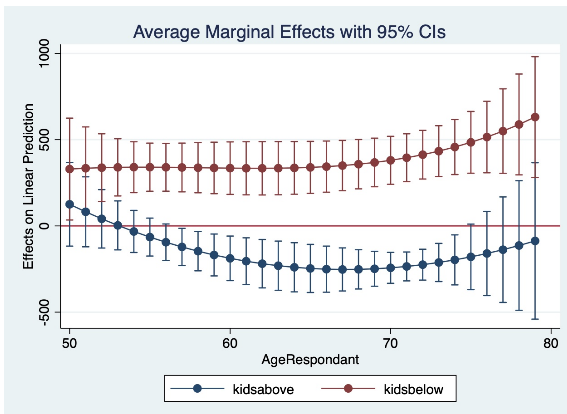

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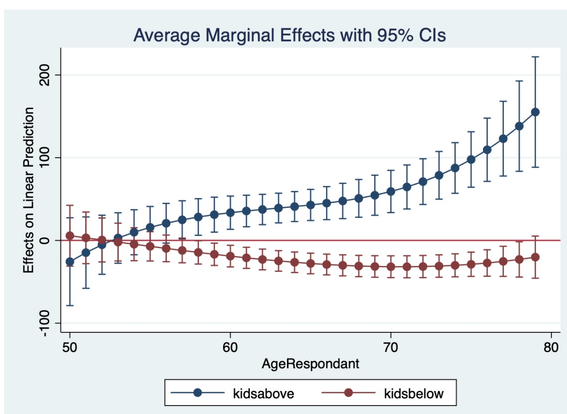
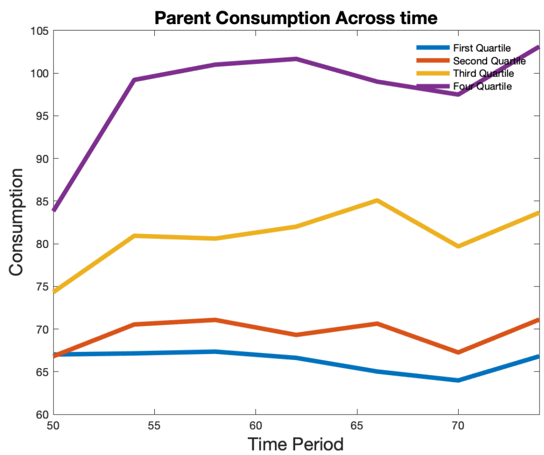
Figure 5. Transfer from parents to children across age (Above or Below)



.5

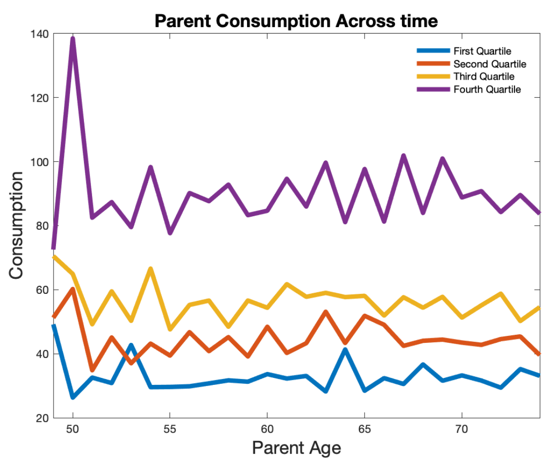
Figure 6. Transfer from children to parents across age (Above or Below)

Figure 8. Parent Consumption Across Time Model vs Data



.45

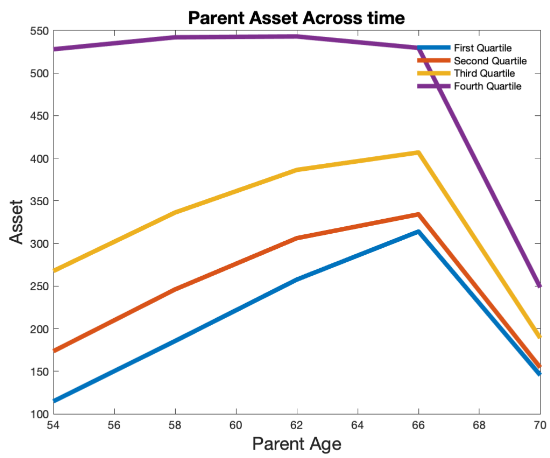
Figure 9. Model



.45

Figure 10. HRS Data

Figure 11. Model Results: Parent Asset Across Time



.45

Figure 12. Model

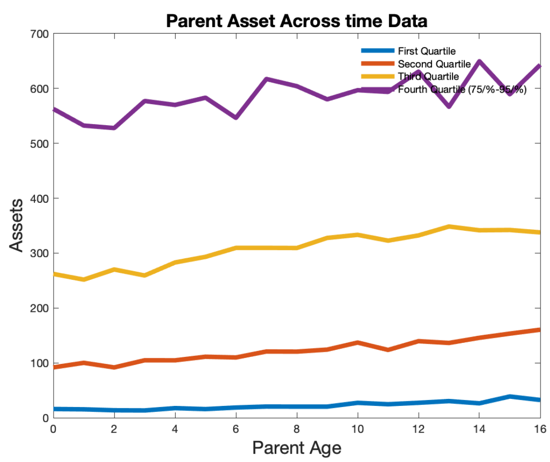


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Figure 13. HRS Data

Figure 14. Model Results: Parent Transfer Across Time

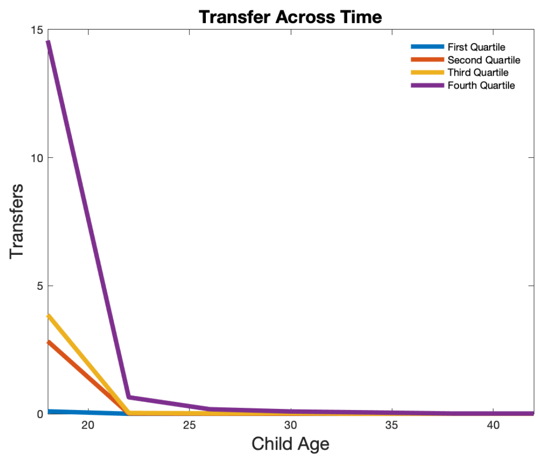

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Figure 15. Model

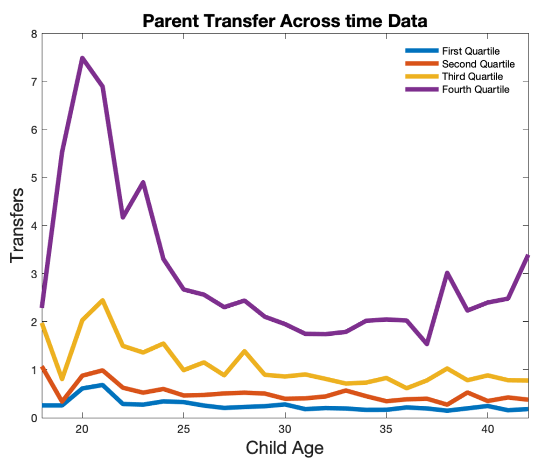

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Figure 16. HRS Data

Figure 17. Parent Consumption Gap Across Time

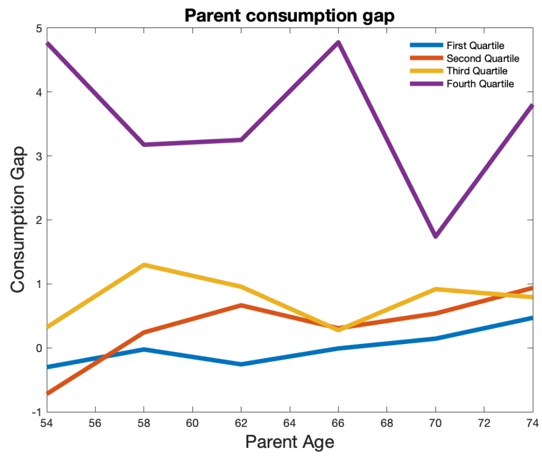

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Figure 18. Model

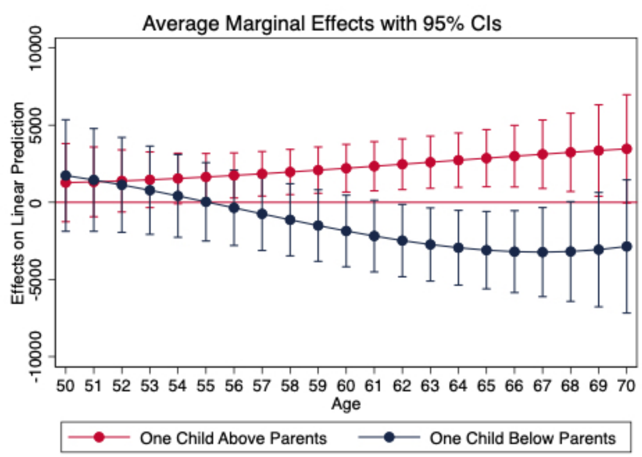

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Figure 19. PSID Data

Figure 20. Model Results: Parent Transfer Across Time Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

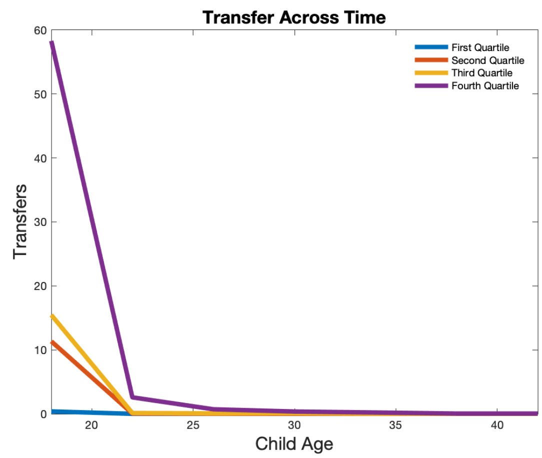

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Figure 21. Model with Dynamic Altruism

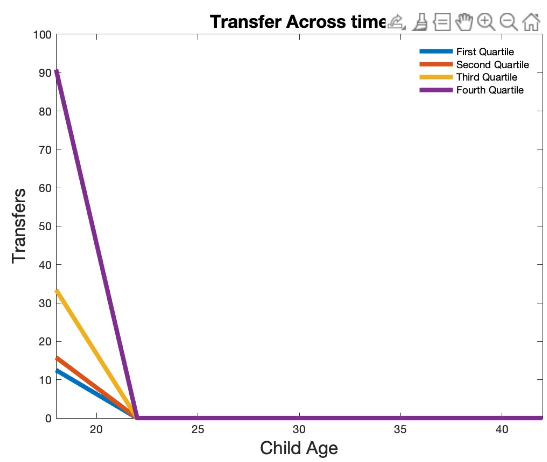

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Figure 22. Model without Dynamic Altruism

Figure Note: The transfers in the model with dynamic altruism are the accumulated transfer for four years. Then the first transfer is the college transfer.

Figure 23. Child Consumption Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

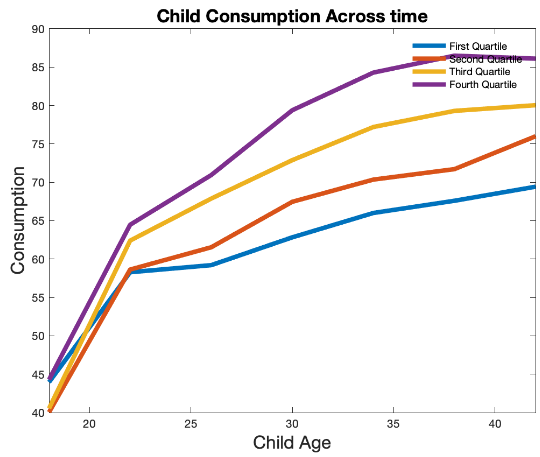

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Figure 24. Model with Dynamic Altruism

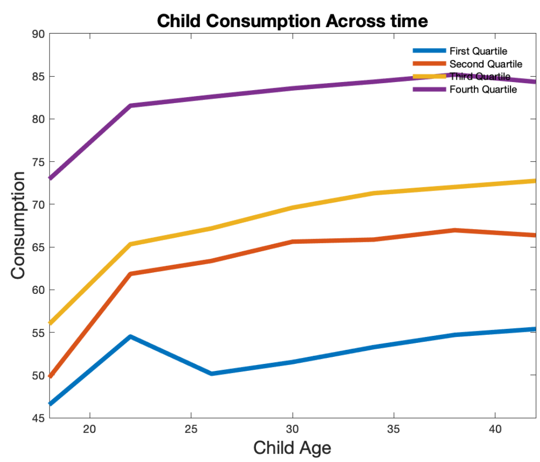

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Figure 25. Model without Dynamic Altruism

Figure 26. Parent Consumption Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

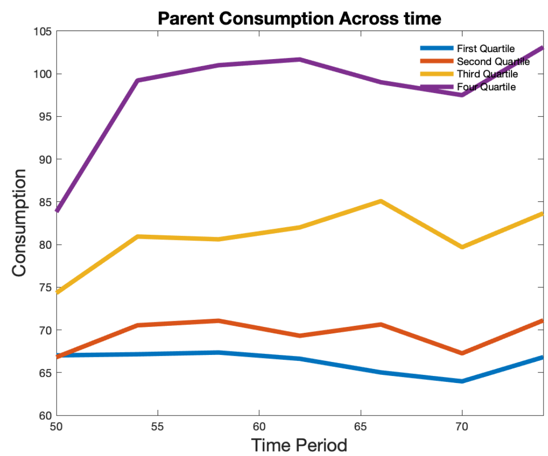

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Figure 27. Model with Dynamic Altruism

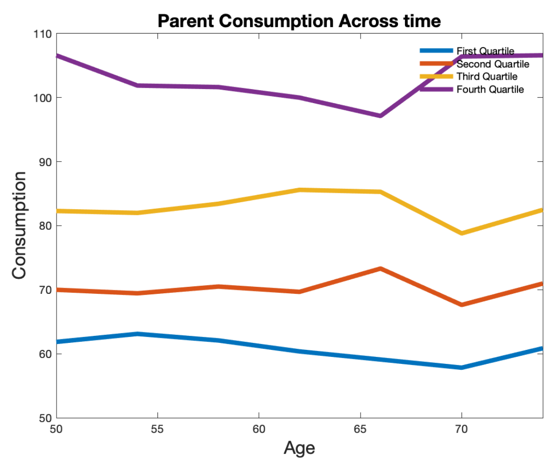

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Figure 28. Model without Dynamic Altruism

Figure 29. Model Results: Parent Asset Across Time Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

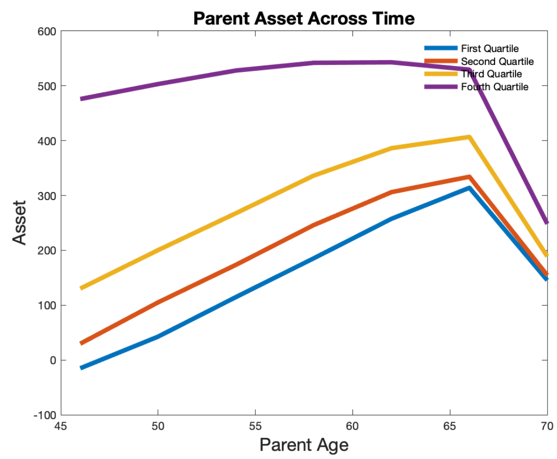

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Figure 30. Model with Dynamic Altruism

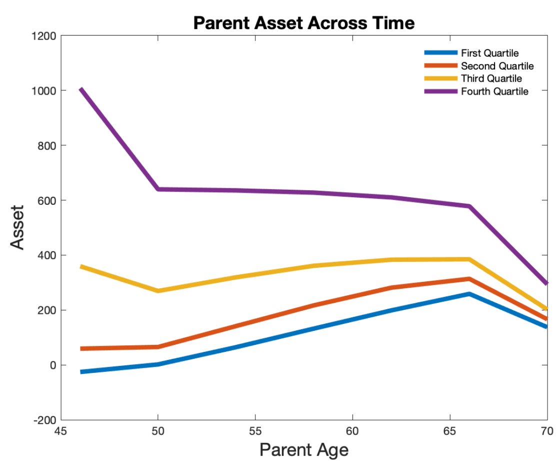

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Figure 31. Model without Dynamic Altruism

Figure 32. Parent Consumption Gap Across Time Model with Dynamic Altruistic Transfers vs without Dynamic Altruistic Transfers

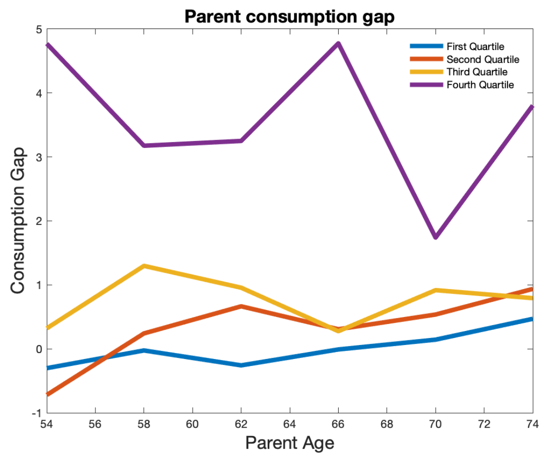

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Figure 33. Model with Dynamic Altruism

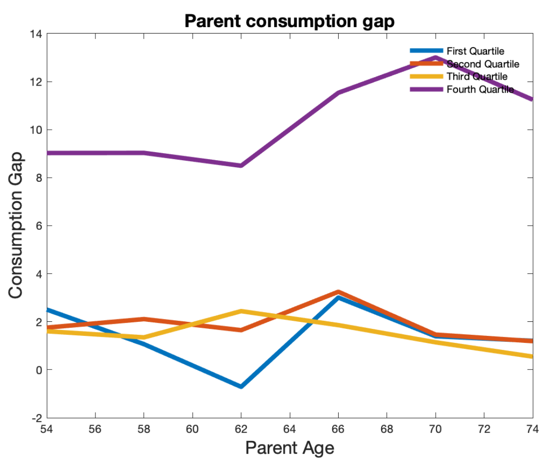

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Figure 34. Model without Dynamic Altruism

Table 15. Transfer from Kids to Parents

	(1)	(2)	(3)	(4)	(5)	(6)
	Prob Transfer	Prob Help Health Cost	Prob Help ADL	Prob Help IADL	Prob Help in Future	Mothly Helped Hours
Child 3 Quartiles Below Parents	1.30***	0.37***	0.08	0.08	-1.95**	10.46
	(5.22)	(3.12)	(0.35)	(0.28)	(-2.01)	(0.81)
Child 2 Quartiles Below Parents	0.36**	0.07	0.12	-0.08	-1.16**	10.04
	(2.20)	(0.98)	(1.20)	(-0.67)	(-1.98)	(1.05)
Child 1 Quartile Below Parents	0.10	0.05	-0.05	0.07	-0.20	19.32**
	(0.86)	(0.80)	(-0.75)	(0.77)	(-0.52)	(2.45)
Child 1 Quartile Above Parents	0.82***	0.04	-0.15*	-0.21*	0.66*	-3.79
	(5.19)	(0.64)	(-1.69)	(-1.85)	(1.72)	(-0.54)
Child 2 Quartiles Above Parents	2.42***	0.40***	-0.24*	-0.41**	0.71	-12.90
	(8.00)	(2.63)	(-1.66)	(-2.17)	(1.22)	(-1.46)
Child 3 Quartiles Above Parents	5.45***	0.90***	-0.57	-0.82**	2.65**	-9.90
	(8.07)	(3.07)	(-1.53)	(-2.05)	(2.57)	(-0.64)
Professional Degree	0.92***	0.17**	-0.05	0.19	-0.85*	8.77
	(5.15)	(2.20)	(-0.50)	(1.52)	(-1.87)	(1.35)
Bachelor Degree	-0.13	0.05	0.09	-0.00	0.77*	-0.64
	(-0.78)	(0.80)	(1.16)	(-0.02)	(1.89)	(-0.13)
College DropOut	-0.68***	-0.10	0.11	0.25**	2.26***	0.61
	(-4.04)	(-1.35)	(1.40)	(2.26)	(5.16)	(0.10)
Married	-0.61***	-0.09	-0.27***	-0.20**	1.21***	-12.13*
	(-5.16)	(-1.62)	(-3.90)	(-2.21)	(3.94)	(-1.87)
Partnered	-0.19	-0.25**	-0.09	0.04	0.53	0.12
	(-1.07)	(-2.45)	(-0.81)	(0.28)	(1.07)	(0.01)
Parent Real Total Wealth	-0.00	0.00	-0.00	-0.00	-0.00	-0.00
	(-0.28)	(0.89)	(-0.50)	(-1.22)	(-0.88)	(-1.13)
Parent Real Total Household Income	-0.00***	-0.00	0.00	0.00	0.00	-0.00*
	(-3.29)	(-0.41)	(1.34)	(1.11)	(0.56)	(-1.77)
Parent Real Non Housing Fin. Wealth	-0.00	-0.00	-0.00	0.00	0.00	0.00
	(-1.34)	(-1.23)	(-0.33)	(0.39)	(0.14)	(0.96)
Child Work	-0.08	0.10	-0.04	0.04	0.91*	4.05
	(-0.50)	(1.06)	(-0.30)	(0.27)	(1.92)	(0.42)
Child Work Partime	0.09	0.16**	-0.13	-0.16	-1.00***	-5.95
	(0.76)	(2.54)	(-1.57)	(-1.48)	(-2.98)	(-1.25)
Contact Frequency	0.00***	0.00***	0.00***	0.00***	0.01***	0.01
	(5.24)	(3.37)	(5.52)	(7.45)	(10.00)	(1.30)
Female	0.19**	0.09**	0.61***	0.91***	9.92***	9.57*
	(2.13)	(2.10)	(10.79)	(12.55)	(37.27)	(1.87)
Step-kid	-0.79***	-0.21***	-0.39***	-0.53***	-16.34***	0.03
	(-5.93)	(-3.49)	(-5.06)	(-5.30)	(-31.83)	(0.00)
Constant	-286.65***	-26.55	113.27	36.43	-133.52	-930.19
	(-2.63)	(-0.26)	(1.31)	(0.40)	(-0.40)	(-0.22)
Observations	156979	128183	157216	157204	153013	2999

t statistics in parentheses, standard error cluster by household

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 17. Transfer and Education

	(1)	(2)	(3)	(4)	(5)	(6)
	Tot. Kids to Parts \$	Tot. Kids to Parts \$	Tot. Kids to Parts \$	Tot. Parts to Kids \$	Tot. Parts to Kids \$	Tot. Parts to Kids \$
Child 3 Quartile Below	-25**		-32***	497***		498***
	(-2.08)		(-2.72)	(5.99)		(6.09)
Child 2 Quartile Below	-21***		-25***	311***		313***
	(-4.24)		(-5.24)	(7.92)		(8.04)
Child 1 Quartile Below	-15***		-18***	88***		90***
	(-3.65)		(-4.23)	(2.87)		(2.93)
Child 1 Quartile Above	13***		15***	-92***		-92***
	(4.11)		(4.60)	(-6.26)		(-6.41)
Child 2 Quartile Above	46***		50***	-130***		-132***
	(6.45)		(7.03)	(-7.51)		(-8.02)
Child 3 Quartile Above	99***		105***	-168***		-173***
	(6.04)		(6.40)	(-8.06)		(-8.70)
High School	2	7***		-18	-45**	
	(0.65)	(2.87)		(-0.75)	(-1.98)	
College DropOut	7**	16***		29	-22	
	(2.06)	(4.66)		(1.18)	(-0.90)	
College	17***	31***		-51	-138***	
	(3.88)	(7.47)		(-1.47)	(-4.25)	
More Than College	34***	49***		21	-76**	
	(5.46)	(8.01)		(0.54)	(-2.00)	
Observations	76374	76374	76374	79136	79136	79136

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

C.3 Income Transition and Education

Table 18. Income Transition and Education

	(1)	(2)
	Dif Decile Parent-Kids Rich	Dif Decile Parent-Kids Poor
Child High School	0.08	0.36***
	(0.29)	(4.20)
Child College DropOut	0.50**	0.64***
	(1.98)	(6.89)
Child College	0.80***	1.18***
	(3.08)	(9.46)
Child More Than College	0.94***	1.26***
	(3.60)	(9.24)
Observations	1604	1723

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$