Grandchild Care, Intergenerational Resource Allocation and Retirement: A Collective Approach*

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May 2008

Abstract

This paper explores how grandchild care needs can affect elderly women's retirement decisions. We model intergenerational resource allocation within a general collective framework where the elderly and the middle generation cooperate to make Pareto efficient allocation decisions. We estimate the model using data from the Health and Retirement Study. Our results indicate that grandchild care needs have important impacts on intergenerational transfers of time and money, but small net impacts on retirement. This is consistent with an intergenerational family risk sharing model where elderly women adjust intergenerational transfers and leisure rather than work, to meet childcare needs.

JEL Codes: D13, J13, J14, J22, J26,
Keywords: Grandchild care, Intergenerational Transfers, Retirement

*I would like to thank Nicola Pavoni, Ian Preston, James Banks, Samuel Belinski, Hilary Hoynes, attendees at my transfer seminar and at the CRFR conference for insightful comments. All mistakes remain my own.
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1 Introduction

Increasing life expectancy coupled with declining fertility rates, have contributed towards the verticalisation of families over the past few decades. Families nowadays tend to consist of smaller numbers within each generation, but have longer chains of generations, so that having three generations alive at the same time for a couple of decades is becoming increasingly common. Such increase in the number of generations simultaneously alive, creates further opportunities for intergenerational networks and support which can take the form of financial and/or time transfers.

At the same time, the increase in the labour force participation of women[1] has been accompanied by an increasing need for childcare. Although the external childcare market has expanded considerably over the past few decades, another informal childcare network has also expanded: grandparent-provided childcare. Indeed, with increased life expectancy and with no parallel increase in the retirement age, it can be expected that grandparents would be potential contributors in grandchild care[2].

Data from the US Census 2000 shows that there has been nearly a double increase in the number of children under 18 living in grandparent headed households[3], from 2 million or 3.2% in 1970 to 4.5 million or 6.3% in 2000. There has also been an increase in the proportion of children of pre-primary school age with a working mother, who are being cared for primarily by their grandparents during the day. Figure 1 plots the trends in primary childcare arrangements for working mothers with children under 5 using data from ChildStats.gov. As can be seen from the diagram, there has been a steady increase in grandparent care use from 15.9% in 1985 to 19.6% in 2005, compared to other arrangements which were either stable or which experienced a decline over the past 20 years[4]. On average, preschoolers with employed mothers were spending 24 hours per week in grandparent care.

These figures show that grandparent's involvement in grandchild care is becoming an increasingly common phenomenon[5]. At an age where one could be anticipating the enjoyment

[1] Labour force participation of women with children under 18 increased from 47% to 71% in between 1975 and 2006. Source: *Bureau of Labour Statistics*

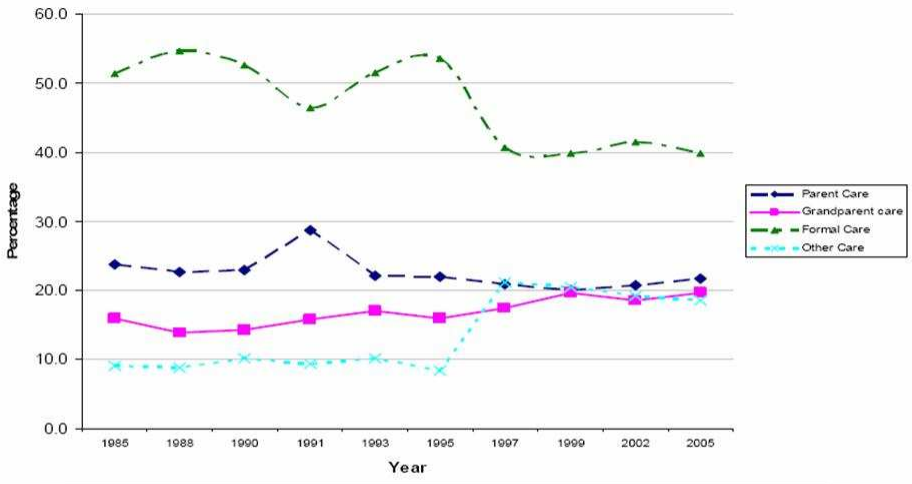
[2] Although developed countries have experienced a decrease in the number of 3 generation families living together, families still prefer to stay at proximity so that the scope for intergenerational transfers is still large. In his survey of European countries' intergenerational networks, Kholi (2004) refers to this phenomenon as "intimacy at a small distance" and points out that about 80% of households live within 25km of family members.

[3] Such trends have been attributed to rising substance abuse, AIDS, unemployment, teen pregnancy, and rising out of wedlock birthrates. The median age of US grandparent caregivers is 57. The majority, 68% of grandparent caregivers are White while 29% are African-American.

[4] Formal care includes centre based care and non relative care. Other care include other relatives care, self care and children in kindergardens. From 1997, it also included children with no regular care arrangements which might partly explain the steep rise in other care arrangements from 1997.

[5] Grandparent involvement is actually very common in some European countries such as Italy, Norway and

Figure 1: Primary childcare Arrangements for Children under 5



	1985	1988	1990	1991	1993	1995	1997	1999	2002	2005
Parent Care	23.8	22.7	22.9	28.7	22.1	22.0	20.9	20.1	20.7	21.7
Grandparent care	15.9	13.9	14.3	15.8	17.0	15.9	17.5	19.7	18.6	19.6
Formal Care	51.3	54.7	52.6	46.4	51.5	53.5	40.6	39.8	41.5	39.8
Other Care	9.0	8.8	10.1	9.3	10.1	8.4	21.1	20.4	19.2	18.6

Data from Table Fam3.B Child Stats: http://www.childstats.gov/americaschildren/famsoc3.asp#20

of their retirement years, one can be called forth to take care of a grandchild, which could be resource intensive, imposing additional time and money constraints on the grandparent. Intergenerational transfers are therefore still prevalent, and with rising childcare costs, rising life expectancy and rising labour force participation of women, this phenomenon might have some important implications for the welfare of the elderly.

This paper has two main objectives. Firstly, we estimate the net impact of variables potentially affecting grandchild care needs on the retirement status of US grandmothers. Secondly, we attempt to distinguish the different channels via which grandchild care variables operate to affect the retirement decision of grandmothers.

We adopt a general collective approach where the two main agents, the grandparent generation and the middle generation, make Pareto efficient inter-family decisions. In this framework, we allow for intergenerational transfer of time from the grandmother to the middle generation in terms of direct time contribution to childcare. On the other hand, intergenerational transfer of money can go both ways, depending on the relative allocation of resources within the intergenerational family. We use endogenous switching regressions to estimate how variables

Greece. For instance, in Greece 2004, 80% of children under 2 received care by relatives (mostly grandmothers) for an average of 30 hours a week. *Source: Research of Income and Treaties of Existence*

affecting grandchild care needs, affect intergenerational allocation of resources i.e., transfers of time and money in two states: when the grandmother is working and when she is retired, and how those intergenerational transfers in turn affect the grandmother's retirement status.

We use data from the Health and Retirement Study (HRS) which is a comprehensive data set containing specific information about hours of grandchild care and financial transfers between generations, as well as a pool of demographic and income variables belonging to both generations. We deal with selection issues in our intergenerational transfers equations by using standard two step procedures. Identification of the impact of intergenerational transfers on retirement is obtained by using middle generation's variables as exclusion restrictions from the main retirement equation for the grandmother. In other words, we allow grandchild care variables to operate only via intergenerational transfers of time and money.

We find that grandchild care needs have small net impacts on retirement but important effects on time and money transfers. More specifically, we find that while the number of grandchildren and age of the middle generation slightly decrease the probability of the grandmother being retired, a married status for the middle generation slightly increases the probability of the grandmother being retired. On the other hand, age and marital status of the middle generation have a negative impact on hours of grandchild care provided by the grandmother while cost of formal child care, as proxied by average wage of childcare workers in the census region, has a positive impact on both hours of grandchild care and net financial transfers from the grandmother. We also find that allocated time transfers in the different work states of the grandmother, are important in determining the retirement decision while net financial transfers have negligible impacts on retirement.

Our results are consistent with an intergenerational family risk sharing model where higher grandchild care needs drives up both time and money transfers, and where elderly women adjust leisure rather than work to meet childcare needs. Also, given the potentially important impacts of time transfers, the government could influence retirement behaviour via appropriate childcare subsidies given to the middle generation.

Section 2 presents some background information where we briefly review the related literature and describe the data, section 3 provides a description of the main framework and the family model, section 4 describes the empirical strategy and identification issues. In section 5, we present estimates of the net impact of grandchild care variables on retirement and attempt to distinguish the channels through which grandchild care operates. Finally, we conclude in section 6.

2 Background

2.1 Related Literature

There are three main branches of the economic literature to which this study is related: (1) retirement, (2) intergenerational transfers, and (3) collective approach to family decision making. While the broader retirement literature emphasizes the importance of financial incentives and health shocks in driving retirement behaviour [Stock and Wise (1990), French (2005)], the family decision making retirement literature tends to focus on couple's joint decision making while ignoring potential transfers of time and money to and from the middle generation [Gustman and Steinmeier (2000), Maestas (2001)]. Yet, family commitments are an important part of our lives and cannot be neglected when making important economic decisions. A third branch of the retirement literature considers retirement transitions, keeping in mind that retirement is closely linked to labour supply decisions and that individuals may choose an entire retirement path instead of an absolute absorbing retirement date [Meghir and Whitehouse (1997), Maestas (2007)]. Most studies on retirement do not take the middle generation into account nor do they consider how the potential time transfers between those generations could influence retirement decisions. Yet, there is evidence that such transfers within family networks are still prevalent. On the other hand, the transfers literature is mainly empirical and seeks to test the motives behind financial transfers [Altonji, Hayashi and Kotlikoff (1992), Cox and Rank (1992)], while the caregiving literature focuses on hours care provided by adult children to their elderly parents but not the other way round [Pezzin and Schone (1997, 1999)].

To our knowledge, Ying Wang and Marcotte (2007) is the only paper which deals with the impact of caring for a grandchild on the labour supply of elderly households. Using PSID data, they find that taking in a grandchild increases the probability of being in the labour force. Our study is different in three ways. Firstly, we interprete the intergenerational family problem within a collective framework [Chiappori (1992), Blundell, Chiappori and Meghir (2005)] which assumes that the intergenerational family makes Pareto efficient decisions. With this simple efficiency assumption, we can therefore abstract from specifically modelling how intergenerational families take decisions[6] while at the same time recognising intergenerational family members as separate entities who can potentially have different preferences. Secondly, while we also estimate a reduced form equation for retirement of grandparents as starting point, we explore further and investigate the channels through which grandchild care can influence retirement behaviour, in our case intergenerational transfers of time and money. Finally, we focus on households which have grandchildren living within 10 miles so as to allow for both day care grandparents and grandparents with coresident grandchildren.

[6] In contrast to a Nash bargaining model which would have required the explicit modelling of threat points.

2.2 Data

2.2.1 Sample Selection

We use US data from the Health and Retirement Study (HRS) 1996-2002. The HRS is a biennial longitudinal study starting from 1992 onwards, and interviewing individuals born between 1931 and 1941, and their spouses. It is a comprehensive data set containing specific information about hours of grandchild care and financial transfers between generations, as well as a pool of demographic and income variables.

In our study, we focus on grandmothers for the grandparent household. More specifically, when the grandparent household is a single female, we construct variables for the grandparent household based on her interview. On the other hand, when the grandparent household is a married couple, we focus on the female in the couple and construct variables for the grandparent household based on the female's interview[7].

The HRS survey includes a family section from which we construct hours of grandchild care and financial transfers variables, as well as variables belonging to the middle generation such as age, education, marital status, number of grandchildren, etc. When the middle generation is married, we focus on the female member of the middle generation couple. Since, we observe the daughters-in-law of the HRS respondents only from 1996 onwards, we therefore use only waves 1996 to 2002 of the survey.

We limit our sample to grandmothers who have at least one middle generation member with children living within 10 miles of the grandparent household (in other words, the middle generation household must have at least one member of the grandchild generation in their household and must live within 10 miles of the grandparent household). The reason for limiting the sample to those generations living within reasonable distance[8] of each other is that it allows us to focus on grandmothers who have the opportunity to provide grandchild care[9].

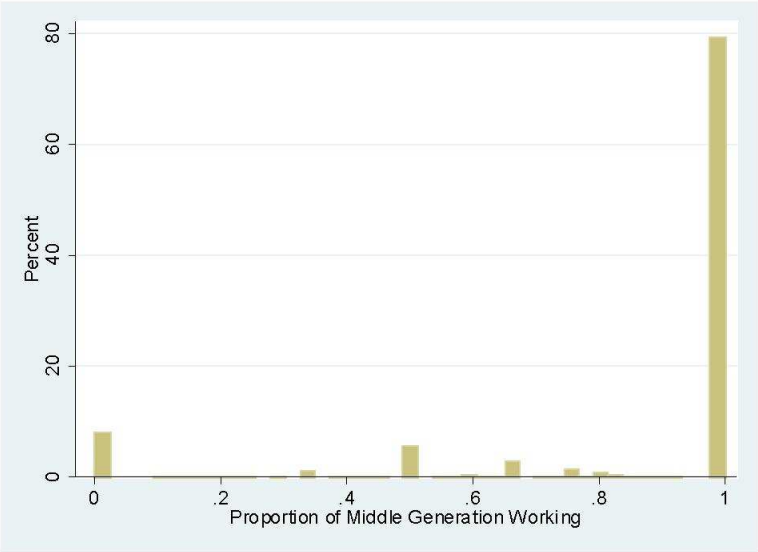
We focus on elderly women with employed adult children and assume that the middle generation's employment decisions are exogenously fixed. About 80% of elderly women had

[7] 72% of grandmothers in our sample were married. We report results for all grandmothers whether they are married or single. The two groups of grandmothers are arguably similar since they were all partnered and had children at a point in time. We also ran separate regressions for single grandmothers and married grandmothers. The results were qualitatively similar to our main results for both single and married grandmothers.

[8] We do not model the decision to live within 10 miles of each other and treat this variable as exogenous. The only measure of distance available in the HRS provides is whether the middle generation lives within 10 miles based on the question: *"Do [KID NAME] and [KID SP NAME] live within 10 miles of you?"*. 65% of all grandmothers in the HRS had at least one member of the middle generation with grandchildren living within 10 miles.

[9] Including the entire sample in one of our robustness checks yielded qualitatively similar results although the net impact of grandchild care variables tend to be smaller than when we restricted the sample to 10 miles.

Figure 2: Proportion of Middle Generation Working



all of the middle generation working as illustrated in Figure 2. Considering only working middle generation members simplifies the analysis by allowing us to focus on the two main states of interest: work of grandmother or retirement of grandmother. Also, the 1990's USA witnessed some major reforms notably welfare waivers in the early 1990's and the 1996 PROWRA legislation, aimed at encouraging low income families into work. Our sample being focussed on the period until after those reforms, it is therefore reasonable to assume that the middle generation's employment decisions are exogenously fixed either by demand side constraints or by the additional minimum work requirement constraints imposed by the reform[10]. We therefore consider the retirement decision of the grandmother in the subsample where the middle generation is working. This yields 8,504 observations in total.

2.2.2 Summary Statistics

Summary statistics are reported in Table 1. The mean age of grandmothers is 61.6. 75% of grandmothers reported that they were in good health and 72% of grandmothers had a spouse present in the household. Average education of grandmothers were 11.8 years of schooling and 55% of grandmothers reported that they were not working for pay. Mean age of middle generation was 37.5 years and 72% of the middle generation were married or partnered. The average number of grandchildren, i.e. children of the middle generation living within 10 miles

[10] A major component of the 1996 PROWRA legislation was the introduction of strict work requirements: to be eligible for TANF benefits, single parent families were required to work at least 20 hours per week in 1997 increasing to 30 hours by 2000 while two parent families were required to work for at least 35 hours per week.

of the grandparent household, is 3.75 and average education of the middle generation is 12.6 years of schooling. An overview of all the variables used is provided in the Data Appendix.

Summary statistics for intergenerational transfers of time and money are provided in Table 2. In the HRS, respondents are first asked whether they provided more than 100 hours of grandchild care in the two years preceding interview, and those with an affirmative answer were then required to give the number of hours provided. Similarly, respondents are first asked whether they gave (received) financial transfers totalling $500 in the previous two years preceding interview and about the amount given (received). The specific questions relating to transfers are outlined in the Appendix.

In our sample, 53.6% of all grandmothers reported providing more than 100 hours of grandchild care in the previous two years, while 36.2% provided more than $500 financial transfers to the middle generation. On average, grandchild care amounted to 6.9 hours per week while net financial transfers, defined as financial assistance given to the middle generation minus financial assistance received from the middle generation, amounted to $27.1 per week.

2.2.3 Correlations with Retirement Status

We choose to focus the analysis on the retirement decision rather than on work hours since in our data set the majority of working grandmothers work between 30 to 50 hours a week with a peak at around 40 hours a week as can be seen in the left panel of Figure 3. Moreover, there does not seem to be much variation in mean of weekly hours of work for working grandmothers by care status where care status takes value 1 if the grandmother is providing grandchild care and 0 if she is not providing any grandchild care[11]. We therefore focus the analysis on the retirement decision of elderly women.

There seems to be a positive correlation between hours of grandchild care and retirement status as shown in the left panel of Figure 4. Figure 4 shows the mean weekly hours of grandchild care provided by the grandparent household by self reported retirement status of the grandmother. Such positive correlation tends to suggest that retired grandmothers might be expected to provide more hours of grandchild care than working grandmothers or that the more hours of grandchild care one provides, the more likely one is to be retired. On the other hand, we observe a negative correlation between net financial transfers and retirement status as shown in the right panel of Figure 4. The correlation pattern between net financial transfers and retirement is consistent with some level of substitution between time and money transfers: retired grandmothers seem more willing to provide hours of help but lower financial help to

[11] Also, a t-test does not reject the hypothesis that there are no differences between weekly hours of care between elderly women who provide care and those who do not (p-value of 0.63). The data also indicates a small and insignificant positive correlation of between hours of care and hours of work for working grandmothers.

Figure 3: Distribution of Work Hours of Elderly Women

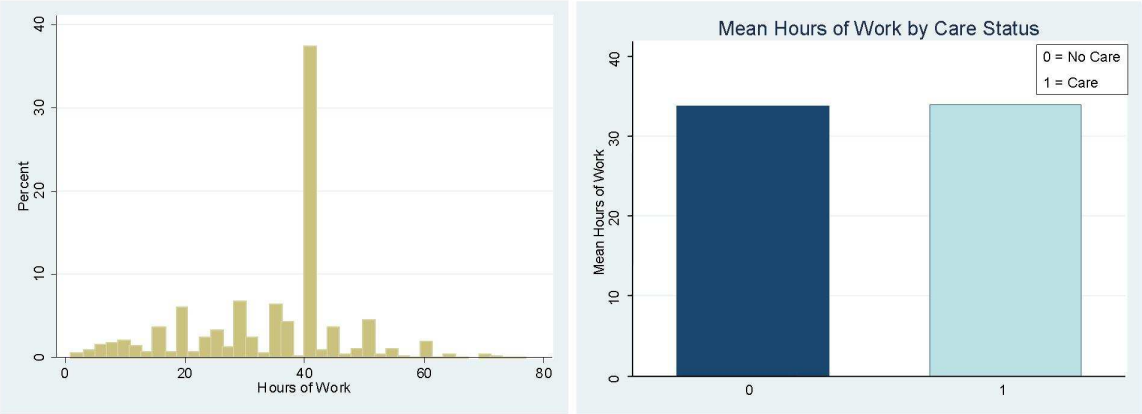
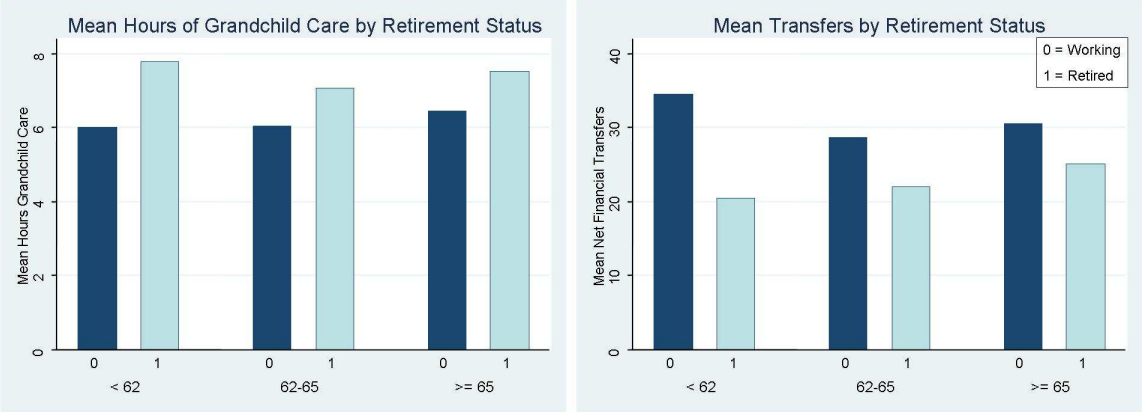


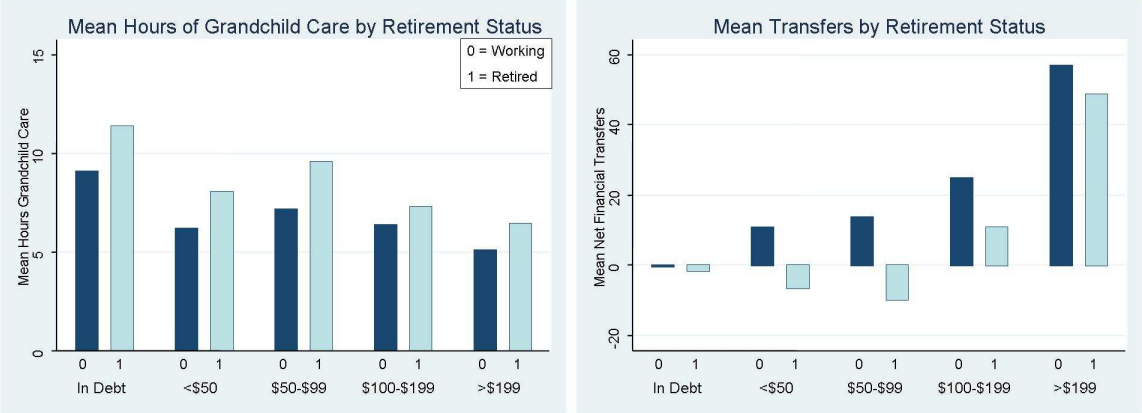
Figure 4: Intergenerational Transfers by Retirement Status and Age



the middle generation.

Splitting the sample according to wealth groups we observe similar correlations as shown in Figure 5. Retired people tend to give more hours of care but lower financial transfers. On the other hand, wealthier grandmothers tend to give lower hours of care overall suggesting that ability to pay for external childcare is a potential determinant of grandchild care contribution. Those with wealth below $100,000 tend to give financial transfers when they are working but receive financial transfers when they are retired. This seems consistent with some form of intergenerational family "risk sharing" where low wealth grandparent tend to receive more financial help from their descendants.

Figure 5: Intergenerational Transfers by Retirement Status and Wealth



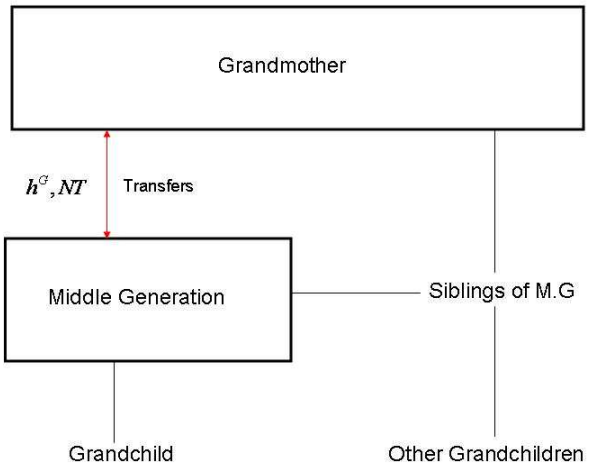
3 General Framework

In order to study the joint decision of intergenerational families and distinguish the different channels through which caring for a grandchild can affect retirement behaviour, we borrow from the collective framework literature [Chiappori (1992), Blundell et al. (2005)] to model the decision of the intergenerational family. Our main assumption is that there are two distinct agents, in this case two generations - grandparent (G) and middle (M) generations, who make Pareto efficient decisions. The assumption of Pareto efficiency allows us to abstract from specifically modelling intergenerational behaviour and instead focus on the efficient allocation of family resources while at the same time allowing each generation to have its own preferences.

While a dynamic forward looking model could be desirable to analyse retirement behavior and savings across time, we believe that the static model can provide us some insights as to the different channels through which grandchild care can operate to influence retirement behaviour. The static model could for instance, be interpreted as a second stage problem where in the first stage, the intergenerational family allocates a given amount of resources to each period (transfers across time), and subsequently in each period, the intergenerational family decides on intergenerational transfers (transfers across generations) taking as given the intergenerational family resources available for that particular period[12]. We therefore stick to the static model to gain some insights as to the different channels and efficiency considerations which the intergenerational family might take when allocating intergenerational family resources.

[12]This is similar to the intra and inter period reformulation of the intertemporal Pareto efficient collective model adopted by Mazzocco (2007).

Figure 6: General Framework



3.1 Intra Generational Decisions

Since we are interested in studying the allocation of resources between generations and not within each generation, we use the simple chauvinistic approach [Killingsworth (1983)] to model intragenerational decisions. Moreover, since women are more likely to be involved in childcare as compared to men, we focus our attention on grandmothers for the grandparent generation and on daughters and daughters-in-law for the middle generation. We therefore assume that male's labour supply is exogenously fixed by institutional factors. The female in each generation, therefore treats the earned income of her spouse, as her unearned income.

Taking their respective spouses income as given, the grandmother and the middle generation then cooperatively decide the allocation of resources. We thus use the chauvinistic approach to model intragenerational allocations between spouses, and the collective approach to model intergenerational allocations between generations. The general framework is illustrated in Figure 6.

3.2 Inter Generational Decisions

3.2.1 Preferences and Parameters

Let C^i be the private consumption bundles consumed by agent $i = G, M$ with price normalised to 1. Each agent is endowed with T units of time which they can allocate to L^i, h^i and H^i,

respectively, leisure, hours of childcare and hours of work of agent i. The wage w^i represents the cost of time while unearned income is denoted by Y^i and includes pensions and social security benefits, interest income and earnings of husband if married.

Assume that the grandparent generation derives utility from its own consumption and leisure, and from its own contribution to child quality $q\left(h^G\right)$ (so that we allow for warm glow), $V^G\left(C^G, L^G, q\left(h^G\right)\right)$. Also, assume that the middle generation gets utility from its own consumption, leisure, and total quality of grandchild generation, $V^M\left(C^M, L^M, K\right)$. Since the grandchild lives in the same household as the middle generation, assuming that the adult middle generation cares for the total quality of its own child is not a far fetched assumption and is in line with the general childcare literature[13] [Blau and Robins (1988), Blau (1993)]. One can treat grandchild quality as a home produced good where each agent inputs hours of child care, $K = k\left(h^G, h^M, h^E\right)$ and h^E is hours of childcare provided by the external market at cost w^E per hour. On the other hand, hours of grandchild care from the grandparent generation h^G is similar to a public good yielding utility to both generations.

3.2.2 Family Problem

Since the grandparent generation faces discrete retirement decision, we have two "states": state R, when the grandparent generation is retired and state W, when the grandparent generation is working. The family therefore has to choose consumption levels, leisure and hours of childcare for both agents, hours of external child care, and whether the grandparent generation is to retire or not.

Under the assumption of Pareto efficiency, the problem can be modelled as though the family solves:

[13] Arguably, the grandmother could value total quality of grandchild generation instead of her own contribution only. Since we do not observe hours of childcare of the middle generation nor hours of formal childcare, we choose to stick to the warm glow specification for the sake of identification in our "structural" retirement equation. We recognise that this could potentially lead to an omitted variable bias in our coefficients. Under the assumption that h^G, h^M and h^F are substitutes in production of grandchild quality, this would bias our estimated coefficients for predicted hours of grandchild care downwards in our "structural" retirement equation.

In an attempt to check the hypothesis that h^M does not enter the "structural" retirement equation, we exploit variation between full time and part time working middle generation and assume that the middle generation devotes all non work time to childcare, to identify the potential impact of middle generation childcare hours on the retirement of elderly women. The estimated coefficients for middle generation care hours were very small and insignificant (in both the OLS regressions and the two stage least squares using middle generation variables as instruments) which is consistent with our inference that G potentially cares for her own contribution to grandchild quality rather than for overall quality.

$$Max_{\{C^G,C^M,L^G,L^M,h^G,h^M,h^E,H^G\}} V^M$$

s.t.

(1) Grandparent "Participation Constraint"

$$V^G \geq \bar{V}^G$$

(2) Budget Constraint

$$C^G + C^M + w^E h^E \leq Y^G + Y^M + w^G H^G + w^M H^M \tag{1}$$

(3) Time Constraints for i = G,M

$$L^i + h^i + H^i = T$$

(4) Production Function - Child Quality

$$K = k\left(h^G, h^M, h^E\right)$$

$\bar{V}^G$ is the utility that the grandparent generation would receive given realisations of wages and income and can also include other exogenous variables such as demographics or distribution factors. It can be interpreted as some preallocated welfare level for the grandparent generation[14].

3.2.3 Double Indifference Assumption

In the discrete choice framework, one needs an additional assumption, namely the double indifference assumption following Blundell et al. (2007), so that the optimal solution is Pareto efficient from both agent's point of view. Double indifference states that that if agent G is indifferent between working and retiring, then agent M also has to be indifferent between agent G working or retiring. The intuition is as follows: if agent G is indifferent between working and retiring but agent M would prefer agent G to be working, agent M could, for instance, give more cash transfers to agent G in the state that G works, so as to induce agent G to work.

[14]Given the assumption of Pareto efficiency, no additional assumption is required for the determination of the $\bar{V}^G$ such that there is not need to explicitly model the way the family allocates resources. We just need to assume that there exists a $\bar{V}^G$ such that the solution to the above family problem would coincide with the optimal (Pareto efficient) choices made by the intergenerational family as in Chiappori (1992).

When agent G is working, she gets a discrete jump in her time constraint and will therefore have to be compensated in terms increased consumption (in this case more cash transfers). This assumption ensures that the welfare of each agent does not change discontinuously along the participation frontier and is similar to assuming that $\bar{V}^{GP}$ is a continuous function of wages and incomes of each generation.

3.2.4 Two Stage Problem

Under the assumptions of Pareto efficiency, double indifference (continuity) and selfish or caring preferences, we can therefore split the family problem above and rewrite it as though the family were solving a two stage problem, such that the optimal allocation under the two stage problem coincides with the optimal allocation under the family problem.

In the first stage, the family agrees on (a) the level of public good (hours of grandchild care h^G) in each state (R - Retirement and W - Work), and (b) on a sharing rule ϕ^G, ϕ^M in each state, conditional on the level of public goods: $\phi^G + \phi^M = Y^G + Y^M + w^G T + w^M T - w^G h^G$. ϕ^i is the level of intergenerational family full income net of the value of hours of grandchild care[15], allocated to agent $i = G, M$. Step 1 of the problem is thus similar to choosing hours of grandchild care h^G and net financial transfers NT in each state: $\phi^G = Y^G + w^G T - w^G h^G - NT$ and $\phi^M = Y^M + w^M T + NT$. Net financial transfers are defined as the difference between transfers from the grandparent to the middle generation, T^G, and transfers from the middle generation to the grandparent generation, T^M: $NT = T^G - T^M$ and can be either negative or positive, depending on the allocation of intergenerational family resources[16].

In the second stage, given hours of grandchild care and net financial transfers stemming from step 1, each agent solve their decentralised problem. In other words, the middle generation chooses leisure, own childcare hours, external hours of childcare and own consumption, and the grandparent generation chooses whether to retire or not, and own consumption.

3.3 The Retirement Decision

We consider only discrete labour participation decisions for the grandparent generation in the sense that those who choose to work, work for a given amount of hours, say H hours per week. This yields two states: R, the state when the grandparent is retired and W, the state when the grandparent is working.

[15] Value of grandchild care is measured by the opportunity cost of grandparent's time, given by wage w^G

[16] If for instance, the intergenerational family attributes a very high welfare weight to the middle generation, then it is possible for the middle generation to benefit from both higher hours of grandchild care and higher positive net financial transfers from the grandparent generation.

In step 2, taking intergenerational resource allocation i.e., hours care and net financial transfers in each state as given, the grandparent generation decides whether to retire or not. Each period, the grandparent generation therefore chooses whether to work or not by comparing utility from working and utility from not working. Consumption and leisure of the grandparent generation are given by their private budget and time constraints. The grandparent's maximisation problem thus becomes[17]:

$$Max\left[V\left(C^R, L^R, q\left(h^R\right)\right), V\left(C^W, L^W, q\left(h^W\right)\right)\right]$$

s.t.

Consumption and leisure of grandparent generation when retired R:

$$C^R = Y - NT^R$$

$$L^R = T - h^R$$

Consumption and leisure of grandparent generation when working W:

$$C^W = Y + wH - NT^W$$

$$L^W = T - H - h^W$$

where Y is other household income, NT^s is net financial transfers in state $s \in \{R, W\}$, h^s is hours of grandchild care in state s, and H is amount of hours worked. Increased net financial transfers from grandparent generation to middle generation therefore decreases amount of consumption available to the grandparent generation. On the other hand, increased hours of grandchild care lead to a decrease in amount of leisure available to the grandparent generation.

The grandparent gets out of the labour force if utility from retiring is greater than utility from working:

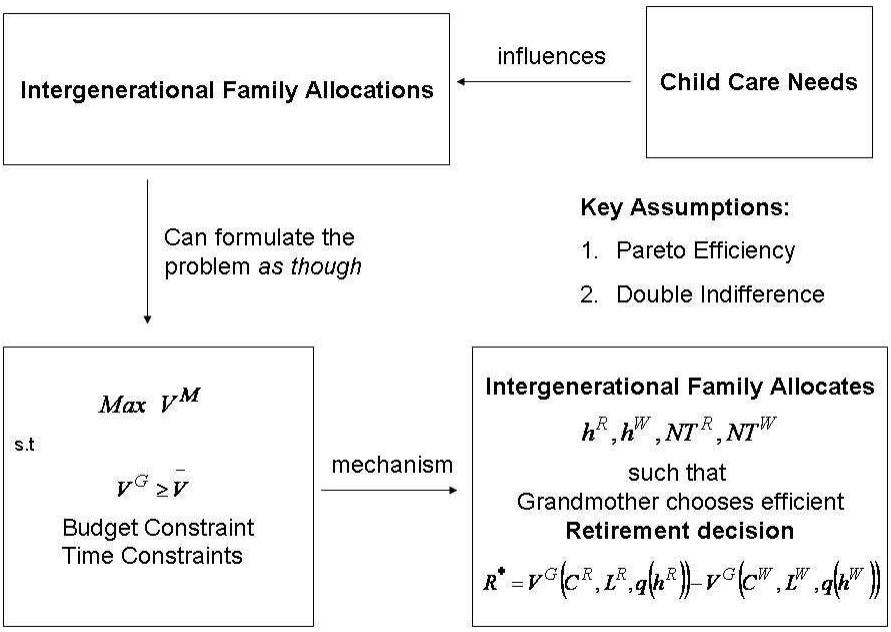
$$V\left(C^R, L^R, q\left(h^R\right)\right) - V\left(C^W, L^W, q\left(h^W\right)\right) \geq 0$$

$$V\left(Y - NT^R, T - h^R, q\left(h^R\right)\right) - V\left(Y + wH - NT^W, T - H - h^W, q\left(h^W\right)\right) \geq 0 \qquad (2)$$

Under the assumptions of Pareto efficiency, double indifference and selfish or caring preferences, the result stemming from the second step problem should coincide with that from the family decision problem. The impact of caring for grandchildren can therefore affect the retirement decision of the grandparent via the allocated hours of childcare and net financial

[17]For the sake of notation, we drop superscripts G since we are now focussing only on the decentralised problem of the grandparent generation.

Figure 7: Channels through which Grandchild Care Needs Operate



transfers in each state.

3.4 Through Which Channels do Grandchild Care Needs Operate?

As can be seen from equation (2), there are therefore four main channels through which grandchild care can affect retirement: time and money transfers in each of the states, h^W, h^R, NT^W, NT^R. The efficiency and double indifference assumptions imply that the allocation of time and money in the different states are such that the grandmother's retirement choice stemming from equation (2), will coincide with the optimal allocation from family problem (1). For instance, if there is an exogenous increase in the cost of formal child care, one would expect that this would have an impact on hours of childcare and on net financial transfers in both states, which in turn would influence the retirement decision. The intuition behind the channels is illustrated in Figure 7.

When considering the retirement decision, the grandmother will consider the amount of time that she would be expected to devote to grandchild care if she chooses the work state h^W, the amount of time that she would be expected to devote to grandchild care if she chooses the retirement state h^R, the amount of net financial transfers that she would be expected to make if she chooses the work state NT^W, and the amount of net financial transfers that she

would be expected to make if she chooses the retirement state NT^R.

Probability of retiring can either increase or decrease with h^W and h^R, depending on whether the time constraint effect (in terms of decreased leisure) or the warm glow effect (in terms of direct utility from grandchild quality) dominates. For instance, consider an exogenous variation which leads to the family allocating increased hours of grandchild care in the work state h^W. From the time constraint, the grandparent would get a lower amount of pure leisure in the work state, and subsequently a lower utility from leisure in that state, leading to an increase in the probability of retiring. At the same time the grandparent would get higher utility from the increase in grandchild quality in the work state (warm glow) which would lead to a decrease in the probability of retiring. In this case the probability of retiring might either increase or decrease. A similar intuition applies to h^R.

On the other hand, net financial transfers enter the grandmother's retirement decision only via the budget constraints in the two states. Increased net financial transfers in any state, would lead to a decrease in consumption of the grandparent generation in that particular state, which would in turn decrease the utility of the grandparent in that state. One would therefore expect increased net transfers in the work state NT^W to increase the probability of retiring while an increase in net transfers in the retirement state NT^R would decrease the probability of retiring.

The main interest is therefore to see how an exogenous variation which influences grandchild care needs, would have an impact of intergenerational transfers of time and money in each state, and how those transfers in turn influence the retirement decision.

4 Econometric Specification and Empirical Strategy

4.1 Econometric Specification

Retirement Equation As can be seen from equation (2), grandmother's retirement decisions is modelled as depending on hours of grandchild care in different states, transfers in different states, wages and unearned income. Moreover, we include a step function in age, i.e. a dummy variable for whether the grandmother is aged below 62 and another dummy variable for whether the grandmother is aged 65 and above, with reference category those grandmothers aged between 62 and 65. The aim of the age step function is to capture the social security incentives in the US[18], where the early retirement age is 62 and the usual retirement age is 65.

[18]Social Security data and earnings history are classified as restricted information in the HRS. In the US, the earliest age at which one becomes eligible to apply for social security is age 62. The usual retirement age is 65, increasing to 67 by 2020. If one has claimed benefits before the usual retirement age and is still working, benefits are deducted by $1 for every $2 earned above an annual limit. If one is still working at age 65 or above, benefits are deducted by $1 for every $3 earned above another annual limit.

Social security incentives enter nonlinearly in the budget constraint and can therefore affect the retirement behaviour by giving different opportunity sets to grandmothers, depending on whether she is eligible to apply for social security or not.

We also include a dummy variable taking value 1 if the grandmother is in good health. Health is expected to affect the amount of healthy time available to the grandmother and therefore the time constraint of the latter. For instance, total endowment of time T can be interpreted as total endowment of healthy time such that T is a function of health. One would therefore expect a healthy grandmother to have more time to allocate within activities. Health could also potentially affect the marginal utilities from leisure. For instance, an unhealthy grandmother, could value leisure more (higher marginal utility from leisure), so that if she is unhealthy, she would be more likely to retire and maybe devote more time towards both leisure and grandchild care. We also include interaction terms between hours of care, age step function and health to allow for a flexible specification and to capture the fact that a healthy grandmother can potentially have different marginal utilities from leisure and from grandchild care compared to an unhealthy grandmother.

Rewrite equation (2) in latent variable form by defining:

$$R_{it}^{*} = V\left(Y - NT^{R}, T - h^{R}, q\left(h^{R}\right)\right) - V\left(Y + wH - NT^{W}, T - H - h^{W}, q\left(h^{W}\right)\right)$$

$$R_{it}^{*} = \theta' \mathbf{X}_{1it} + \epsilon_{it} \tag{3}$$

where $\mathbf{X}_{1it}$ is a vector of covariates corresponding to hours of care and transfers in different states, wages, unearned income, grandmother's demographic variables (education, age, marital status, health, ethnicity) and an age step function. R_{it}^{*} can be interpreted as the difference between the utility from retiring and the utility from working and is not observed. Retirement status is the observed variable and takes value one if the person is retired and zero otherwise.

$$R_{it} = 1\{R_{it}^{*} \geq 0\}$$

Intergenerational Transfers Equations Under the double indifference assumption, so that welfare of each agent does not change discontinously along the participation frontier, net financial transfers and hours of grandchild care have to adjust accordingly to compensate for any discrete jump in leisure hours as outlined in section 3.2.3. We therefore allow the intergenerational transfers equation to switch regimes depending on whether the grandparent is working or retired[19].

[19]Simple t-tests on the means of hours care and net financial transfers, suggest that mean hours care are significantly higher at the 1% level, when grandmothers are retired, while mean net financial transfers are

When the grandparent is retired, hours care of grandparent and net transfers equations are respectively:

$$h_{it}^{R} = \theta^{h^R} \cdot \mathbf{X}_{2it} + \epsilon_{it}^{h^R} \tag{4}$$

$$NT_{it}^{R} = \theta^{NT^R} \cdot \mathbf{X}_{2it} + \epsilon_{it}^{NT^R} \tag{5}$$

When the grandparent is working, the hours care of grandparent and net transfers equations are respectively:

$$h_{it}^{W} = \theta^{h^W} \cdot \mathbf{X}_{2it} + \epsilon_{it}^{h^W} \tag{6}$$

$$NT_{it}^{W} = \theta^{NT^W} \cdot \mathbf{X}_{2it} + \epsilon_{it}^{NT^W} \tag{7}$$

Regressors in the hours care and net financial transfers equations include wage and unearned income in each state, grandmother's demographic variables (education, age, marital status, health, ethnicity), middle generation's demographics (education, age, marital status, number of grandchildren, number of siblings), and average wage of childcare workers in the census division of grandmother's residence.

Wage and Unearned Income Variables Wage is included to reflect the opportunity cost of childcare and also the bargaining power of each generation. Intuitively, from a family productivity point of view, a working grandparent earning a high wage would have a high opportunity cost of time and might therefore devote less time towards grandchild care and more time to market work. On the other hand, a higher wage would also have an income effect which might imply that the grandparent chooses to work less, enjoy more leisure, and devote more time towards caring for a grandchild if leisure and grandchild quality are normal goods. An additional effect, the bargaining power effect is also possible. For instance, a higher potential wage for the grandmother could imply that she has a higher bargaining power and in this case could imply higher or lower hours of grandchild care, depending on her relative tastes for leisure as opposed to grandchild care.

Under the assumption that grandchild quality is a normal good, a higher unearned income would mean that the family would want to devote more resources towards the production of grandchild quality. So a higher unearned income, could be associated with higher hours of childcare. Education of grandmother is also included as control to capture potential differences in preferences for childcare according to education groups. Since we only imperfectly observe

significantly different for working and retired grandmothers at the 15% significance level. In our empirical section, we perform Wald test statistics for endogenous switching for each of our specifications. Overall, the test statistics seem to confirm our hypothesis of switching regressions / different coefficients in each state for hours of care equation at the 5% level in all specifications. There was no significant evidence of coefficient switching for the net financial transfers equations at the 5% level.

income of the middle generation in the HRS data[20], we use education of the middle generation as a proxy for their income.

Child Quality Production Health of the grandmother could affect childcare production in several ways. Firstly, a healthy grandmother would have more healthy total time T available which means that she can afford to devote more time to grandchild care. Secondly, the production technology for grandchild quality could also depend on health. For instance, a healthy grandmother could have a higher marginal product of producing grandchild quality[21] and therefore lead to a higher demand for grandmother provided childcare. Finally, by also affecting the marginal utility from leisure of the grandmother, health could have another indirect impact on hours of childcare. For instance, an unhealthy grandmother could value non work time higher so that she decides to retire and devote more time to private leisure and grandchild caring.

Demand for Grandchild Care Since we do not observe the age of the grandchild generation, we use age of the middle generation as proxy for age of grandchild generation. We also include the number of grandchildren in the regressions. These variables are expected to influence the demand for grandchild care since an infant would logically require constant care while older children spend part of their time at school. Number of grandchildren on the other hand can have an ambiguous impact on intergenerational transfers. For instance, more grandchildren could mean more need for childcare. However, it could also decrease the "bargaining power" of the middle generation. For instance, if a grandmother has a unique grandchild, she might be more willing to devote her time to caring for it. On the other hand, if she has several grandchildren, she might value the time she spends with her grandchildren less, thereby decreasing her willingness to spend time with them.

Substitutes for Transfers Marital status of the grandmother, marital status of middle generation, number of siblings in the middle generation and cost of childcare reflect the potential substitutes for transfers. Presence of a spouse for the grandmother can have two different effect on transfers: (1) higher demand for time and attention or (2) potential caregiver. While (1) is expected to lead to lower hours of grandchild care, (2) can lead to either higher or lower expected hours of grandchild care from the grandmother depending on whether grandfather

[20]Bandwidth total income (earned plus unearned) information is available for the whole household in the middle generation so that it is difficult to infer wages and unearned income from such information. Moreover, 30% of our sample have that information missing. Also, the bandwidth information is reported by the grandparent household and so, likely to be highly inaccurate.

[21]E.g. by engaging in more activities with the grandchildren and making grandma's babysitting less boring or more instructive.

care is a substitute or complement to grandmother care. If it is a substitute, then one would expect lower hours of grandmother care, but if it is a complement, grandmother care can increase if the grandmother's marginal utility from grandchild care is higher when she is with her husband. On the other hand, having a greater proportion of the middle generation who is married would mean that the middle generation can afford to be more independent in terms of both time and finance. In this case, both hours of grandchild care and net financial transfers are expected to be lower. An increase in the number of siblings of the middle generation can also have different effects. While increased number of siblings could mean increased demand for time and money from the grandparent generation, it could also be the other way round, with siblings actually helping each other so that we get decreased demand for transfers from the grandparent generation. Average wage of childcare workers in the census region is included as a proxy for cost of external childcare. From a productive efficiency point of view, one would expect that a higher cost of childcare would lead to a lower demand for external childcare and therefore a higher demand for grandparent provided childcare. Higher cost of childcare could also raise the financial needs of the middle generation and therefore increase net financial transfers from the grandparent generation.

Reduced Form Retirement Equation Substituting equations (4), (5), (6) and (7) into the retirement equation (3) yields the reduced form retirement equation:

$$R^*_{it} = \delta' \mathbf{X}_{it} + u_{it} \tag{8}$$

where the parameter vector δ consist of functions of the parameters $(\theta^{h^R}, \theta^{NT^R}, \theta^{h^W}, \theta^{\phi^{NT^W}}, \theta)$ and the vector $\mathbf{X}$ englobes all the exogenous regressors in the model.

4.2 Empirical Strategy and Identification

Since we have to predict wages, and intergenerational transfers in each state, while accounting for labour force participation selection, we need a series of exclusion restrictions to identify all the equations in the model. For the sake of notation, rewrite the equations of interest as functions of variables. A summary of the variables used in the basic model is provided in Table A1. The basic empirical model thus comprises the following equations:

The retirement equation (3):

$$R^*_{it} = f\left(wage, h^R, h^W, NT^R, NT^W, Demo^G, SS\right) + \epsilon_{it}$$

which is a function of wage, hours of grandchild care and net financial transfers in each state, demographics of the grandmother, an age step function to capture social security incentives

and interaction terms between the age step function and health, and hours of grandchild care in both states

The intergenerational transfers equation in each state (4), (5), (6), (7):

$$h_{it}^{R} = f\left(wage, Demo^{G}, Demo^{M}, Care\,cost, sel_1\right) + \epsilon_{it}^{h^R}$$

$$NT_{it}^{R} = f\left(wage, Demo^{G}, Demo^{M}, Care\,cost, sel_1\right) + \epsilon_{it}^{NT^R}$$

$$h_{it}^{W} = f\left(wage, Demo^{G}, Demo^{M}, Care\,cost, sel_0\right) + \epsilon_{it}^{h^W}$$

$$NT_{it}^{W} = f\left(wage, Demo^{G}, Demo^{M}, Care\,cost, sel_0\right) + \epsilon_{it}^{NT^W}$$

which is a function of exogenous regressors including wage, demographics of the grandmother, middle generation's demogrraphics, wage of childcare workers in the census of residence of the grandmother and a selection correction term.

The "reduced" form retirement equation (8):

$$R_{it}^{*} = f\left(wage, Demo^{G}, Demo^{M}, Care\,cost, SS\right) + u_{it}$$

which include all the exogenous regressors present in the intergenerational transfers equation and in the retirement equation (3).

The wage equation of the grandmother:

$$Wage_{it} = f\left(Demo^{G}, Census, Tenure, sel_2\right) + \epsilon_{it}^{w}$$

which is a vector of exogenous regressors consisting of demographics of the grandmother, census division of residence, self reported number of years of work and a selection correction term.

4.2.1 Wage Imputation

Since we do not observe wage for retired people, we need to impute the potential wage[22]. Following, Blundell et al. (2007) wage imputation method, we allowed the coefficients of education to vary with time so as to allow for variations in the aggregate price of human capital

[22]We also tried imputing wages from the last wage or annual salary divided by annual hours of work (rescaled to account for changes in the CPI) that the grandmother received in their last job before retiring, based on the HRS 1992 Job History Section. However, many grandmothers have that information missing and the estimates suffered from severe measurement error. Moreover, no wage information is available for grandmothers who have not worked before, even though their potential wage could play a role in the allocation of intergenerational resources across family members. We therefore stick to regression methods to impute wages for all grandmothers.

over time[23]. The wage equation is then estimated using a standard two step techniques. For those grandmothers whose predicted wage is below the US federal minimum wage of $5.15, we impute the minimum wage as their expected wage.

To identify the coefficients in the wage equation of the grandmother, we need to have at least one variable excluded from the wage equation but included in the "reduced form" retirement equation (8). Since, wage equation of the grandmother includes only variables relating to the grandmother, while we expect the retirement decision of the grandmother to also depend on middle generation's variables (due to intergenerational transfers), any of the middle generation's variables can therefore be used as exclusion restriction. Moreover we can also exploit the non linearity of the selection correction term to identify the parameters in the wage equation.

4.2.2 Estimating the Net Effects of Grandchild Care Variables

After estimating the wage equation of the grandmother, we predict the wage for all grandmothers: $E(Wage) = \hat{\beta}_t' \mathbf{X}_{3it}$. Assuming that u follows type 1 extreme value distribution, we then run a logit[24] on the "reduced" form retirement equation (8), using the imputed wage. To identify the coefficients of equation (8), we need to have at least 1 variable excluded from equation (8) but included in the wage equation of the grandmother. Let this variable be the census region of residence of the grandmother. We are implicitly assuming that the labour market conditions in the census of residence of the grandmother is reflected via the wage of the grandmother only, and therefore only indirectly affect her labour market decision. We therefore include census region in the wage equation of the grandmother but exclude it from her retirement equation.

4.2.3 Estimating the Intergenerational Transfers Equations

Estimation of the intergenerational transfers equations involves two potential problems (1) unobserved counterfactual and (2) selection bias. The problem of unobserved counterfactual arises because we observe hours of grandchild care in state s and net financial transfers in state s, only for those grandmothers who are currently in state s where $s \in \{R, W\}$. In other words, h^R and NT^R are observed when $R = 1$, and h^W and NT^W are observed when $R = 0$. We therefore need to predict hours care and net financial transfers in the different regimes for all grandmothers using equations (4), (5), (6) and (7).

[23] We also tried a different specification where coefficients of education were not allowed to vary over time and this did not change any of the results.

[24] In the empirical section, we also consider a probit specification, i.e. we consider the case where the error term in the retirement equation follows a normal distribution. The qualitative results are very similar to that of the logit specification. We therefore stick to the logit specification for all reported results.

However, OLS on the subsample of grandmothers in state s could lead to biased estimates due to potential selection in unobservables. If for instance, the allocation of intergenerational transfers is correlated with the decision to retire due to some unobserved aspect of family preferences so that $E(\epsilon^{h^R}|R=1) \neq 0$, $E(\epsilon^{NT^R}|R=1) \neq 0$, $E(\epsilon^{h^W}|R=0) \neq 0$ and $E(\epsilon^{NT^W}|R=0) \neq 0$, then OLS for each equation on the respective subsamples, would yield biased estimates. Following Lee (1983), assume that the error terms $\epsilon^{h^R}, \epsilon^{NT^R}, \epsilon^{h^W}, \epsilon^{NT^W}$, and u are jointly distributed, with $u \sim$ *Gumbel* and $E(\epsilon^x|\mathbf{X}) = 0$ and $V(\epsilon^x|\mathbf{X}) = \sigma_x^2$ where $x \in \left\{h^R, h^W, NT^R, NT^W\right\}$. Also, let $\phi(.)$ be the density of the standard normal distribution, $\Phi(.)$ is the cumulative density of the standard normal distribution and P_i is the probability that outcome $i = 0, 1$ occurs . Under the assumption of type 1 extreme value distribution for u, $P_1 = \frac{e^{\delta'\mathbf{X}}}{1+e^{\delta'\mathbf{X}}}$ and $P_0 = \frac{1}{1+e^{\delta'\mathbf{X}}}$. See Appendix for more details.

We therefore follow the two step selection correction techiques proposed by Lee (1983) to estimate the model[25]:

1. Logit on the reduced form equation (8) yields consistent estimates of δ. We can therefore get estimates of selection correction terms: $\frac{\phi[\Phi^{-1}(\hat{P}_1)]}{\hat{P}_1}$ and $\frac{\phi[\Phi^{-1}(\hat{P}_0)]}{\hat{P}_0}$
2. OLS on the regime equations (4), (5), (6), (7) while including the relevant selection correction term estimated from step one as a regressor

We therefore run OLS regressions on each transfers equation (equations (4) to (7)), using the imputed wage[26] and including the selection correction terms obtained from the "reduced" form retirement equation (8), to control for selection. Since we are using imputed wage, we need at least one variable included in the wage equation but excluded from the intergenerational transfers equation. Let this variable be the self reported years of tenure of the grandmother. While we expect her work experience to affect her potential wage, we do not expect her work experience to directly affect the amount of intergenerational transfers within the family.

Moreover, since we are including a selection correction term estimated from the reduced form retirement equation, we need at least one exclusion restriction to identify the parameters in the hours of care and net financial transfers equations in each regime. The age step

[25] In our empirical specification, we also use the modified Durbin and MacFadden selection correction estimator based on multinomial logit, proposed by Bourguignon et al. (2007). The coefficients were qualitatively similar to the Lee (1983) estimates with only small variations in magnitude. We therefore stick to the computationally simpler Lee (1983) estimator in all reported results.

[26] For working grandmothers, $E(Wage_{it}|R_{it}=0) = \hat{\beta}_t'\mathbf{X}_{3it} - \hat{\sigma}_{\eta_*\epsilon^w} \cdot \frac{\phi[\Phi^{-1}(P_0)]}{P_0}$ and for retired grandmothers $E(Wage_{it}|R_{it}=1) = \hat{\beta}_t'\mathbf{X}_{3it} + \hat{\sigma}_{\eta_*\epsilon^w} \cdot \frac{\phi[\Phi^{-1}(P_1)]}{P_1}$, where $\hat{\sigma}_{\eta_*\epsilon^w}$ is the estimated covariance between the error terms in the wage equation and the transformed error term $\eta_* = \Phi^{-1}[G(\eta)]$ from the reduced form retirement equation, $\phi(.)$ and $\Phi(.)$ are the normal density and cumulative normal density respectively, $G(.)$ is the cumulative Gumbel density function, and P_i is the probability of state $i = 0, 1$ occuring.

function, variable, included in the retirement equation but excluded from the hours of care and net financial transfers equations is used as exclusion restriction. After all, it is very likely that social security incentives embodied in the age step function would directly influence the retirement decision, but it is unlikely to directly have an impact on hours of care or net financial transfers[27]. Furthermore, the non linearity of the selection correction term provides further scope for identification.

4.2.4 Estimating the Impact of Intergenerational Transfers

Identification of the parameters in the retirement equation (3) requires some stronger assumptions. Firstly, we have to assume that our specification of the grandparent generation's utility is correct i.e, that the grandmother gets utility from her own consumption, leisure and own contribution to grandchild quality $V^G\left(C^G, L^G, q\left(h^G\right)\right)$. This assumption would be important for the interpretation of the coefficients of the hours of childcare and net financial transfers in equation (3). Secondly, for econometric identification of the parameters, since we are using imputed hours of care in retirement, imputed hours of care in work, imputed[28] net transfers in retirement and imputed net transfers in work, we need at least 4 exclusion restrictions. We use, middle generation's variables (age, education, marital status, number of grandchildren, and number of siblings in the middle generation) as well as cost of formal child care as exclusion restrictions since we expect those variables to affect intergenerational transfers but not the retirement decision directly.

5 Results

Since our retirement equation (3) is a function of hours care and net financial transfers in both states, the net marginal effect of any variable affecting grandchild care on retirement can be decomposed as:

$$\frac{\partial Pr\left(R=1|\mathbf{X}\right)}{\partial x} = \frac{\partial Pr\left(R=1|\mathbf{X}\right)}{\partial h^R} \cdot \frac{\partial E\left(h^R|\mathbf{X}\right)}{\partial x} + \frac{\partial Pr\left(R=1|\mathbf{X}\right)}{\partial NT^R} \cdot \frac{\partial E\left(NT^R|\mathbf{X}\right)}{\partial x}$$

$$+\frac{\partial Pr\left(R=1|\mathbf{X}\right)}{\partial h^W} \cdot \frac{\partial E\left(h^W|\mathbf{X}\right)}{\partial x} + \frac{\partial Pr\left(R=1|\mathbf{X}\right)}{\partial NT^W} \cdot \frac{\partial E\left(NT^W|\mathbf{X}\right)}{\partial x}$$

[27] Even though age of the grandmother is also included as a regressor in the hours of care and net financial transfers equations to capture age effects on intergenerational transfers, it does not move on a one to one basis with the age step function and therefore avoids the problem of multicollinearity.

[28] The standard errors would have to be adjusted to take into account the fact that the predicted values have been estimated. In the empirical section, we therefore bootstrap the standard errors.

where $\frac{\partial Pr(R=1|\mathbf{X})}{\partial x}$ is the net marginal effect of variable x on the probability of being retired, and x is a variable affecting grandchild care such as marital status of middle generation or cost of formal childcare. The net effect of any variable affecting grandchild care therefore operates via intergenerational transfers of time and money in both states, which subsequently affect retirement behaviour.

We estimate the "reduced" form retirement equation (8) to get the net marginal effect of grandchild care variables on the probability of being retired: $\frac{\partial Pr(R=1|\mathbf{X})}{\partial x}$. Then, we analyse how the channels vary with grandchild care variables by estimating the intergenerational transfers equations (4), (5), (6), (7) to obtain estimates of the marginal effects of grandchild care variables on intergenerational transfers in each state: $\frac{\partial E(h^R|\mathbf{X})}{\partial x}$, $\frac{\partial E(NT^R|\mathbf{X})}{\partial x}$, $\frac{\partial E(h^W|\mathbf{X})}{\partial x}$, $\frac{\partial E(NT^W|\mathbf{X})}{\partial x}$, and finally, we estimate equation (3) to understand how intergenerational transfers in each state affect the probability of being retired: $\frac{\partial Pr(R=1|\mathbf{X})}{\partial h^R}$, $\frac{\partial Pr(R=1|\mathbf{X})}{\partial NT^R}$, $\frac{\partial Pr(R=1|\mathbf{X})}{\partial h^W}$, $\frac{\partial Pr(R=1|\mathbf{X})}{\partial NT^W}$. We report further robustness checks in our Appendix section.

5.1 Estimates of Net Effect of Grandchild Care Variables

Marginal effects for the "reduced" form retirement equation (8) are reported in Table 3. The dependent variable in the logit regression is a dummy taking value 1 if the respondent does not work for pay and 0 if she works for pay. Regressors include wage and income variables, variables affecting intergenerational transfers of time and money, and the age step function, meant to capture Social Security incentives.

As expected, the older the grandmother is, the higher the probability of being retired. Similarly, being above the usual Social Security age i.e. aged 65 and above, increases the probability of being retired while being in good health decreases the probability of being retired, which is also consistent with the main findings of the retirement literature[29].

Grandchild care variables seem to have small impacts on the probability of the grandmother being retired. The older the middle generation is, the lower the probability of the grandmother being retired. Marital status of the middle generation has a positive and significant impact on the probability of the grandmother being retired while number of grandchildren living close by have a negative impact on the grandmother's probability of being retired.

Overall, the marginal effects from "reduced form" retirement equation seems to indicate that grandchild care variables have some small net impacts on the probability of the grandmother being retired. However, it is very difficult to interprete those net effects, since they do not explain the mechanism behind those coefficients. This is due to the different (and potentially opposite) effects that hours of care in work and in retirement, and net financial

[29] E.g. French (2005)

transfers in work and in retirement, can have on retirement behaviour. We therefore seek to formally analyse the channels through which grandchild care operate in the next subsections.

5.2 Channels: Intergenerational Transfers

Since it is expected that exogenous variations which directly affect the middle generation would indirectly affect the grandparent generation via hours of care and net financial transfers in each state, it would be interesting to analyse how intergenerational transfers vary with grandchild care variables. Equations (4) to (7) are therefore estimated using two step estimation techniques, controlling for grandmother's selection in and out of work.

5.2.1 Hours Care Equations

Two equations are estimated for hours care: (1) hours care for working grandmothers and (2) hours care for retired grandmothers. The estimated coefficients for the hours care equation in each state are reported in Table 4a.

Middle generation's variables seems to matter a lot in the determination of hours of grandchild care. The older is the middle generation, the fewer are the hours of childcare received. This is consistent with the fact that the older is the middle generation, the more likely they have older children who would therefore require fewer hours of care. Similarly, the middle generation being married leads to fewer hours of childcare suggesting that the presence of a spouse in the middle generation household, leads to the availability of more immediate helping hands, thus requiring fewer hours from the grandmother. Moreover, married couples tend to be wealthier than single parents, so that married couples might afford external childcare better than single parents. A higher cost of formal childcare leads to higher hours of childcare by the grandmother in both states. This is consistent with productive efficiency where the family substitutes formal childcare for grandmother care when the former becomes more costly[30]. Similarly a greater number of middle generation siblings decreases hours of grandchild care in both states, suggesting some form of intra-generational risk sharing where aunts or uncles could be helping out with child care, thereby leading the middle generation to rely less on grandmothers.

Overall, age of the middle generation, marital status of the middle generation and cost of formal childcare seem to be the main driving forces behind hours of care determination in both states suggesting that childcare needs are important in determining grandchild care. This

[30]It is possible that higher cost of formal childcare could also be reflecting higher quality of formal childcare. In this case, if quality is a normal good, one would expect a higher demand for formal childcare and a lower demand for grandmother provided childcare. In this case, our coefficient on formal childcare cost would underestimate the impact of higher formal childcare cost on grandmother's hours of grandchild care.

is consistent with our intergenerational family efficiency assumption where greater childcare needs by the middle generation, leads to the grandmother supplying higher hours of grandchild care.

5.2.2 Financial Transfers Equations

Table 5a reports results from two step regressions on net financial transfers in the work and in the retirement states. Wage and other household income have positive and significant impacts on net financial transfers. This is consistent with risk sharing behaviour where the grandparent generation "shares the wealth" with the middle generation. The middle generation being married results in a decrease in financial transfers which is consistent with the fact that a spouse in the middle generation would make the couple more independent since there are additional hands to help with both childcare and bread earning in the middle generation household. Interestingly, a higher wage of childcare workers leads to a rise in financial transfers from grandparent to middle generation[31], suggesting that financial transfers are partly driven by the need for them, which is also consistent with the intergenerational family engaging in efficient risk sharing behaviour.

5.3 Estimates of Impact of Intergenerational Transfers

Marginal effects are reported for the retirement equation (3) in Table 6. The usual suspects, namely age and health, have large and significant impacts on the probability of retirement. Keeping expected hours of grandchild care and net financial transfers in each state fixed, the older one is, the more likely one is retired while being in good health decreases the probability of being retired. Being below the early social security age has a negative impact on probability of being retired and being above the usual social security age has a positive marginal effect. Those results are consistent with the general retirement literature which emphasize the importance of social security and health in determining retirement[32].

Given our assumption on the preferences of the grandparent generation, i.e. that hours of grandchild care and net financial transfers in the different states enter the grandparent's decision, only via their time and budget constraints, and a potential warm glow motive for hours of grandchild care, we attempt to give a more "structural" interpretation[33] to the marginal

[31] Running similar regressions for the sample of grandmothers who did not have any middle generation members living close by also yielded a positive but much smaller (and insignificant at the 10% level) coefficient for wage of childcare workers. This tends to suggest that cost of childcare in the census region of residence is an appropriate measure of cost of formal childcare for those living close by and supports the hypothesis that formal childcare costs could be potentially driving net financial transfers.

[32] French (2005)

[33] The interpretation is structural in the sense that we relate it to our structural model outlined in section 3

effects of hours of grandchild care in work and in retirement, and net financial transfers in work and in retirement. From section 3.3, we modelled the retirement decision by comparing the utility of the grandparent generation when retired to its utility when working. Reiterating, the grandmother retires if

$$V^G\left(C^R, L^R, q\left(h^R\right)\right) - V^G\left(C^W, L^W, q\left(h^W\right)\right) \geq 0$$

$$V^G\left(Y - NT^R, T - h^R, q\left(h^R\right)\right) - V^G\left(Y + wH - NT^W, T - H - h^W, q\left(h^W\right)\right) \geq 0$$

Thus, an increase in the hours of childcare that the intergenerational family allocates to a state, would decrease the amount of pure leisure time available to the grandmother in that particular state, which would therefore decrease the amount of utility that she gets from that state, thereby decreasing the probability of her choosing that state. However, higher hours of childcare in any state can also increase her utility directly via the warm glow effect, thereby increasing her probability of choosing that particular state. The results from Table 6 indicate that the warm glow effect seems to dominate the time constraint effect since higher hours of grandchild care allocated to the work state decreases the probability of retiring and vice versa. Net financial transfers in the different states on the other hand, do not seem to significantly affect the retirement decision.

Overall, the allocated intergenerational transfers of time in each state seem to be the main channels via which grandchild care variables operate to determine retirement behaviour of grandmothers. On the other hand, net financial transfers do not seem to matter as much. Also, the warm glow effect seems to dominate the time constraint effect which tends to indicate that the grandmother potentially enjoys her contribution to grandchild quality. Finally, the impact of intergenerational transfer of time in each states go in opposite directions, suggesting that any variables likely to positively affect hours of grandchild care in both states, might have only a small net impact on retirement status once the effects cancel out.

5.4 Adding Wealth, Altruism and Exchange Variables

Adding wealth as control, does not qualitatively change the marginal effects estimated from the reduced form retirement equation (Table 3). In an attempt to control for unobserved heterogeneity as much as possible, we also include a dummy variable reflecting whether the grandmother has included the middle generation as a recipient for bequests in her will. This variable is meant to capture potential altruistic motives towards the middle generation. A dummy variable reflecting whether the grandparent generation gave a deed to a house to the

but it is not rigorously structural in the sense that we do not attempt to specifically recover the parameters of the utility function of the grandparent generation.

middle generation during the past two years is also included to capture the possibility of tied financial transfers. Bequests and housing deeds can either be complements or substitutes to financial transfers. For instance, wealthier households could be expected to give more intervivos, bequests and house deeds to their children. On the other hand, since the family has a lifetime budget constraint, giving more bequests could mean having to give less intervivos or house deeds to children. We also included a dummy variable about whether the grandmother expects help from the middle generation in terms of old age care, at a later stage in her life. This variable is meant to capture potential exchange motives where the grandmother is providing grandchild care with a view to receiving old age care at a later stage.

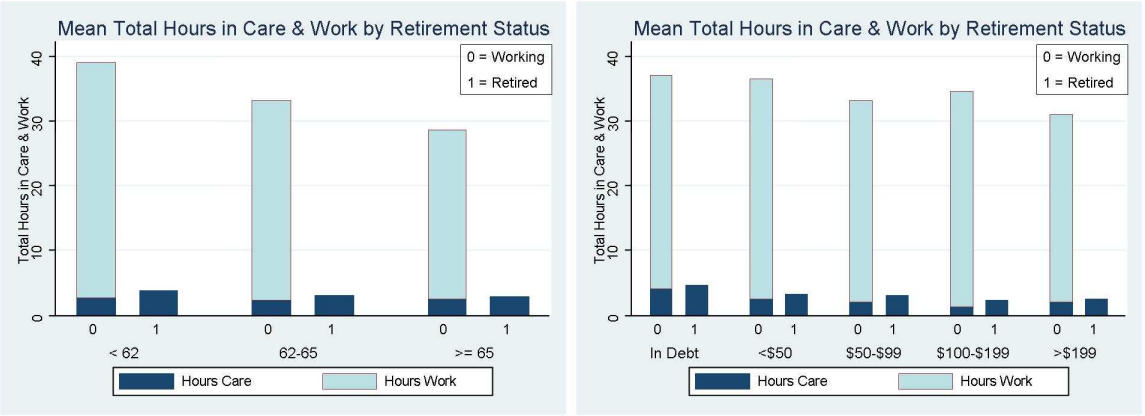
Adding wealth, altruism and exchange motive variables does not qualitatively change the net effects obtained from the reduced form retirement equation (Table 3). Including the middle generation in the will has a positive impact on the probability of being retired. Similarly, having given a deed to a house to the middle generation also has a positive impact on the probability of being retired. On the other hand, expecting future help from the middle generation has a negative impact on the probability of being retired. This could be due to the fact that those who expect help from the middle generation, decide to work more today so as to be able to "pay" the middle generation later on for their future services.

The results for our hours of care equations also do not change much when we add wealth, altruism and exchange motive variables (Tables 4a and 4b). Interestingly expectation of future help from the middle generation has a positive impact on grandmother's hours of grandchild care (significant at the 5% level when she is working). This tends to suggest that there is an underlying exchange motive where the grandmother is willing to provide higher hours of care provided that the middle generation provides her with old age care in a few years.

Adding wealth, altruism and exchange motive variables do not qualitatively change the estimated coefficients in our financial transfers equations either (Tables 5a and 5b). Wealth has a positive and significant impact on financial transfers in both the work and the retirement state. Having given a deed to a house to the middle generation has a positive impact on grandmother's net financial transfers (significant at the 5% level when she is working), even after controlling for wealth. This tend to be consistent with potential altruistic motives in giving money. Alternatively, it could be that the middle generation are at a period of their life cycle where they needed a house and a lot of money to facilitate the rearing of children, such that family risk sharing encourages the grandmother to give more money as well as a house.

Finally, the marginal effects of intergenerational transfers in each state do not change much upon the inclusion of wealth, altruism and exchange variables (Table 6). Thus the inclusion of variables capturing some potential dynamics in the model does not change the results qualitatively. This tends to suggest that the even though we might have intertemporal

Figure 8: Total Work and Care Hours



cooperation among family members, our static model is still informative about the main intratemporal channels via which the intergenerational family allocates resources.

5.5 Implications and Scope for Policy

To sum up our results, we find that grandchild care needs have small net impacts on retirement but are important in driving time and net financial transfers that the intergenerational family allocates to the different work states of the grandmother. Allocated time transfers in turn are important in determining the retirement decision while net financial transfers have negligible impacts on retirement. Moreover, since the impact of allocated time transfers in the different work states of the grandmother $s \in \{R, W\}$ go in opposite directions, the result is that an increase in grandchild care needs which leads to an increase in allocated hours of care in the two states, only have small net impacts on the retirement decision of the grandmother once the time effects in the different states offset each other.

Given the small net impacts of grandchild care needs on retirement, elderly women seem to be sacrificing mainly leisure time to meet grandchild care needs rather than adjust work decisions. Indeed, as illustrated in Figure 8, elderly women seem to be adjusting leisure time rather than work with working elderly women devoting much more time to work and grandchild care compared to retired grandmothers. Thus, even though retired grandmothers in general devote more time to grandchild care, the higher grandchild care provided by retired elderly women are still much lower than usual work hours of working elderly women. Retired grandmothers thus still enjoy considerable pure leisure time.

Moreover, our results are consistent with our model of intergenerational family risk sharing with higher grandchild care needs driving up both time and money transfers. Finally,

given the potentially important impacts of time transfers in the different work states of the grandmother, the government could influence retirement behaviour via appropriate childcare subsidies given to the middle generation. For instance, a policy influencing only the allocated hours of grandchild care in the retirement state could lead to a fall in probability of the grandmother being retired. From our basic regression results, increasing childcare subsidies by \$6.9 per hour if grandmothers are retired would lead to a one hour decrease in allocated weekly hours of care in the retirement state due to lower grandchild care needs in that state, and a subsequent increase in probability of work by 6.3%. Intuitively, childcare subsidies decrease the allocated hours of care in retirement thereby decreasing the utility of the grandmother in the retirement state, resulting in a higher probability of working.

6 Conclusion

The rising trends of grandparents caring for grandchildren in the USA suggest that grandparent provided childcare is becoming increasingly important for intergenerational families. Caring for a grandchild is resource intensive in the sense that it involves time and financial transfers. Those intergenerational transfers of time and money, could potentially have different implications on the grandparent generation's economic behaviour.

We adopt a general collective framework to analyse the way that the two generations, grandparent and middle, allocate family resources in two different states: retirement and work. Under the assumption of Pareto efficiency and double indifference, the intergenerational family allocates hours of grandchild care and net financial transfers in each state in such a way that the grandmother will choose the efficient retirement outcome. An endogenous switching regression model where hours care and net financial transfers switch regimes according to whether the grandmother is retired or not, is used to estimate the model.

From our "reduced" form retirement equation, we find that grandchild care variables such as age of the middle generation, marital status of the middle generation, number of grandchildren, cost of formal childcare and number of siblings in the middle generation, seem to have small net impacts on retirement. However, it is hard to interprete the channels through which those grandchild care variables operate. We therefore estimate our intergenerational transfers of time and money equations to get a more precise idea of how childcare needs could be influencing allocation of resources in the intergenerational family.

We find that childcare needs as reflected by age and marital status of the middle generation, and average cost of formal child care, seem to have important influences on allocated hours of grandchild care in both the retirement and the work state of the grandmother. Also, income variables of the grandmother and average cost of formal childcare seem to be the

main driving forces behind intergenerational transfers of money. Higher childcare needs of the middle generation, therefore lead to higher intergenerational transfers of time and money towards the middle generation. This is consistent with the intergenerational family cooperating to undertake efficient allocations or sharing the risk.

From our "structural" retirement equation, we find that allocated intergenerational transfers of time in each state seem to be the main channels via which grandchild care needs operate to determine retirement behaviour of grandmothers. On the other hand, net financial transfers do not seem to have much impact on the retirement decision.

Our results are consistent with an intergenerational family risk sharing model where elderly women adjust intergenerational transfers of time and money and leisure rather than work, to meet grandchild care needs. Higher childcare needs are met with higher allocated intergenerational transfers of time and money in both the retirement and work states. Finally, given the potentially important effects of time transfers, the government could influence retirement behaviour via appropriate childcare subsidies given to the middle generation.

7 Appendix

7.1 Data Appendix

7.1.1 Construction of Variables

Dependent Variables

Retirement Status (1): Dummy variable taking value 1 if grandmother not working for pay and 0 otherwise.

Retirement Status (2): Dummy variable taking value 1 if grandmother self reports fully retired or partly retired and 0 otherwise.

Hours Care: Weekly hours of childcare provided by the grandmother. Constructed by dividing the total hours of grandchild care provided by the grandmother during the 2 years preceding the interview by 104 weeks.

Net Transfers: Weekly net financial transfers. Defined as financial transfers from grandparent to middle generation minus financial transfers from middle generation to grandparent generation, during the 2 years preceding the interview, and dividing the total by 104 weeks.

Variables belonging to Grandparent Generation

Wage: Hourly wage of grandmother. Imputed from wage equation (**??**)

Other Income: Defined as weekly total household income (in $'00) minus grandmother's earned income (if any). Includes pension and social security benefits of grandparents, spousal income, capital income etc. Includes grandfather's earnings if the grandmother is married and the grandfather is working.

Education: Years of Schooling of Grandmother

Age: Age of the Grandmother

Age Step Function: Step function in age to indicate whether the grandmother is aged strictly below 62, or is aged 65 and above (reference category are those grandmothers aged between 62 and 65). Meant to capture Social Security incentives.

Health: Self reported health status of grandmother. Dummy variable taking value 1 for excellent, very good and good health, and 0 for fair and poor health.

Marital Status: Dummy variable taking value 1 if spouse present and 0 otherwise

Black: Dummy variable taking value 1 if the grandmother is Black and 0 otherwise

Will Children: Dummy taking value 1 if the grandmother included middle generation in her will and 0 otherwise. This variable is meant to capture whether the grandmother feels altruistic towards the middle generation

Deed Children: Dummy taking value 1 if the grandparent household has given a deed to a house to the middle generation over the past 2 years

Expect help Children: Dummy taking value 1 if the grandmother expects the middle generation to take care of her if needed and 0 otherwise

Wealth: Total household wealth of the grandparent household (in $0,000)

Variables belonging to Middle Generation In the HRS, the grandparent household is asked a question about which member of the middle generation lives within 10 miles and whether they have children and has to list up members of the middle generation. In 54% of the cases, the grandparent household lists only one member of the middle generation. If the grandparent household listed 2 more more members of the middle generation, we either take the average or the sum of the variables for the middle generation.

Education: Average years of schooling. Used as a proxy for income of middle generation.

Age: Average age. Used as proxy for average age of grandchildren.

Marital Status: Proportion married or partnered.

Number of Children: Total number of members above 18 present in the middle generation (Number of Siblings in the Middle Generation)

Number of Grandchildren: Constructed from adding up all the children reported for each member of the middle generation living close by and who have children

Cost of Child care: Average wage of childcare givers in the census division of residence. Constructed from the 2004 National Compensation Survey US department of labour `www.bls.gov/ncs/ocs/compub.htm#Division`

All monetary variables (financial transfers, wages, other income etc.) have been converted into 2004 dollars using the CPI calculator from Bureau of Labour Statistics `http://data.bls.gov/cgi-bin.cpicalc.pl`

7.1.2 Transfers in the HRS

The family module of the HRS asks specific questions about grandchild care provision (hours transfers) and financial transfers to and from the middle generation. Interviews are retrospective e.g. the 2000 wave asked about hours of care and financial transfers provided altogether in 1998 and 1999.

We construct our hours care variable from the questions:

- *Did you (or your husband/or your wife/or your partner/.../or your late husband/or your late wife/or your late partner) spend 100 or more hours in total (since Previous Wave Interview Month-Year/in the last two years) taking care of (grand or great-grandchildren/grandchildren)?* [HRS 1996-2002: Question D76]
- *Roughly how many hours altogether did you spend?* [HRS 1996-2002: Question D77]

Thus, the HRS questionnaire asks a first question about whether any member of the grandparent household spent 100 hours or more in the last two years (equivalently about 1 hour per week) taking care of grandchildren. If the answer is affirmative, the respondent is then asked the number of hours spent taking care of grandchildren. We treat great-grandchildren as grandchildren in our analysis and do not seek to distinguish between them. We divide the amount of hours of grandchild care by 104 to construct our weekly hours of grandchild care variable.

The HRS also asks a series of questions on financial transfers between generations. The definition of financial transfers in the HRS corresponds to intervivos transfers and excludes bequests. The questions relating to intervivos transfers in the HRS are outlined below:

- *BY FINANCIAL HELP WE MEAN GIVING MONEY, HELPING PAY BILLS, OR COVERING SPECIFIC TYPES OF COSTS SUCH AS THOSE FOR MEDICAL CARE OR INSURANCE, SCHOOLING, DOWN PAYMENT FOR A HOME, RENT, ETC. THE FINANCIAL HELP CAN BE CONSIDERED SUPPORT, A GIFT OR A LOAN.* [HRS 1996-2002: Family Section]
- Financial transfers from grandparent generation to middle generation:
  - *Including help with education but not shared housing ...or shared food or any deed to a house,(...in the last two years) did you (or your husband/or your wife/or your partner/.../or your late husband/or your late wife/or your late partner) give financial help totaling $500 or more to any of your children (or grandchildren)?* [HRS 1996-2002: Question D50]

- *...about how much was that altogether during the period ...* [HRS 1996-2002: To Child Codebook Section]

- Financial transfers from middle generation to grandparent generation:

  - *(Since Previous Wave Interview Month-Year/In the last two years) did you (or your husband/or your wife/or your partner/.../or your late husband/or your late wife/or your late partner) receive financial help totaling $500... or more from your child? ELSE or more from any of your children?* [HRS 1996-2002: Question D61]
  - *About how much did that amount to ...* [HRS 1996-2002: From Child Codebook Section]

Thus, the HRS questionnaire first asks whether transfers of more than $500 were made over the past two years (roughly equivalent to $5 a week) and if affirmative, the respondent is then asked to state the amount of transfers given and/or received. We treat financial transfers from grandparent generation to grandchild generation as financial transfers from grandparent generation to middle generation and add them together. We then subtract financial transfers from middle generation to grandparent generation and divide the total by 104 to construct our weekly net financial transfers variable.

7.2 Selection Correction Terms

Estimating our intergenerational transfers equations (4) to (7) by OLS on the subsample of grandmothers in state s could lead to biased estimates due to potential selection in unobservables. If for instance, the allocation of intergenerational transfers is correlated with the decision to retire due to some unobserved aspect of family preferences so that $E(\epsilon^{h^R}|R=1) \neq 0$, $E(\epsilon^{NT^R}|R=1) \neq 0$, $E(\epsilon^{h^W}|R=0) \neq 0$ and $E(\epsilon^{NT^W}|R=0) \neq 0$, then OLS for each equation on the respective subsamples, would yield biased estimates. Following Lee (1983), assume that the error terms $\epsilon^{h^R}, \epsilon^{NT^R}, \epsilon^{h^W}, \epsilon^{NT^W}$, and u are jointly distributed, with $u \sim$ *Gumbel* and $E(\epsilon^x|\mathbf{X}) = 0$ and $V(\epsilon^x|\mathbf{X}) = \sigma_x^2$ where $x \in \left\{h^R, h^W, NT^R, NT^W\right\}$.

Now, consider regime $R=1$. OLS regression of hours care and net financial transfers on the retired subsample would yield biased estimates since:

$$E(h_{it}^R|R_{it}=1) = \theta^{h^R} \cdot \mathbf{X}_{2it} + E(\epsilon_{it}^{h^R}|R_{it}=1) = \theta^{h^R} \cdot \mathbf{X}_{2it} + \sigma_{\epsilon^{h^R}u_*} \cdot \frac{\phi\left[\Phi^{-1}(P_1)\right]}{P_1}$$

$$E(NT_{it}^R|R_{it}=1) = \theta^{NT^R} \cdot \mathbf{X}_{2it} + E(\epsilon_{it}^{NT^R}|R_{it}=1) = \theta^{NT^R} \cdot \mathbf{X}_{2it} + \sigma_{\epsilon^{NT^R}u_*} \cdot \frac{\phi\left[\Phi^{-1}(P_1)\right]}{P_1}$$

Similarly for regime $R = 0$,

$$E(h_{it}^W | R_{it} = 0) = \theta^{h^W} \cdot \mathbf{X}_{2it} + E(\epsilon_{it}^{h^W} | R_{it} = 0) = \theta^{h^W} \cdot \mathbf{X}_{2it} - \sigma_{\epsilon^{h^W} u_*} \cdot \frac{\phi\left[\Phi^{-1}(P_0)\right]}{P_0}$$

$$E(NT_{it}^W | R_{it} = 0) = \theta^{NT^W} \cdot \mathbf{X}_{2it} + E(\epsilon_{it}^{NT^W} | R_{it} = 0) = \theta^{NT^W} \cdot \mathbf{X}_{2it} - \sigma_{\epsilon^{NT^W} u_*} \cdot \frac{\phi\left[\Phi^{-1}(P_0)\right]}{P_0}$$

where $\phi(.)$ is the density of the standard normal distribution, $\Phi(.)$ is the cumulative density of the standard normal distribution and σ_{ij} is the covariance between i and j, $u_* = \Phi^{-1}\left[G(u)\right]$, $G(u)$ is the Gumbel cumulative distribution function and P_i is the probability that outcome $i = 0, 1$ occurs . Under the assumption of type 1 extreme value distribution for u, $P_1 = \frac{e^{\delta \cdot \mathbf{X}}}{1+e^{\delta \cdot \mathbf{X}}}$ and $P_0 = \frac{1}{1+e^{\delta \cdot \mathbf{X}}}$.

In one of our empirical exercises, we also tried the modified Durbin and MacFadden selection correction estimator based on multinomial logit, proposed by Bourguignon et al. (2007), to estimate the intergenerational transfers equation using the selmlog command in STATA. The selection correction term (in the two choice case, simple logit) is given by $\sigma \cdot r^* \left[m(P_1) + m(P_0)\right]$ where $m(P_j) = \int \Phi^{-1}\left[G(v - logP_j)\right] g(v)\, dv$, ϵ^x , $x \in \left\{h^R, h^W, NT^R, NT^W\right\}$ follow normal and u follow Gumbel with G being the cumulative Gumbel density function, g the Gumbel density function, σ is the standard error of ϵ^x and r^* is the correlation between the transformed error term $u^* = \Phi^{-1}\left[G(u)\right]$and ϵ^x. The coefficients were qualitatively similar to the Lee (1983) estimates with only small variations in magnitude.

7.3 Further Robustness Checks

We perform robustness checks by employing an alternative definition of retirement by classifying the grandmother as retired if she self reports herself as fully or partly retired (Tables A2-A5). Furthermore, we tried varying the sample, firstly limiting the sample to those grandmothers with middle generation with children living within 10 miles and then including all grandmothers (Tables A6-A9). The results were qualitatively similar in all cases.

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Table 1 Summary Statistics

Variable	*Mean*	*s.d*
Grandmother		
Age	61.6	5.32
Proportion in Good Health	0.75	0.43
Proportion aged below 62	0.47	0.50
Proportion aged 65 & above	0.31	0.46
Proportion Married	0.72	0.45
Proportion Black	0.15	0.36
Education	11.8	2.79
Other Income per week ($'00)	8.58	13.6
Proportion Not Working for Pay	0.55	0.50
Proportion Self Reported Retired	0.61	0.49
Middle Generation		
Age	37.4	6.86
Proportion Married	0.72	0.40
Number of Grandchildren	3.75	3.08
Education	12.6	2.93
Other		
Total no. of Siblings in Middle Generation	4.29	2.42
Total no. of Grandchildren	7.24	6.56
Average Wage of Childcare workers	9.37	1.49
Included Middle Generation in Will	0.44	0.50
Gave a Deed to a House to Middle Generation	0.01	0.11
Expect help from Middle Generation in Old Age	0.55	0.50
Wealth ($'0,000)	34.7	104

Table 2

Intergenerational Transfers in Previous Year

Variable	*Percentage*
Provided more than 100 Hours Care	53.6
Provided more than $500 Financial Transfers	36.2
Received more than $500 Financial Transfers	5.6

Intergenerational Transfers In Previous Year – Grandmothers who Provide Care

Variable	*Percentage*
Provided more than 200 Hours Care	77.3
Provided more than 500 Hours Care	48.5
Provided more than $1000 Financial Transfers	34.1
Provided more than $5000 Financial Transfers	13.1
Received more than $1000 Financial Transfers	4.3
Received more than $5000 Financial Transfers	1.6

Intergenerational Transfers – Grandmothers who Provide Care

Variable	*Mean*	*s.d*
Weekly Hours Care	6.9	10.3
Weekly Net Financial Transfers ($)	27.1	230

Table 3 Marginal Effects for Reduced Form Retirement Equation

Variable	*Dependent Variable: Dummy = 1 if Not Working for Pay and 0 Otherwise*							
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	-0.077	0.005***	-0.069	0.018***	-0.074	0.004***	-0.064	0.019***
Other Income ($'00 per week)	0.001	0.001	-0.0001	0.002	0.0002	0.001	-0.001	0.001
Years of Schooling	0.058	0.007***	0.04	0.012***	0.052	0.006***	0.035	0.011***
Age	0.017	0.004***	0.016	0.005***	0.017	0.004***	0.016	0.005***
Married	0.187	0.021***	0.159	0.038***	0.175	0.021***	0.135	0.043***
Good Health	-0.256	0.034***	-0.164	0.057***	-0.228	0.48***	-0.167	0.064***
Below early SS Age (<62)	0.007	0.041	0.043	0.051	0.086	0.061	0.063	0.053
Above usual SS Age (≥ 65)	0.123	0.054**	0.133	0.068*	0.153	0.075**	0.12	0.069*
Black	0.102	0.027***	0.076	0.030**	0.098	0.026***	0.064	0.030***
Middle Generation								
Years of Schooling	-0.002	0.003	-0.002	0.003	-0.003	0.003	-0.002	0.003
Age	-0.001	0.001	-0.002	0.001	-0.001	0.001	-0.002	0.001
Married	0.038	0.021*	0.033	0.021	0.04	0.021*	0.035	0.021*
No. of Children (Grandkids)	-0.005	0.003*	-0.003	0.003	-0.004	0.003	-0.002	0.002
Substitutes								
No. of Siblings in Middle Generation	-0.003	0.004	-0.003	0.004	0.02	0.013	-0.002	0.003
Wage of Childcare Workers ($ per hour)	-0.002	0.006	0.004	0.006	-0.001	0.006	0.004	0.006
Other Controls								
Wealth of Grandparent ($0,000)			0.005	0.003*			0.005	0.002**
Included Middle Generation in Will					0.036	0.018**	0.021	0.018
Gave a Deed to Middle Generation					0.068	0.059	0.079	0.051
Expect future help from Middle Generation					-0.067	0.015***	-0.054	0.021***
Time Dummies	x		x		x		x	
Pseudo-R^2	0.2		0.21				0.21	
No. of Observations	8504		8504		8504		8504	

Marginal Effects from Logit Regressions on Pooled Cross Section; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table 4a Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.426	0.125***	0.003	0.075	0.24	0.254	-0.014	0.076
Other Income ($'00 per week)	-0.014	0.007*	-0.015	0.01	-0.006	0.009	-0.013	0.011
Years of Schooling	-0.491	0.129***	0.016	0.074	-0.319	0.116***	0.029	0.076
Age	0.038	0.037	-0.075	0.037**	0.07	0.033**	-0.067	0.037*
Married	-0.443	0.375	0.464	0.315	0.013	0.327	0.517	0.032
Good Health	0.815	0.533	0.426	0.335	0.068	0.434	0.344	0.332
Black	-0.644	0.358*	0.406	0.383	-0.378	0.342	0.411	0.384
Middle Generation								
Years of Schooling	0.082	0.043*	0.046	0.041	0.076	0.043*	0.049	0.041
Age	-0.115	0.020***	-0.094	0.020***	-0.119	0.020***	-0.096	0.020***
Married	-1.514	0.282***	-0.957	0.323***	-1.391	0.276***	-0.933	0.323***
No. of Children (Grandkids)	0.058	0.043	0.049	0.039	0.038	0.043	0.048	0.039
Substitutes								
No. of Siblings in Middle Generation	-0.015	0.052	-0.085	0.050*	-0.02	0.052	-0.087	0.050*
Wage of Childcare Workers ($ per hour)	0.306	0.074***	0.144	0.080*	0.312	0.074***	0.148	0.081*
Other Controls								
Wealth of Grandparent ($0,000)					-0.002	0.002	-0.001	0.001
Included Middle Generation in Will								
Gave a Deed to Middle Generation								
Expect future help from Middle Generation								
Mills	-2.163	1.018**	-0.009	0.636	-0.559	0.736	-0.219	0.618
Time Dummies	x		x		x		x	
R^2	0.04		0.04		0.04		0.04	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table 4b Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.278	0.107**	-0.007	0.072	0.424	0.097***	-0.019	0.073
Other Income ($'00 per week)	-0.011	0.008	-0.014	0.01	-0.009	0.009	-0.012	0.011
Years of Schooling	-0.351	0.116***	0.024	0.072	-0.455	0.113***	0.032	0.074
Age	0.063	0.035*	-0.067	0.037*	0.024	0.033	-0.066	0.037*
Married	-0.060	0.335	0.511	0.312	-0.442	0.32	0.528	0.312*
Good Health	0.238	0.466	0.318	0.335	0.899	0.418**	0.295	0.332
Black	-0.478	0.351	0.39	0.387	-0.699	0.348**	0.405	0.388
Middle Generation								
Years of Schooling	0.081	0.044*	0.053	0.041	0.098	0.044**	0.05	0.041
Age	-0.119	0.020***	-0.095	0.020***	-0.113	0.020***	-0.094	0.020***
Married	-1.454	0.280***	-0.957	0.324***	-1.487	0.281***	-0.955	0.324***
No. of Children (Grandkids)	0.039	0.043	0.043	0.039	0.062	0.043	0.043	0.039
Substitutes								
No. of Siblings in Middle Generation	-0.020	0.203	-0.090	0.050*	-0.038	0.053	-0.089	0.050*
Wage of Childcare Workers ($ per hour)	0.312	0.074***	0.152	0.081*	0.313	0.075***	0.149	0.081*
Other Controls								
Wealth of Grandparent ($0,000)					-0.002	0.002	-0.001	0.001
Included Middle Generation in Will	-0.220	0.236	-0.179	0.268	-0.303	0.237	-0.148	0.268
Gave a Deed to Middle Generation	-0.227	1.141	1.044	0.997	-0.313	1.171	1.044	0.997
Expect future help from Middle Generation	0.287	0.233	0.405	0.249	0.482	0.231**	0.406	0.249
Mills	-1.047	0.862	-0.148	0.635	-2.545	0.690***	-0.299	0.615
Time Dummies	x		x		x		x	
R^2	0.04		0.04		0.04		0.04	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table 5a Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	7.355	3.403**	0.181	1.4498	9.633	3.212***	0.745	1.511
Other Income ($'00 per week)	2.172	0.255***	2.347	0.195***	1.691	0.265***	2.052	0.205***
Years of Schooling	-4.593	3.703	3.548	1.480*	-6.653	3.594*	2.929	1.509*
Age	1.357	1.039	1.566	0.728**	0.464	0.997	1.405	0.725*
Married	-8.905	10.67	12.88	6.279**	-16.29	10.24	11.43	6.276*
Good Health	-2.457	14.42	-4.105	6.683	6.595	13.43	-2.96	6.604
Black	-28.06	10.69***	-12.57	7.631	-29.73	10.544***	-12.09	7.64
Middle Generation								
Years of Schooling	1.491	1.337	-0.573	0.817	1.39	1.33	-0.663	0.816
Age	-0.48	0.613	-0.108	0.394	-0.355	0.61	-0.088	0.393
Married	-6.986	8.539	-1.877	6.436	-10.4	8.481	-3.089	6.419
No. of Children (Grandkids)	0.152	1.324	-0.055	0.78	0.284	1.315	-0.015	0.778
Substitutes								
No. of Siblings in Middle Generation	-1.199	1.607	-1.169	0.997	-0.922	1.601	-1.169	0.995
Wage of Childcare Workers ($ per hour)	5.15	2.252**	3.041	1.606*	4.588	2.249**	2.982	1.603*
Other Controls								
Wealth of Grandparent ($0,000)					0.188	0.039***	0.095	0.023***
Included Middle Generation in Will								
Gave a Deed to Middle Generation								
Expect future help from Middle Generation								
Mills	1.52	26.12	-5.085	12.697	-25.15	22.91	0.49	12.29
Time Dummies	x		x		x		x	
R^2	0.04		0.05		0.05		0.06	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table 5b Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	8.072	3.237**	0.41	1.436	8.287	3.106***	0.853	1.457
Other Income ($'00 per week)	2.113	0.255***	2.313	0.196***	1.687	0.266***	2.032	0.206***
Years of Schooling	-5.069	3.572	3.055	1.439**	-5.339	3.512	2.595	1.466*
Age	1.155	1.042	1.36	0.727*	0.669	1.004	1.255	0.724*
Married	-11.04	10.34	12.48	6.218**	-13.31	10.06	11.32	6.222*
Good Health	2.687	14.11	-4.517	6.674	3.921	13.306	-3.609	6.603
Black	-28.45	10.75**	-10.63	7.711	-27.64	10.65**	-10.43	7.727
Middle Generation								
Years of Schooling	1.507	1.341	-0.596	0.818	1.361	1.335	-0.667	0.817
Age	-0.509	0.613	-0.124	0.394	-0.399	0.611	-0.106	0.393
Married	-6.843	8.591	-2.893	6.449	-8.97	8.54	-3.878	6.445
No. of Children (Grandkids)	0.23	1.322	-0.095	0.781	0.229	1.316	-0.059	0.78
Substitutes								
No. of Siblings in Middle Generation	-1.058	1.611	-1.167	0.997	-0.824	1.606	-1.178	0.996
Wage of Childcare Workers ($ per hour)	5.264	2.258**	2.862	1.610*	4.674	2.256**	2.854	1.609*
Other Controls								
Wealth of Grandparent ($0,000)					0.189	0.039***	0.093	0.023***
Included Middle Generation in Will	0.697	7.208	8.507	5.333	-1.398	7.189	6.839	5.33
Gave a Deed to Middle Generation	93.03	36.33**	7.381	19.88	93.36	36.18**	8.554	19.85
Expect future help from Middle Generation	-5.506	7.138	4.12	4.96	-4.756	7.041	3.99	4.953
Mills	-5.911	25.85	-1.728	12.67	-13.92	23.09	2.649	12.246
Time Dummies	x		x		x		x	
R^2	0.04		0.05		0.05		0.06	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table 6 Marginal Effects for Structural Form Retirement Equation

Variable	*Dependent Variable: Dummy = 1 if Not Working for Pay and 0 Otherwise*							
	M.E	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Predicted Hours Care in Work	-0.052	0.020***	-0.064	0.020***	-0.043	0.019**	-0.062	0.023***
Predicted Hours Care in Retirement	0.063	0.023***	0.06	0.028**	0.053	0.022**	0.061	0.027**
Predicted Net Transfers in Work	-0.001	0.001	-0.0005	0.001	-0.001	0.001	-0.001	0.001
Predicted Net Transfers in Retirement	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001
Grandmother								
Wage ($ per hour)	-0.025	0.009***	-0.04	0.007***	-0.025	0.007***	-0.036	0.007***
Other Income ($'00 per week)	-0.002	0.003	-0.001	0.002	-0.001	0.003	-0.002	0.002
Years of Schooling	-0.002	0.011	0.011	0.009	-0.001	0.009	0.008	0.009
Age	0.014	0.004***	0.018	0.004***	0.013	0.004***	0.017	0.004***
Married	0.053	0.037	0.093	0.029***	0.056	0.032*	0.087	0.026***
Good Health	-0.213	0.023***	-0.266	0.024***	-0.209	0.020***	-0.259	0.021***
Below early SS Age (<62)	-0.025	0.019	-0.02	0.02	-0.029	0.021	-0.024	0.021
Above usual SS Age (≥ 65)	0.01	0.02	0.012	0.021	0.014	0.021	0.016	0.019
Black	0.008	0.039	0.029	0.034	0.009	0.046	0.019	0.033
Other Controls								
Wealth of Grandparent ($0,000)			0.0004	0.0003			0.0004	0.0003
Included Middle Generation in Will					0.01	0.019	0.018	0.018
Gave a Deed to Middle Generation					0.05	0.164	0.019	0.17
Expect future help from Middle Generation					-0.068	0.029**	-0.065	0.031**
Time Dummies	x		x		x		x	
Pseudo-R^2	0.19		0.2		0.2		0.2	
No. of Observations	8504		8504		8504		8504	

Marginal Effects from Logit Regressions on Pooled Cross Section

Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A1

Equation	Category	Regressors
"Structural" Retirement Equation (3)	Endogenous Variables	Wage of the grandmother
		Hours of care in retirement, Hours of care in work,
		Net transfers in retirement, Net transfers in work
	Grandmother's Demographics	Other income, Age, Education, Marital Status, Ethnicity
	Social Security	Age Step Function: 1{age<62} and 1{age>=65}
		Interaction terms
Intergenerational Transfers Equations (4)-(7)	Grandmother's Demographics	Wage of the grandmother
		Other income, Age, Education, Marital Status, Ethnicity
	Middle gen's Demographics	Age, Education, Marital status,
		Number of grandchildren, Number of siblings
	Care Cost	Wage of childcare workers in census region
Wage Equation (9)	Grandmother's Demographics	Other income, Age, Education, Marital Status, Ethnicity
	Exclusion Restrictions	Census division of residence, Years of tenure

Table A2 Marginal Effects for Reduced Form Retirement Equation

Variable	*Dependent Variable: Self Reported Status = 1 if Retired and 0 Otherwise*							
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	-0.061	0.006***	-0.057	0.011***	-0.056	0.005***	-0.053	0.011***
Other Income ($'00 per week)	0.002	0.003	0.0002	0.004	0.001	0.003	-0.0001	0.004
Years of Schooling	0.059	0.009***	0.041	0.010***	0.051	0.008***	0.036	0.009***
Age	0.032	0.005***	0.031	0.006***	0.031	0.005***	0.031	0.007***
Married	0.145	0.021***	0.137	0.027***	0.129	0.021***	0.124	0.031***
Good Health	-0.203	0.040***	-0.187	0.057***	-0.202	0.047***	-0.192	0.061***
Below early SS Age (<62)	-0.044	0.041	-0.017	0.056	0.017	0.059	0.019	0.058
Above usual SS Age (≥ 65)	0.149	0.051***	0.147	0.072**	0.156	0.072**	0.146	0.076*
Black	0.1	0.025***	0.087	0.030***	0.093	0.024***	0.08	0.030***
Middle Generation								
Years of Schooling	-0.001	0.003	-0.0001	0.003	-0.001	0.003	-0.001	0.003
Age	-0.0001	0.001	-0.001	0.001	-0.0003	0.001	-0.001	0.001
Married	0.024	0.019	0.018	0.021	0.025	0.02	0.02	0.021
No. of Children (Grandkids)	-0.007	0.003***	-0.004	0.003	-0.006	0.003**	-0.003	0.003
Substitutes								
No. of Siblings in Middle Generation	0.002	0.003	-0.0005	0.004	0.001	0.011	0.001	0.004
Wage of Childcare Workers ($ per hour)	-0.007	0.006	-0.002	0.006	-0.007	0.006	-0.003	0.006
Other Controls								
Wealth of Grandparent ($0,000)			0.001	0.004			0.002	0.004
Included Middle Generation in Will					0.036	0.017**	0.031	0.02
Gave a Deed to Middle Generation					0.057	0.062	0.066	0.061
Expect future help from Middle Generation					-0.064	0.014***	-0.071	0.020***
Time Dummies	x		x		x		x	
Pseudo-R^2	0.21		0.22		0.22		0.22	
No. of Observations	8504		8504		8504		8504	

Marginal Effects from Logit Regressions on Pooled Cross Section; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A3a Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.22	0.111**	0.025	0.074	0.209	0.114*	0.014	0.072
Other Income ($'00 per week)	-0.004	0.009	-0.018	0.009*	-0.004	0.0098	-0.012	0.01
Years of Schooling	-0.292	0.132**	-0.024	0.087	-0.285	0.136**	-0.008	0.08
Age	-0.009	0.046	-0.024	0.049	0.005	0.042	-0.018	0.043
Married	0.179	0.333	0.408	0.282	0.224	0.326	0.432	0.276
Good Health	0.018	0.44	0.301	0.312	-0.061	0.434	0.279	0.302
Black	-0.364	0.394	0.316	0.37	-0.358	0.398	0.315	0.367
Middle Generation								
Years of Schooling	0.072	0.047	0.055	0.039	0.072	0.047	0.056	0.039
Age	-0.098	0.022***	-0.108	0.019***	-0.098	0.022***	-0.108	0.019***
Married	-1.256	0.303***	-1.048	0.296***	-1.247	0.303***	-1.029	0.296***
No. of Children (Grandkids)	0.062	0.047	0.045	0.037	0.061	0.048	0.044	0.037
Substitutes								
No. of Siblings in Middle Generation	-0.003	0.058	-0.104	0.047**	-0.0002	0.058	-0.103	0.047**
Wage of Childcare Workers ($ per hour)	0.174	0.080**	0.247	0.076***	0.172	0.080**	0.247	0.076***
Other Controls								
Wealth of Grandparent ($0,000)								
Included Middle Generation in Will					-0.0001	0.001	-0.002	0.002
Gave a Deed to Middle Generation								
Expect future help from Middle Generation								
Mills	-0.823	0.805	0.093	0.753	-619	0.769	-0.025	0.685
Time Dummies	x		x		x		x	
R^2	0.04		0.03		0.04		0.04	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A3b Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.227	0.118*	0.027	0.074	0.202	0.112*	0.014	0.07
Other Income ($'00 per week)	-0.005	0.009	-0.016	0.009*	-0.004	0.009	-0.011	0.01
Years of Schooling	-0.305	0.137**	-0.014	0.084	-0.281	0.134**	0.001	0.078
Age	-0.006	0.044	-0.022	0.045	0.006	0.041	-0.012	0.042
Married	0.205	0.331	0.408	0.279	0.261	0.322	0.437	0.274
Good Health	-0.007	0.442	0.308	0.306	-0.062	0.439	0.266	0.299
Black	-0.359	0.406	0.238	0.374	-0.319	0.402	0.246	0.371
Middle Generation								
Years of Schooling	0.072	0.047	0.059	0.039	0.072	0.048	0.06	0.039
Age	-0.098	0.022***	-0.107	0.019***	-0.097	0.022***	-0.108	0.019***
Married	-0.727	0.305***	-1.040	0.297***	-1.271	0.305***	-1.022	0.297***
No. of Children (Grandkids)	0.059	0.048	0.041	0.037	0.058	0.048	0.04	0.037
Substitutes								
No. of Siblings in Middle Generation	-0.007	0.059	-0.107	0.047**	-0.004	0.059	-0.106	0.047**
Wage of Childcare Workers ($ per hour)	0.172	0.081**	0.257	0.076***	0.168	0.080**	0.256	0.076***
Other Controls								
Wealth of Grandparent ($0,000)	-0.007	0.059			-0.001	0.001	-0.002	0.002
Included Middle Generation in Will	0.074	0.258	-0.372	0.249	0.079	0.259	-0.344	0.247
Gave a Deed to Middle Generation	-0.554	1.293	1.243	0.941	-0.537	1.296	1.226	0.942
Expect future help from Middle Generation	0.363	0.258	0.327	0.233	0.346	0.256	0.316	0.231
Mills	-0.819	0.83	0.167	0.718	-0.565	0.773	-0.033	0.664
Time Dummies	x		x		x		x	
R^2	0.04		0.04		0.04		0.04	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A4a Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	6.52	3.42*	1.957	1.525	13.17	3.346***	0.478	1.468
Other Income ($'00 per week)	2.005	0.276***	2.496	0.186***	1.284	0.256***	2.051	0.204***
Years of Schooling	-3.396	4.065	1.48	1.792	-10.04	4.006**	2.687	1.65
Age	2.61	1.413	1.816	0.998*	0.402	1.224	1.655	0.883*
Married	2.147	10.21	10.01	5.800*	-8.549	9.736	11.1	5.665*
Good Health	-5.425	13.55	-6.707	6.41	18.37	12.44	-8.617	6.192
Black	-21.81	12.06*	-24.23	7.605***	-32.35	12.16***	-19.66	7.521***
Middle Generation								
Years of Schooling	0.453	1.444	-0.069	0.796	0.442	1.435	-0.143	0.794
Age	0.145	0.668	-0.351	0.381	0.217	0.665	-0.368	0.38
Married	-5.212	9.284	-3.294	6.082	-9.518	80214	-4.634	6.066
No. of Children (Grandkids)	-0.585	1.455	-0.11	0.765	0.285	1.447	-0.025	0.761
Substitutes								
No. of Siblings in Middle Generation	0.302	1.784	-1.678	0.957*	0.065	1.778	-1.708	0.955*
Wage of Childcare Workers ($ per hour)	4.182	2.446*	3.583	1.555**	4.826	2.444**	3.287	1.55**
Other Controls								
Wealth of Grandparent ($0,000)								
Included Middle Generation in Will					0.134	0.316***	0.145	0.028***
Gave a Deed to Middle Generation								
Expect future help from Middle Generation								
Mills	11.55	24.82	-10.07	15.49	-45.39	20.75**	-14.14	14.05
Time Dummies	x		x		x		x	
R^2	0.03		0.06		0.04		0.06	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A4b Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	6.445	3.605*	1.049	1.509	11.14	3.407***	0.289	1.437
Other Income ($'00 per week)	1.938	0.277***	2.479	0.187***	1.56	0.277***	2.037	0.205***
Years of Schooling	-3.324	4.242	2.19	1.715	-8.106	4.063**	2.692	1.605*
Age	2.431	1.353*	1.727	0.912*	0.915	1.254	1.467	0.857*
Married	1.737	10.14	11.11	5.72*	-7.059	9.78	11.202	5.625**
Good Health	-1.938	13.58	-8.622	6.295	13.76	13.04	-9.202	6.138
Black	-20.37	12.42	-20.66	7.68***	-27.83	12.27**	-17.9	7.601**
Middle Generation								
Years of Schooling	0.463	1.447	-0.079	0.796	0.465	1.44	-0.154	0.795
Age	0.084	0.667	-0.382	0.382	0.145	0.664	-0.387	0.381
Married	-5.404	9.332	-3.971	6.102	-8.623	9.305	-5.197	6.089
No. of Children (Grandkids)	-0.453	1.455	-0.071	0.765	0.06	1.446	-0.055	0.762
Substitutes								
No. of Siblings in Middle Generation	0.447	1.793	-1.663	0.958*	0.332	1.784	-1.701	0.956*
Wage of Childcare Workers ($ per hour)	4.257	2.458*	3.332	1.561**	4.598	2.448*	3.175	1.556**
Other Controls								
Wealth of Grandparent ($0,000)					0.123	0.031***	0.143	0.028***
Included Middle Generation in Will	4.291	7.897	6.937	5.083	1.125	7.889	5.28	5.068
Gave a Deed to Middle Generation	104.6	39.66***	9.712	19.38	103.9	39.38***	11.72	19.33
Expect future help from Middle Generation	-8.201	7.88	2.573	4.783	-3.214	7.802	2.089	4.746
Mills	10.59	25.58	-12.74	14.77	-30.91	23.34	-13.17	13.61
Time Dummies	x		x		x		x	
R^2	0.04		0.06		0.04		0.07	
No. of Observations	8504		8504		8504		8504	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A5 Marginal Effects for Structural Form Retirement Equation

Variable	*Dependent Variable: Self Reported Status = 1 if Retired and 0 Otherwise*							
	M.E	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Predicted Hours Care in Work	0.354	0.065***	-0.092	0.08	-0.381	0.065***	-0.264	0.064***
Predicted Hours Care in Retirement	-0.452	0.081***	0.109	0.099	0.482	0.085***	0.333	0.082***
Predicted Net Transfers in Work	-0.008	0.002***	-0.006	0.003**	0.007	0.002***	-0.003	0.002
Predicted Net Transfers in Retirement	0.024	0.005***	-0.002	0.007	-0.028	0.006***	-0.015	0.005***
Grandmother								
Wage ($ per hour)	-0.149	0.019***	0.035	0.013***	0.035	0.015**	0.047	0.013***
Other Income ($'00 per week)	-0.048	0.010***	0.015	0.011	0.062	0.011***	0.038	0.009***
Years of Schooling	0.122	0.015***	-0.027	0.014*	-0.016	0.012	-0.03	0.012**
Age	-0.015	0.006**	0.029	0.010***	0.058	0.008***	0.046	0.007***
Married	0.085	0.022***	0.057	0.059	0.259	0.033***	0.153	0.040***
Good Health	-0.028	0.034	-0.153	0.085*	-0.391	0.034***	-0.301	0.049***
Below early SS Age (<62)	-0.053	0.019***	-0.074	0.019***	-0.062	0.019***	-0.076	0.019***
Above usual SS Age (≥ 65)	0.096	0.018***	0.065	0.019***	0.083	0.019***	0.059	0.019***
Black	0.455	0.033***	-0.184	0.145	-0.61	0.076***	-0.426	0.097***
Other Controls								
Wealth of Grandparent ($0,000)			0.002	0.001*			0.003	0.001***
Included Middle Generation in Will					0.365	0.055***	0.22	0.052***
Gave a Deed to Middle Generation					-0.662	0.015***	-0.08	0.298
Expect future help from Middle Generation					0.186	0.053***	0.022	0.044
Time Dummies	x		x		x		x	
Pseudo-R^2	0.2		0.21		0.21		0.22	
No. of Observations	8504		8504		8504		8504	

Marginal Effects from Logit Regressions on Pooled Cross Section

Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A6 Marginal Effects for Reduced Form Retirement Equation

Variable	(a) Dummy = 1 if Not Working for Pay				(b) Dummy = 1 if Self Report Retired			
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	-0.051	0.004***	-0.036	0.011***	-0.035	0.003***	-0.031	0.009***
Other Income ($'00 per week)	0.002	0.002	0.003	0.003	0.006	0.003*	0.008	0.004**
Years of Schooling	0.06	0.007***	0.02	0.007***	0.038	0.006***	0.02	0.007***
Age	0.018	0.004***	0.017	0.005***	0.031	0.005***	0.027	0.008***
Married	0.193	0.020***	0.107	0.037***	0.142	0.021***	0.107	0.034***
Good Health	-0.27	0.037***	-0.149	0.060**	-0.14	0.040***	-0.096	0.050*
Below early SS Age (<62)	-0.067	0.036*	0.042	0.046	-0.109	0.034***	0.02	0.05
Above usual SS Age (≥ 65)	0.137	0.047***	0.08	0.056	0.107	0.043**	0.089	0.063
Black	0.048	0.029*	0.015	0.02	0.054	0.025**	0.044	0.025*
Middle Generation								
Years of Schooling	0.002	0.004	-0.001	0.003	0.001	0.003	-0.001	0.003
Age	-0.001	0.002	0.0001	0.001	0.001	0.002	0.001	0.001
Married	0.028	0.029	0.026	0.023	0.031	0.026	0.03	0.025
No. of Children (Grandkids)	0.001	0.003	0.001	0.002	-0.008	0.002	-0.00001	0.002
Substitutes								
No. of Siblings in Middle Generation	-0.015	0.006***	-0.013	0.006**	-0.007	0.005	-0.007	0.005
Wage of Childcare Workers ($ per hour)	0.007	0.006	0.011	0.006**	0.006	0.005	0.007	0.005
Other Controls								
Wealth of Grandparent ($0,000)			0.005	0.001***			0.002	0.002
Included Middle Generation in Will			0.023	0.016			0.04	0.019**
Gave a Deed to Middle Generation			0.13	0.056**			0.133	0.059**
Expect future help from Middle Generation			-0.047	0.048***			-0.055	0.020***
Time Dummies	x		x		x		x	
Pseudo-R^2	0.18		0.2		0.21		0.23	
No. of Observations	100017		100017		100017		100017	

Marginal Effects from Logit Regressions on Pooled Cross Section; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A7a Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.221	0.068***	-0.038	0.042	0.211	0.055***	-0.030	0.036
Other Income ($'00 per week)	-0.01	0.007	-0.013	0.008*	-0.009	0.008	-0.012	0.008
Years of Schooling	-0.454	0.111***	0.043	0.063	-0.416	0.098***	0.025	0.057
Age	0.078	0.033**	-0.083	0.033**	0.503	0.033	-0.077	0.033**
Married	-0.052	0.309	0.473	0.241*	-0.090	0.275	0.516	0.267*
Good Health	0.086	0.466	0.176	0.295	0.299	0.41	0.065	0.28
Black	-0.006	0.303	0.654	0.351*	-0.002	0.031		
Middle Generation								
Years of Schooling	0.018	0.042	0.012	0.041	0.032	0.041	0.013	0.041
Age	-0.046	0.020**	-0.093	0.021***	-0.047	0.020**	-0.092	0.021**
Married	-1.111	0.336***	-1.165	0.364***	-1.191	0.337***	-1.217	0.365***
No. of Children (Grandkids)	0.023	0.034	0.041	0.032	0.024	0.034	0.035	0.032
Substitutes								
No. of Siblings in Middle Generation	0.004	0.069*	-0.110	0.068	-0.012	0.069	0.654	0.355*
Wage of Childcare Workers ($ per hour)	0.188	0.064***	0.144	0.067**	0.174	0.064***	0.149	0.067**
Other Controls								
Wealth of Grandparent ($0,000)					-0.001	0.001	-0.001	0.001
Included Middle Generation in Will					-0.001	0.199	0.07	0.222
Gave a Deed to Middle Generation					0.391	1.21	1.891	0.851**
Expect future help from Middle Generation					0.802	0.195***	0.716	0.206***
Mills	-0.626	0.756	0.097	0.504	-1.081	0.604*	0.029	0.479
Time Dummies	x		x		x		x	
R^2	0.02		0.03		0.02		0.03	
No. of Observations	100017		100017		100017		100017	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A7b Hours of Care

Variable	*Dependent Variable: Weekly Hours of Grandchild Care*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	0.093	0.074	0.013	0.044	0.084	0.066	0.012	0.042
Other Income ($'00 per week)	-0.006	0.009	-0.014	0.007*	-0.007	0.009	-0.009	0.008
Years of Schooling	-0.179	0.114	-0.047	0.062	-0.163	0.104	-0.046	0.06
Age	-0.020	0.037	-0.049	0.035	-0.019	0.035	-0.044	0.034
Married	0.217	0.294	0.334	0.241	0.295	0.28	0.385	0.239
Good Health	-0.334	0.412	0.266	0.262	-0.446	0.387	0.17	0.258
Black	0.01	0.344	0.675	0.332**	0.037	0.348	0.662	0.337**
Middle Generation								
Years of Schooling	0.03	0.045	0.013	0.038	0.032	0.045	0.019	0.038
Age	-0.061	0.022***	-0.088	0.020***	-0.061	0.022***	-0.088	0.020***
Married	-1.167	0.362***	-1.126	0.339***	-1.259	0.362***	-1.173	0.340***
No. of Children (Grandkids)	0.089	0.037**	0.014	0.03	0.084	0.037**	0.009	0.03
Substitutes								
No. of Siblings in Middle Generation	-0.055	0.074	-0.104	0.063	-0.074	0.074	-0.116	0.063*
Wage of Childcare Workers ($ per hour)	0.07	0.039	0.212	0.063***	0.07	0.069	0.216	0.063***
Other Controls								
Wealth of Grandparent ($0,000)					-0.0001	0.002	-0.002	0.002
Included Middle Generation in Will					0.07	0.216	0.064	0.206
Gave a Deed to Middle Generation					-0.108	1.416	1.907	0.801**
Expect future help from Middle Generation					0.753	0.211***	0.712	0.192***
Mills	-0.835	0.696	0.417	0.539	-0.748	0.611	0.356	0.495
Time Dummies	x		x		x		x	
R^2	0.02		0.02		0.02		0.03	
No. of Observations	100017		100017		100017		100017	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A8a Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	7.051	2.119***	0.277	1.012	6.109	1.731***	0.421	0.874
Other Income ($'00 per week)	2.032	0.229***	1.631	0.184***	1.587	0.243***	1.069	0.193***
Years of Schooling	-6.785	3.516*	3.274	1.537**	-5.529	3.075*	2.139	1.385
Age	1.431	1.026	1.233	0.808	0.508	1.019	0.805	0.795
Married	-16.68	9.727*	18.5	6.652***	-19.06	8.664**	16.64	6.506**
Good Health	1.264	14.45	3.636	7.229	8.195	12.98	1.832	7.073
Black	-24.74	9.550*	-16.28	8.609*	-20.4	9.601**	-10.16	8.649
Middle Generation								
Years of Schooling	0.386	1.288	1.185	0.993	0.166	1.286	0.417	0.991
Age	-0.407	0.637	-0.258	0.518	-0.45	0.636	-0.255	0.514
Married	-14.63	10.58	-9.569	8.92	-6.83	10.58	-13.12	8.902
No. of Children (Grandkids)	-0.101	1.062	0.172	0.78	-0.016	1.063	0.263	0.776
Substitutes								
No. of Siblings in Middle Generation	-0.777	2.17	-0.575	1.668	-0.477	2.155	-0.851	1.656
Wage of Childcare Workers ($ per hour)	3.139	2.016	4.609	1.643***	2.2	2.019	4.144	1.638**
Other Controls								
Wealth of Grandparent ($0,000)					0.23	0.038***	0.23	0.029***
Included Middle Generation in Will					-1.916	6.261	10.72	5.41**
Gave a Deed to Middle Generation					19.11	38.16	28.04	20.76
Expect future help from Middle Generation					-1.425	6.113	1.873	5.015
Mills	-8.51	23.08	-0.465	12.36	-18.83	19.26	3.999	11.677
Time Dummies	x		x		x		x	
R^2	0.04		0.04		0.04		0.05	
No. of Observations	100017		100017		100017		100017	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A8b Net Financial Transfers

Variable	*Dependent Variable: Weekly Net Financial Transfers*							
	Work		*Retirement*		*Work*		*Retirement*	
Grandmother	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Wage ($ per hour)	5.392	2.448**	0.7	1.055	9.913	2.260***	0.375	0.986
Other Income ($'00 per week)	2.116	0.276***	1.676	0.163***	1.324	0.321***	0.611	0.181***
Years of Schooling	-3.402	3.795	2.951	1.489**	-9.208	3.580**	1.584	1.417
Age	1.144	1.218	1.17	0.841	-1.805	1.226	1.165	0.804
Married	-10.06	0.9769	17.89	5.809***	-27.08	9.727***	16.39	5.69***
Good Health	8.443	13.73	-2.347	6.317	35.81	13.19***	-8.609	6.143
Black	-16.67	11.39	-24.8	8.013***	-21.66	12.25*	-15.21	8.021*
Middle Generation								
Years of Schooling	0.476	1.467	1.249	0.917	-0.484	1.561	0.12	0.911
Age	-0.758	0.712	-0.121	0.481	-0.73	0.752	-0.157	0.475
Married	-10.8	11.99	-11.92	8.181	-17.07	12.76	-14.64	8.106*
No. of Children (Grandkids)	-0.223	1.206	0.218	0.723	-0.150	1.279	0.331	0.714
Substitutes								
No. of Siblings in Middle Generation	0.61	2.448	-1.711	1.518	1.477	2.594	-2.16	1.5
Wage of Childcare Workers ($ per hour)	2.962	2.267	4.361	1.520***	2.121	2.41	3.679	1.507**
Other Controls								
Wealth of Grandparent ($0,000)					0.434	0.059***	0.448	0.037***
Included Middle Generation in Will					-7.367	7.606	8.958	4.904*
Gave a Deed to Middle Generation					23.89	47.67	25.85	19.11
Expect future help from Middle Generation					1.188	7.391	2.235	4.578
Mills	-7.736	23.35	-3.386	13	-75.45	20.41***	-11.84	11.79
Time Dummies	x		x		x		x	
R^2	0.03		0.04		0.05		0.06	
No. of Observations	100017		100017		100017		100017	

Lee Two Step Regressions using Logistic selection correction; Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%

Table A9 Marginal Effects for Structural Form Retirement Equation

Variable	(a) Dummy = 1 if Not Working for Pay				(b) Dummy = 1 if Self Report Retired			
	M.E	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*	*M.E*	*s.d*
Predicted Hours Care in Work	-0.066	0.017***	-0.095	0.018***	-0.009	0.017	0.022	0.016
Predicted Hours Care in Retirement	0.028	0.011**	0.016	0.016	0.119	0.017***	0.09	0.017***
Predicted Net Transfers in Work	0.001	0.001	0.002	0.001	-0.015	0.001***	-0.011	0.001***
Predicted Net Transfers in Retirement	0.002	0.001**	0.002	0.001	0.003	0.001***	-0.002	0.001*
Grandmother								
Wage ($ per hour)	-0.007	0.006	-0.016	0.004***	0.046	0.001***	0.034	0.005***
Other Income ($'00 per week)	-0.003	0.002*	-0.004	0.002*	0.029	0.003***	0.017	0.002***
Years of Schooling	-0.018	0.008**	-0.016	0.008**	-0.017	0.005***	-0.009	0.004**
Age	0.012	0.003***	0.013	0.003***	0.036	0.004***	0.023	0.004***
Married	0.059	0.038	0.109	0.032***	-0.121	0.023***	-0.094	0.025***
Good Health	-0.202	0.021***	-0.243	0.034***	-0.106	0.021***	-0.036	0.032
Below early SS Age (<62)	-0.039	0.017**	-0.052	0.020***	-0.072	0.017***	-0.07	0.017***
Above usual SS Age (≥ 65)	0.014	0.02	0.053	0.019***	0.051	0.016***	0.065	0.014***
Black	0.044	0.035	0.059	0.030*	-0.226	0.044***	-0.218	0.040***
Other Controls								
Wealth of Grandparent ($0,000)			-0.001	0.003*			0.006	0.001***
Included Middle Generation in Will			0.015	0.019			0.012	0.017
Gave a Deed to Middle Generation			-0.063	0.082			0.223	0.035***
Expect future help from Middle Generation			0.023	0.04			-0.266	0.019***
Time Dummies	x		x		x		x	
Pseudo-R^2	0.17		0.18		0.23		0.24	
No. of Observations	100017		100017		100017		100017	

Marginal Effects from Logit Regressions on Pooled Cross Section

Standard Errors adjusted for Clustering; *** Significant @ 1%, ** Significant @ 5%, * Significant @ 10%