Family Size and Intra-Family Transfers – an Empirical Analysis of Long-Term Care using Chinese Household Data

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Abstract

This paper analyzes one type of intra-family transfer - long-term care for the elderly provided by the adult children. I consider the effect of an adult child's own family size, the number of her children, on care arrangements for the elderly parents. A direct implication of family size is that it imposes constraints on the care provider's resources. Such consideration is especially relevant in developing economies where, in the absence of formal long-term care industry and retirement schemes, the elderly population relies primarily on their adult children for financial support. I incorporate the above novel perspective in an empirical study of long-term care for the elderly in China using household survey data. Exploiting exogenous variation in the number of births per couple before and after China's One-Child Policy (1979), I identify the effect of an adult child's family size on long-term care arrangements for his / her elderly parent. Having more offspring decreases the monetary transfer an adult child makes towards the elderly parent. Specifically, the amount of transfer from a representative adult child to his or her elderly parent would decrease by approximately 25% if the adult child has three children instead of one. The findings are significant for the rural sub-sample but not for the urban sub-sample of my dataset, suggesting that declining family size may ease the financial burden of elderly care for the "sandwich generation" and increase the resource availability for the older generation in developing economies.

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1. Introduction

This paper presents an empirical analysis of intra-family and inter-generational resource transfer in the context of informal (family based) long-term care for the elderly in China within a three generational setting. In this setting the adult children of the elderly are considered to be their primary care providers. The question is whether the care provider's own family size, that is the number of her own children, plays a role in determining the amount of financial transfer she provides to the elderly parents as part of the long-term care arrangement for the elderly.

An analysis of family based long-term care for the elderly is especially relevant in China where the formal long-term care industry is poorly developed. Rural China particularly faces acute challenges in the long-term care front for two reasons. First, a vast majority of the elderly rural population do not qualify for public retirement or pension benefits (Heller 2006), leaving the financial burden of long-term care primarily on the working age family members - usually the adult children of the elderly. Second, since the introduction of the market economy in the 1980s, most medical expenses in rural China have been financed by private, out-of-pocket spending. Rising medical costs in the past decade, combined with the significantly lower average income of rural Chinese households compared to urban ones, make it difficult for the adult children of rural families to accommodate the high medical expenses of their disabled elderly parents. [1]

While family based long-term care has been studied in the literature (Knodel et. al. 1992; Pezzin, Pollak and Schone 2004, 2005a, b; Zimmer and Kwong 2003), few have adopted a three-generational approach that incorporates the grandchildren of the elderly,[2] or the family size the care provider. This paper demonstrates the importance of incorporating grandchildren in the analysis and provides testable implications of it on the long-term care arrangement for the elderly in China. An immediate concern I raise is the allocation of limited family resources between the needs of the adult child's own family (including spouse and children) and that of the elderly

[1] In addition to these two considerations, Giles and Mu (2006) also found that the elderly parent's health condition in rural Chinese families imposes constraints on adult children's labor supply decisions which require rural-to-urban migration.

[2] Cox and Stark (1994) advance the "demonstration effect" argument which posits that adult children have an incentive to transfer resources towards elder parents in the presence of their children (the grandchildren of the elderly). Another study by Silverstein et. al. (2006) examines how household composition is correlated with the psychological well-being of elderly in rural China and found that grandparents derive emotional benefits from co-residing with grandchildren.

parents. From a broader perspective, while the adoption of the One-Child Policy (OCP)[3] in China was successful in reducing the total fertility rate,[4] it is also turning the nation into a rapidly aging society[5] raising concerns about the burden of long term care on the current younger generation. However, in a three generational setting the implications of the OCP on family based long term care are not obvious. While the burden of parental care on an adult child increases with fewer siblings to share this burden with, having fewer offspring decreases the financial needs of the adult child's own family.

I test the empirical implications of the above arguments using a novel Chinese household data set. I exploit the exogenous variation in the fertility rate before and after China's One Child Policy (OCP) in late 1970's to construct an instrumental variable for the family size of the adult child.[6] Using a two-step regression model I derive consistent estimates of the effect of the care provider's family size has on the amount of her transfer to the elderly. A larger family size of the adult child, measured by the number of her own children, leads to a smaller amount of monetary transfer from the adult child to the elderly parent. The empirical results are statistically significant only for the rural sample and not for the urban one where, incidentally, the compliance rate for the OCP is higher[7]. Thus, despite popular concerns regarding the consequences of decreasing fertility rate on long-term care for the elderly population, empirical findings in this paper suggest that decreasing family size may in fact ease the financial burden of the "sandwich generation" in developing economies (like that of rural China) and enhance the resource availability for the older generation.

The rest of this paper is organized as follows. Section II provides a brief review of the literature on intra-family transfers related to long-term care, and presents novel perspectives on how own family size affects an adult child's long-term care arrangements towards the elderly parent. The data used in this study is described in Section III. Section IV discusses the empirical

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[3] For more about China's One-Child Policy, see Greenhalgh (1986, 2003).

[4] The total fertility rate in China, measured by the average number of children born to a woman, dropped from above 6 in the 1960's to a below-replacement rate of 1.8 in 2004.

[5] Currently the proportion of Chinese population above the age of 65 is 7.5%. In 25 years the proportion is projected to increase to around 30%.

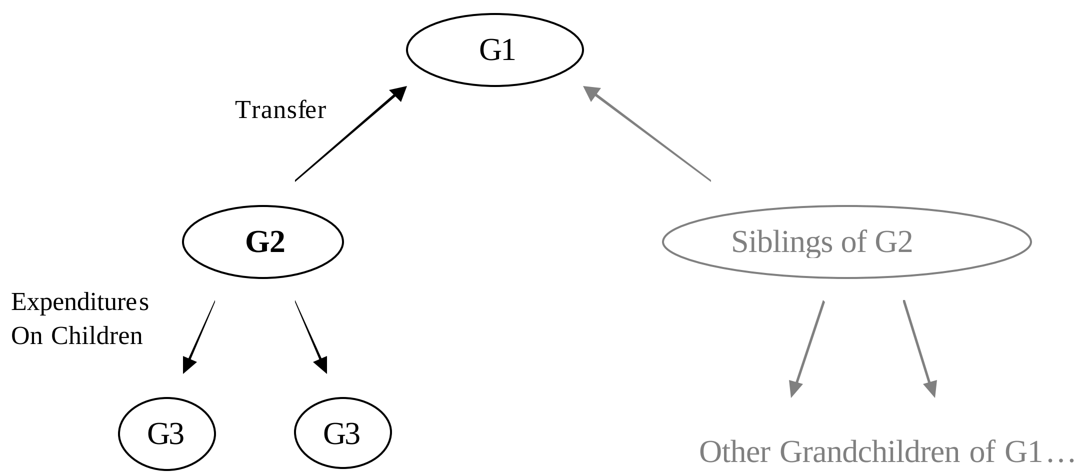
[6] The data set used in this study shows significant evidence that families whose first child was born after 1977 have fewer children than families whose first child was born before 1977.

[7] The compliance rate of OCP is more than 70% in the urban sample compared to only about 35% in the rural sample.

methodology. In particular, I introduce the identification strategy which overcomes the potential endogeneity of the adult child's family size. Empirical findings are also presented in this section. Section V concludes with brief comments about directions for future research.

2. Economic Analysis of Intra-Family Transfer in the Framework of Long-Term Care

For ease of exposition I introduce the following notation. The elderly parents, also referred to as grandparents, are denoted by G1. The subject of study in this paper is an adult child of G1, denoted by G2. This adult child is considered to be the representative care provider among his or her siblings. G2's offspring, denoted by G3, are referred to as the grandchildren in the family. It is important to clarify that, for the rest of this paper, the number of G3 reflects the number of offspring of the focal adult child, not the total number of G1's grandchildren.[8]



An illustration of long-term care in a three-generational family

2.1 Economic interactions between G1 and G2

The analysis of family long-term care in current literature is conducted primarily in a two-generational setting based on two types of models: a *unitary family model*, like Becker's altruist model (1981), and *exchange models*, for example Bernheim et. al. (1985)[9] and Cox (1987). While a unitary family model suggests that elderly parents who receive lower retirement salary or are widowed or disabled tend to receive higher amount of financial or instrumental

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[8] Thus, for the purposes of my analysis, a representative family unit constitutes the elderly parents, their adult child (including his or her spouse), and the adult child's children. This is illustrated in a schematic diagram below.
[9] A more recent paper by Perozek (1998) casts doubt on the empirical results presented in Bernhein et.al. (1985).

transfer from adult children, in exchange based models the adult child's care provision for the elderly is a result of implicit or explicit agreements of exchange between the two generations. In the latter case incentives are provided through bequests or *inter vivos*[10] transfers. Previous studies based on Chinese data have found evidence that the elderly population in China receives predominantly need-based transfers (Lee and Xiao 1998), and familial support plays the role of compensating for inequality in the elderly population's access to public resources (Zimmer and Kwong 2003).

Another important issue which affects the method and amount of transfer is the proximity between G1 and G2. It is generally observed that the coresiding child is the main provider of instrumental support for the elderly (Spillman and Pezzin 2000; Zimmer and Kwong 2003), whereas non-coresiding children provide support in the form of financial and other material transfers (Knodel et. al. 1992). To a certain extent, while proximity can be endogenously explained by the needs of elderly parents (Zimmer 2005; Giles and Mu 2006), there also appear to be strategic considerations when the adult children make living arrangements for the elderly. Pezzin, Pollak and Schone (2005a) model living proximity as the first-stage outcome of the sibling bargaining game and argue that proximity can affect adult children's future bargaining power over their shares of contribution. Using German data, Konrad et. al. (2002) find that the first child of a family is more likely to settle down further away from parents leaving parental care responsibilities to the younger siblings.

2.2 How G3 affects the economic interactions between G1 and G2

Assuming that the G3 in the family are not financially independent, they can affect G2's long term care arrangement for G1 through G2's budget constraint. Consider an altruistic adult (G2) with limited financial resources whose utility depends on the wellbeing of his own children as well as his elderly parents[11]. Evidently the monetary transfer from G2 to G1 cannot be the same when G2 has more children. In particular, this transfer could decrease as G2's expenditure on own children increases because of the substitution effect. Interestingly, it has been observed that as family size shrinks, especially in one-child households[12], parents tend to invest more than

[10] "*Inter vivos*" is a Latin term meaning "between living persons".
[11] This assumption is consistent with Becker's altruist model (1981).

[12] One-child households have become extremely common in China after the introduction of OCP in 1979. In my sample 32% of the adult subjects have only one child.

proportionally on the child's human capital with the expectation of increasing his or her future earnings. The idea is that this would in turn secure parents' probability of receiving financial support (as also the amount of financial transfer) from their offspring when they get older. Based on Chinese household data, Rosenzweig and Zhang (2006) find evidence of a tradeoff between the quantity and quality of children by analyzing families with and without twins - higher per capita investment on children is observed when the number of children declines. Therefore, the financial consequences of decreasing number of grandchildren on long-term care for the elderly in the household are not immediately obvious.

3. Data

The empirical analysis of this paper uses data derived from the 2002 wave of Longitudinal Survey on Healthy Longevity in China (CLHLS)[13] and a subsequent survey of the adult children of the CLHLS elderly sample conducted during the same year. The CLHLS survey was originally conducted to determine the factors that contribute to healthy longevity among the elderly in China. The 2002 wave of CLHLS interviewed elderly population (G1) between 65 and 110 years old from both urban and rural areas in 22 provinces of China[14]. In the same year a sub-sample of the adult children (aged 35-65) of the elderly interviewees from nine[15] out of the original 22 provinces was collected. Only one adult child (G2) of each elderly G1 subject was interviewed in the sub-sample. Combining the 2002 parent survey with the subsequent survey of adult children, I obtain 4364 pairs of G1 and G2 observations.

The merged dataset provides a snapshot of a 3-generational family at the time of the survey (2002). This snapshot includes the elderly parent (G1), one adult child (G2) of G1, and the children (G3) of G2. Important information provided by the merged dataset includes the amount of transfer made from G2 to G1 during the year of 2001. In addition, information on G2's own family (spouse and children) is available, enabling the direct examination of how N_i affects the family care outcome for grandparents in rural and urban parts of China.

[13] The surveys were jointly conducted by the Program on Population, Policy, and Aging, Duke University; the Center for Healthy Aging and Family Studies (CHAFS) and Peking University.

[14] Interviewees of the parent survey were randomly selected from approximately half of the total counties and cities of the 22 provinces.

[15] These nine provinces are Beijing, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Guangxi.

Table T1 in Appendix A2 reports summary statistics for the individual and household level variables used to model resource transfer and care provision for the elderly. 58% of the observations are rural residents and 42% are urban[16].

4. Empirical Analysis

In this section I examine the cross-sectional data described above for determinants of long-term care for elderly. Of special interest to this paper is how adult child's own family size influences the care arrangement and the amount of financial transfer towards the elderly parent. There are two potentially problematic issues for the empirical analysis. Family size (N_i) is endogenous if it is correlated with unobservable individual or household characteristics that also affect long-term care arrangements. G2's unobservable preferences for children may be correlated with his long-term care choices for the elderly parent. For instance, an individual who has strong family ties to parents and siblings may also have a strong preference for offspring of his own (and vice versa). Failure to account for this type of correlation may bias upward the estimated effect of N_i on the amount of care received by the grandparent. The exogeneity of China's One-Child Policy enables me to account for the endogenous nature of N_i and derive consistent estimates. The identification strategy using instrumental variables and two-step regression methods are discussed in detail below.

4.1 Endogeneity of Number of G3 and Identification Strategy:

To deal with possible endogeneity in the number of grandchildren, I take advantage of an exogenous policy shock that occurred in China on a nationwide scale. Concerned with the adverse economic consequences of rapid population growth, the Chinese government started a campaign to re-shape people's preferences over family size in the 1970's and formally stipulated the One-Child Policy (OCP) in 1979. The OCP, by promoting the one-child family as an ideal and by emphasizing the equivalence of sons and daughters, has been shown to be an important factor that led to the decline in China's fertility rate in 1970's and 80's (Feeney and Feng 1993; Greenhalgh 2003; Li 2002 and McElroy and Yang 2000).

I construct an instrumental variable based on the birth year of G2's first child to account for the exogenous variation of N_i due to the population control policy. It is important to realize

[16] Resident types are determined by the "*Hukou*" (household registration) record.

that the implementation of OCP could affect fertility outcomes of couples whose first child was born shortly before 1979. The sample median of the birth spacing between G2's first two births is 3 years. Therefore, the fertility decision of G2 families whose first child was born three years prior to OCP can still be influenced by the policy. I generate an instrumental variable indicating whether the birth year of G2's first child was prior to 1977[17]. Both distributional plots (depicted in figure 2b) and the ordered Probit regression analysis (Table 1) on number of G3 confirm that G2s whose first child was born on or after 1977 are likely to have a significantly lower number of total births[18]. Moreover, as mentioned earlier the impact of OCP on number of births is stronger for urban than for rural observations.

Since the fertility-reducing effect of OCP is less significant in rural China than in the urban areas, the birth year of the first child may furnish a weak instrument for N_i for the rural sub-sample. Therefore, I construct an additional instrumental variable using the gender of the first birth based on the prediction that couples whose first child is female are more likely to have more children. This prediction is backed by two facts. First, a pervasive preference for boys in Chinese society, especially in rural areas, suggests a higher probability of subsequent childbearing if the first birth is a female. Sons are considered essential to carry on the family lineage and to provide long-term care for the elderly parents, especially in rural China where social security and pension systems are poorly developed. Second, in order to mitigate the impact of OCP on selective infanticide or abandonment of female infants in rural areas, the Chinese government modified the population policy in early 1980's to allow most rural families to have two births with minimum spacing (usually 3 to 4 years) if the first born is a girl[19]. The instrumental variable based on the gender of the first birth is more effective in predicting N_i for rural families than the urban ones. Both the distribution plots (figure 2c) and the estimation results of the ordered Probit regression on N_i (Table 1) confirm that the gender of the first birth is an important determinant of total number of births.

I use a two-step procedure to consistently estimate the effect of the number of G3 on measures of long-term care for the grandparents. In the first step I estimate an ordered Probit model using the instrumental variables described above to predict the expected N_i for each

[17] Approximately half of the G2 observations in my dataset have their first childbirth (G3) before the threshold year of 1977.
[18] The empirical results are similar when the year 1979 is used as a cutoff date for the instrumental variable.
[19] For a discussion of the practice of OCP in rural China, see Kaufman et. al 1989.

observation. Four equal intervals of the predicted outcome of N_i are calculated to assign the predicted categories for each observation regarding number of grandchildren. In the second step a Tobit model for censored data is estimated with the long-term care outcome (in terms of the value of monetary transfers to G3) as the dependent variable and the predicted categories of N_i calculated from the first step ordered outcome regression as independent variables. Below I describe the two step procedure in detail.

4.2 First Step Ordered Probit Estimation:

Treating fertility outcomes as endogenous, I estimate an ordered Probit model to predict the number of children (G3) of the adult subject G2. Specifically, I define a latent variable N_i^* as

$$N_i^* = a + b' X_i + c * birthyear_i + d * gender_i + e' prov_i + m_i, \quad i = 1,2,...I \qquad (1)$$

Index i refers to the *ith* adult child observation (G2) in the sample. *A*, *b*, *c*, *d* and *e* are parameters to be estimated, and X_i is a vector of individual and household characteristics of the *ith* G2 observation[20]. A vector of dummy variables ($prov_i$), similar to the fixed effects in a panel model, is also included in the model to capture the unobserved heterogeneity of observations across provinces. The dummy variable $birthyear_i$ equals 1 if G2's first child was born on or after 1977, while $gender_i$ equals 1 if G2's first born child is male. The residual m_i is assumed to be normally distributed. While we can observe the actual number of children for each observed G2, the underlying values of the latent variable N_i^* are not observable. The variance of the residual m_i can therefore be normalized to be one: $m_i \sim N(0,1)$.

The variable N_i is observed and ranges from 0 to 8. For now, childless observations are excluded from the analysis and will be included to address the "demonstration effect" later[21]. N_i is determined as follows:

[20] Information was collected on the health condition, education level and household income of the G2 couple at the time of the survey. These characteristics serve as proxies for attributes of G2 household in an earlier stage that led to the fertility decisions.

[21] Less than 5% of the observations are childless, and the majority of the childless G2 observations have never been married. If childless observations are to be included in the analysis, it is no longer possible to control for spousal characteristics. In the subsequent analysis of demonstration effect, childless observations are included and spousal information is dropped.

$$N_i = 1, \text{ if } N_i^* \le a_1,$$

$$N_i = 2, \text{ if } a_1 < N_i^* \le a_2,$$

$$N_i = 3, \text{ if } a_2 < N_i^* \le a_3,$$

$$\dots$$

$$N_i = 8, \text{ if } N_i^* > a_7$$

where $a_1 < a_2 < ... < a_7$, and a_i's are cutoff points to be estimated. I estimate the model using the full sample as well as separately for the rural and urban sub-samples.

Table 1 presents the marginal effects of the two instrumental variables – year and gender of G2's first birth on N_i – estimated from the ordered Probit model. The complete results from the ordered Probit regression are reported in Table T3 in Appendix A2.

The effectiveness of OCP in reducing fertility rate is shown by the estimated marginal effects of *first-G3-born-after-1977* on the predicted probabilities of various outcomes of N_i. I find that the marginal effects are positive for lower order outcomes and negative for higher order ones. Similar effects are observed for the gender of the first birth: giving birth to a girl as the first child significantly increases the probability of additional births. Overall, both indicators appear to be strong predictors for N_i, although the magnitude of the marginal effect is generally higher for the OCP indicator than the gender-of-first-birth indicator. It is worthwhile pointing out that, while both OCP and first-born-being-male decreased the probability of having more than one child for the urban sample, they have a positive effect on the predicted probability of having two children for the rural observations. These results are consistent with the predicted consequences of the OCP – while the population policy has effectively increased the prevalence of one-child families in urban China, it influenced rural families with preferences for higher order births to have two children instead.

Table 1

Marginal Effects of Year and Gender of First Birth on N_i

Ordered Probit Regression

Dependent Variable N_i = Number of G3

	(1)		(2)		(3)	
	Pooled Sample		**Rural**		**Urban**	
Number of G3	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
N=1						
Predicted Prob(N=1)	0.260		0.132		0.507	
First G3 born after 1977	0.388***	0.012	0.244***	0.013	0.564***	0.021
Gender of first G3 (male=1)	0.124***	0.012	0.095***	0.010	0.111***	0.025
N=2						
Predicted Prob(N=2)	0.490		0.467		0.394	
First G3 born after 1977	0.036***	0.009	0.192***	0.013	-0.215***	0.017
Gender of first G3 (male=1)	0.001	0.003	0.082***	0.010	-0.062***	0.014
N=3						
Predicted Prob(N=3)	0.196		0.284		0.086	
First G3 born after 1977	-0.243***	0.010	-0.188***	0.011	-0.244***	0.017
Gender of first G3 (male=1)	-0.080***	0.010	-0.084***	0.010	-0.039***	0.010
N=4						
Predicted Prob(N=4)	0.044		0.089		0.012	
First G3 born after 1977	-0.127***	0.010	-0.154***	0.010	-0.082***	0.010
Gender of first G3 (male=1)	-0.033***	0.003	-0.062***	0.010	-0.008***	0.002
Number of Observations	3934		2311		1623	

Marginal effects are calculated at sample mean.

*, ** and *** indicate significance levels of 10%, 5%, and 1% respectively.

Following the first stage ordered Probit regression, the predicted probabilities of various outcomes of N_i (numbers of G3) are calculated for each observation:

$$\Pr ob(N_i = 1) = \Phi\{a_1 - (a + b' X_i + c * birthyear_i + d * gender_i + e * prov_i)\},$$

$$\Pr ob(N_i = 2) = \Phi\{a_2 - (a + b' X_i + c * birthyear_i + d * gender_i + e * prov_i)\}$$
$$- \Phi\{a_1 - (a + b' X_i + c * birthyear_i + d * gender_i + e * prov_i)\},$$

$$\ldots$$

$$\Pr ob(N_i = 8) = 1 - \Phi\{a_7 - (a + b' X_i + c * birthyear_i + d * gender_i + e * prov_i)\},$$

Subsequently, variable $Nhat_i$ is generated from these probabilities as the expected number of G3 predicted from the first step ordered Probit regression:

$$Nhat_i = \sum_n n * prob_i(N_i = n)$$

The distribution of $Nhat_i$ is depicted in Figure 3.

Since $Nhat_i$ embodies exogenous variation in the number of grandchildren (born by G2), predicted by the implementation of OCP and the gender of the first born child, it can be used in the second step regression to derive the consistent estimator on the effect of N_i on long-term care outcomes. In order to deal with the possibility that N_i may have a non-linear impact on the long-term care outcomes, categorical variables on number of G3 instead of the continuous variable $Nhat_i$ are used in the second step regression. I assign observations into four categories according to the 4 equal intervals of $Nhat_i$, and generate a vector of dummy variables $D = (D_1, D_2, D_3, D_4)$ for each G2 observation based on the "predicted" category of his family size[22]. The vector D is subsequently included (D_1 is dropped) in the second step model as a regressor to derive unbiased estimates on the marginal effects of G2's family size on G2's long-term care arrangement for the elderly parent.

4.3 Second Step Tobit Regression Model:

T_i denotes the observed amount of money transferred[23] from G2 to G1 in a given period. T_i is censored from below since only non-negative transfers are observed. Summary statistics for T_i are reported in Table T2 in Appendix A2. The proportion of observations for which T_i is censored is 26% for the whole sample, 24% for the rural sample and 28% for the urban sample. Conditional on a positive transfer, the value of the average transfer from G2 to G1 within a year is 482 *Yuan*[24]. The transfer constitutes a non-negligible portion of the elder parent's income, given that 80% of the G1 observations do not receive any retirement salary or pension[25].

Figure 1 in the Appendix A1 shows that the average value of T_i declines as G2's own family size (N_i) increases. To determine how N_i affects the amount of transfer I estimate a Tobit

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[22] The dummy variables are defined as following for *j = 1, 2, 3, 4*.

$D_j = 1$ if $Nhat_i \frac{5-j}{4} \underset{i}{Min}(Nhat_i) + \frac{j-1}{4} \underset{i}{Max}(Nhat_i) \le Nhat_i < \frac{5-j}{4} \underset{i}{Min}(Nhat_i) + \frac{j}{4} \underset{i}{Max}(Nhat_i)$, $D_j = 0$ otherwise.

[23] G2s were asked how much financial support they provided to the elderly parent in 2001. The recorded transfer amounts do not include medical expenditures.

[24] The exchange rate at the time of the survey is approximately *1 USD = 8 Yuan*.

[25] The proportion is 93% for the rural sub-sample. Conditional on receiving retirement salary, the average annual salary is about 4500 *Yuan*.

regression model. Let T_i^* be the underlying latent variable that determines the observed amount transferred from G2 to G1 where:

$$T_i^* = a + b' X_i + l' D_i + g' prov_i + e_i \quad i = 1,2,...I \qquad (2)$$

T_i is observed to be zero if T_i^* is negative:

$$T_i = 0 \quad \text{if } T_i^* \leq 0$$
$$T_i = T_i^* \quad \text{if } T_i^* > 0$$

X_i is a vector of control variables recording characteristics of the *ith* G2 and spouse[26] and relevant characteristics of G1, including age, gender, marital status, and physical and cognitive health indicators. In addition to these demographic characteristics, variables that describe living and family care arrangements between G1 and G2 are also included in X_i. Province specific fixed effects ($prov_i$) are included in the regression equation to account for unobserved heterogeneities across different provinces. About 40% of the adult children in the dataset have young offspring(s) below the age of 18; hence a dummy variable is included in Xi to account for the presence of young grandchildren. e_i is a residual assumed to have a standard normal distribution, i.e. $e_i \sim N(0,1)$.

Generated from the first step ordered Probit estimation, D_i is a vector of dummy variables that reflect the predicted number of children for each G2 observation[27]. Since D_i is predicted using the instrumental variables generated from the birth year and gender of G2's first child, its coefficient, l, which is the main parameter of interest, can be estimated consistently. The estimated marginal effects of number of grandchildren on T_i for the pooled sample are reported in the first panel of Table 2. The marginal effects of other variables on monetary transfer can be found in Table T4 in Appendix A2.

Overall, individuals with more children transferred less to their elderly parents. This is shown by the negative marginal effects of D_2, D_3 and D_4 relative to D_1. It is clear that the effect of N_i on T_i is non-linear. Treating the first category of observations ($D_1=1$, corresponding roughly to those G2 with only one child) as the reference group, the negative effect of increasing number of G3 is statistically significant only for D_3 and D_4, corresponding to the individuals with

[26] These characteristics include age, health condition, education level and household income of the couple at the time of the survey.

[27] According to the distribution of $Nhat_i$ (Graph 3), the four dummy variables correspond roughly to predicted outcomes of one, two, three and above three children.

larger family size (3 or more children). The overall magnitude of the marginal effect is economically significant - having a large family reduces the amount of the transfer from G2 to G1 by more than 90 *Yuan*, which is approximately 25% of the predicted mean monetary transfer. Further decomposition of the marginal effects reveals that having more offspring not reduces the likelihood that G2 makes any contribution to G1's financial needs, but also significantly reduces the amount transferred to G1, conditional on a positive transfer being made. These regression results are consistent with the theoretical prediction that children enter the budget constraint of the adult individuals and the expenditure on one's own children reduces spending on long-term care for elderly parents.

I also split the sample into rural and urban sub-samples, according to the residence location of the elderly, to examine the differences in family long-term care in rural and urban China. The same identification strategies and econometric specifications apply.

The estimated marginal effects of number of grandchildren on T_i for the rural and urban sub-samples are reported in the second and third panels of Table 2 respectively. While an increase in N_i reduces T_i for both groups, the marginal effects are only statistically significant for the rural sub-sample.

Table 2

Marginal Effect of G3 dummy on Monetary Transfer Dependent Variable *Ti* = Monetary Transfer from G2 to G1 in a Year						
	(1) Pooled Sample		**(2) Rural**		**(3) Urban**	
Number of G3 ($Nhat_i$) in Categories	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
D2: 2=< $Nhat_i$ <3						
Unconditional ME: *d(Ey)/dx*	-18.200	(21.112)	-31.439^	(21.754)	-0.820	(44.813)
ME Decomposition						
Df(z)/dx	-0.017	(0.02)	-0.037	(0.026)	-0.001	(0.033)
dE(y|y>0)/dx	-12.766	(14.811)	-22.046^	(15.261)	-0.575	(31.439)
D3: 3=< $Nhat_i$ <4						
Unconditional ME: *d(Ey)/dx*	-96.768***	(27.931)	-81.866***	(29.299)	-15.691	(56.685)
ME Decomposition						
Df(z)/dx	-0.096***	(0.03)	-0.103***	(0.04)	-0.012	(0.042)
dE(y|y>0)/dx	-68.156***	(19.819)	-57.566***	(20.728)	-11.012	(39.794)
D4: $Nhat_i$ >=4						
Unconditional ME: *d(Ey)/dx*	-93.102***	(39.488)	-72.565*	(39.804)	-102.166	(78.35)
ME Decomposition						
df(z)/dx	-0.094**	(0.044)	-0.092*	(0.055)	-0.082	(0.068)
dE(y|y>0)/dx	-65.660**	(28.13)	-51.052*	(28.208)	-72.065	(55.763)
E(y)	384.436		304.576		478.968	
f(z)	0.635		0.648		0.629	
E(y|y>0)	605.337		470		762.022	
Number of Observations	3765		2207		1558	
Number of Left Censored Obs	956		511		445	
Prob>Chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.0142		0.0167		0.0141	

The omitted dummy variable is D_1.
z is defined as *Xbeta / sigma*, therefore *f(z) = prob(y>0)* is the probability that the observed outcome is uncensored
Marginal effects are calculated at sample mean.
*, ** and *** indicate significance levels of 10%, 5%, and 1% respectively. ^ indicates a significance level of 15%

4.4 Other Patterns on Family Long-term Care:

Table T4 in Appendix A2 reports the marginal effects of other individual and household characteristics on the amount of monetary transfer from G2 to G1 in a fixed time period. There is strong evidence that the needs of the elderly affect the value transferred. 54% of the urban elderly in the sample do not collect pension and these individuals received significantly larger transfers from their children.[28] The widowed elderly also receive more financial support from their children. The financial well-being of the adult child is also an important determinant of the amount transferred to elderly parents. Higher education and income levels of G2 are correlated with larger transfers to the elderly.

Although not reported in the paper, I find evidence that need-based factors influence the level of instrumental care received by the elderly[29]. The elderly who have difficulty with activities of daily living (ADL) or are cognitively impaired receive significantly more days of care from their children. These results are consistent with the existing literature (Bian, Logan and Bian 1998; Lee and Xiao 1998; Zimmer and Kwong 2003; Zimmer 2005).

Proximity between adult children and elderly is also an important dimension of long-term care arrangements. It is often observed that coresident adult children are the main providers of instrumental support for the elderly, although the causality between proximity and care provision is not clear because living locations can be highly endogenous (Zimmer 2005; Giles and Mu 2006; Pezzin et. al. 2005). Endogeneity of proximity cannot be easily accounted for within a cross-sectional dataset where transitions in living arrangements are unobservable. Nevertheless, my empirical results reveal that a coresiding adult child is less likely to provide financial transfers to the elderly and will contribute a significantly lower amount, conditional on making a positive transfer. The magnitude of the marginal effects is larger for the urban sub-sample. A speculative explanation of such phenomenon is that there exists a trade-off between monetary and instrumental support – the coresiding adult child provides hands-on care, while the non-coresiding children subsidize the elderly (or the co-residing child) with money[30]. Such results are consistent with previous findings on proximity and care provision (Zimmer and Kwong 2003).

[28] Only 7% of rural G1 observations received a pension at the time of the survey. The impact of pension status on intra-household transfer is therefore not statistically significant for the rural sample.

[29] A Tobit model is used to examine the factors that influence the amount of instrumental support received by the elderly: $S_i^* = a + b'X_i + l'D_i + g'prov_i + e_i \quad i = 1,2,\ldots I$ where S_i^* is the latent variable that determines the observed days of care G2 provided to G1. Measurement on elderly's ADL ability is also included as a covariate. Empirical results are not reported in the paper but are available upon request.

[30] Additional empirical analysis using the CLHLS data shows a positive correlation between co-residence and the amount of instrumental support from G2 to G1. While not presented in the paper, the results are available upon request.

5. Conclusion

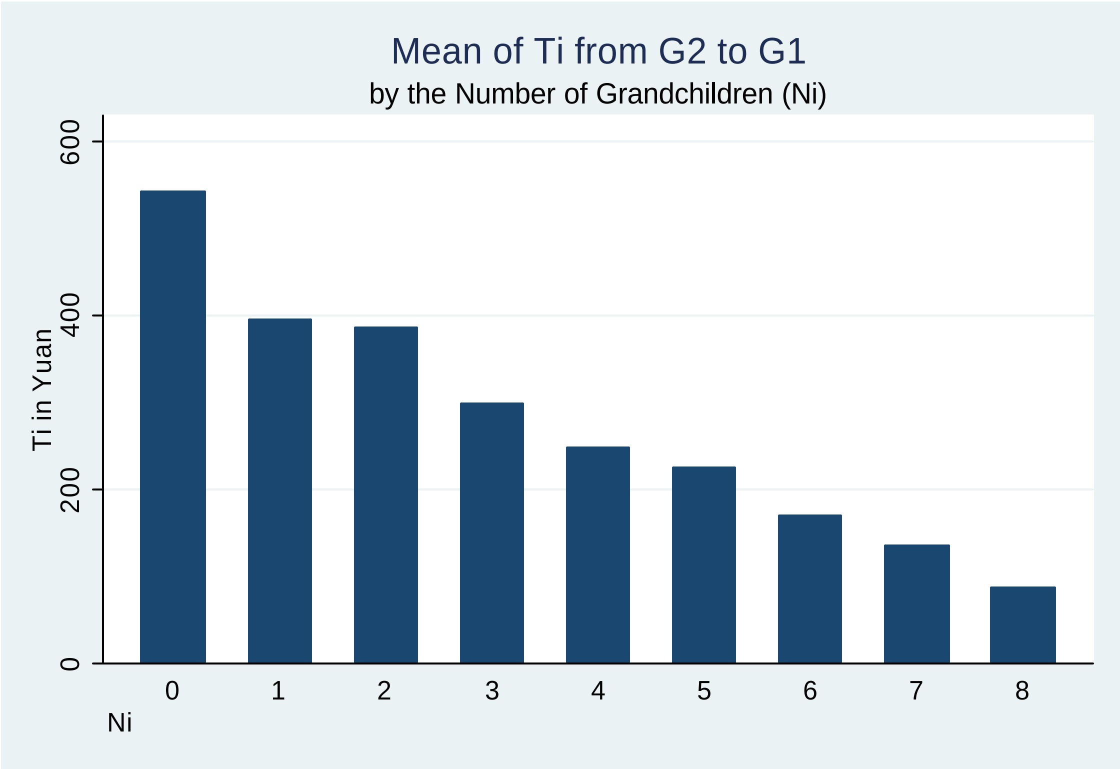
This paper demonstrates the importance of extending the economic research of family long-term care to a three-generational family setting and incorporating the impact of family size on intra-family resource allocation. Treating adult children (G2) as the primary care givers for the elderly (G1), I conduct an empirical analysis using a novel Chinese household-level dataset of the impact of the care provider's own family size on the amount transferred to the elderly. I exploit the exogenous variation in the fertility rate before and after China's One-Child Policy in late 1970's to construct instrumental variables based on the timing and gender of G2's first birth. I find that as G2's family size (measured by the number of own children) increases, the value of G2's monetary transfer to G1 declines. These findings suggest that the number of own children reduces the resources available to elderly parents.

The other empirical results presented in this paper are consistent with the existing literature on family long-term care. There is evidence of need-based transfers, providing supporting evidence for the altruistic model of a family. The findings on proximity reveal a positive correlation between co-residence and the amount of instrumental support, and a negative correlation between co-residence and the amount of financial support.

There is a popular consensus that, despite declining fertility rates and shrinking family sizes in urban China, parents appear to be spending disproportionally more resources on their young children (Rosenzweig and Zhang 2006). Therefore, it is not immediately obvious that the size of urban families relaxes the resource constraints faced by the working age population. The empirical findings in this paper show no evidence of a linkage between N_i and the amount or percentage of transfer made by a focal adult child to the elderly parent in the urban sample, while strong evidence of substitutability (between G3 and G1) is found for rural households. This evidence implies that while working age members in rural families face more strict tradeoffs between the number of children raised and the amount of resource available for elderly in the family, for urban households the total expenditure on childrearing appears to be quite inelastic with respect to the number of offspring (especially when the number is small), implying that the trend of reducing family size is not likely to lead to an increase in the amount of family resources available to the elderly generation.

Appendix A1: Figures

A1 - Figure 1
Mean of Monetary Transfer from G2 to G1 (T_i)
Plotted over Number of Grandchildren (N_i)



A1 - Figure 2
Histogram of Number of Grandchildren (N_i)

Figure 2a
Distribution of N_i for Rural and Urban Sample

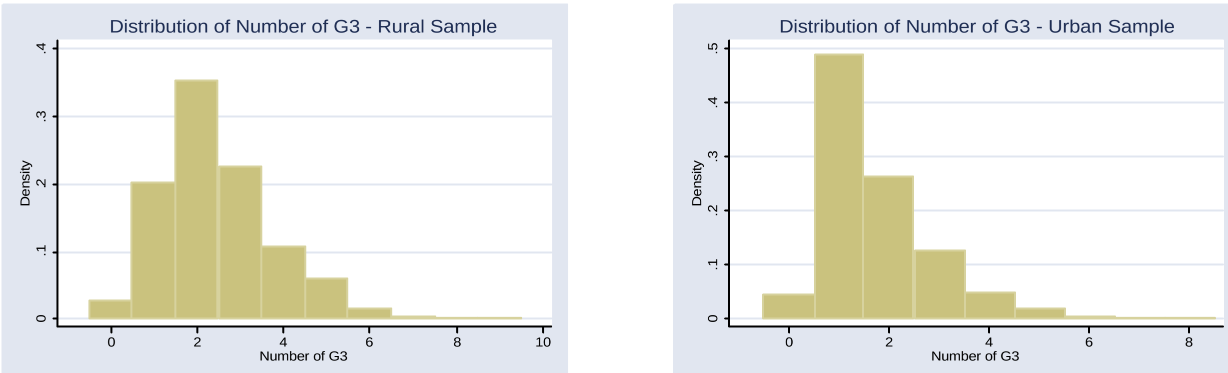
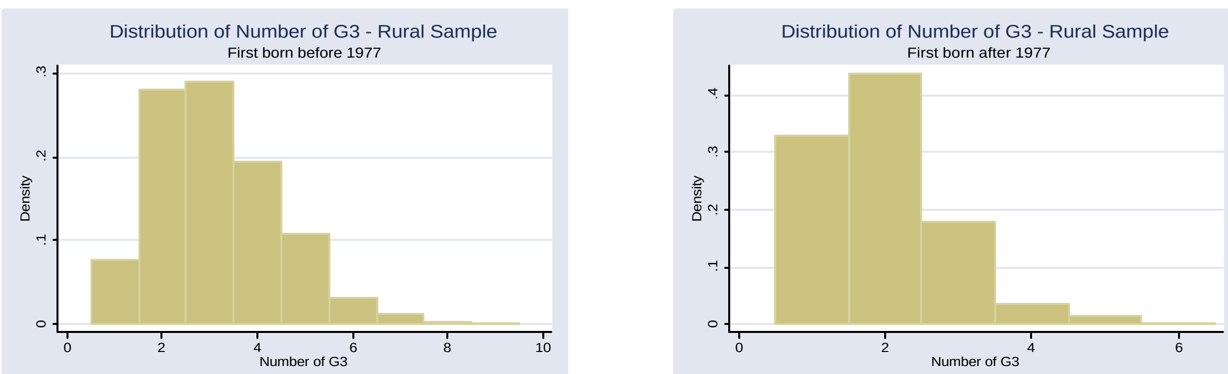


Figure 2b
Distribution of N_i - First Birth before and after 1977
Rural Sample



Urban Sample

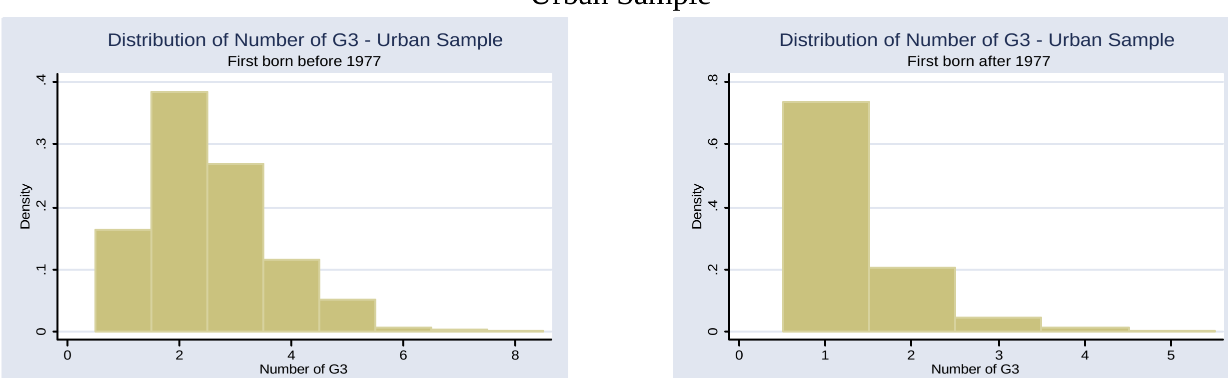
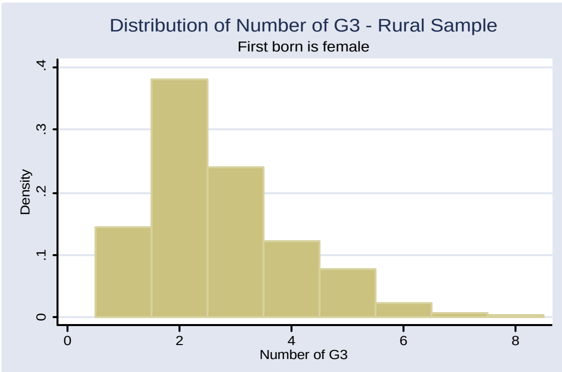
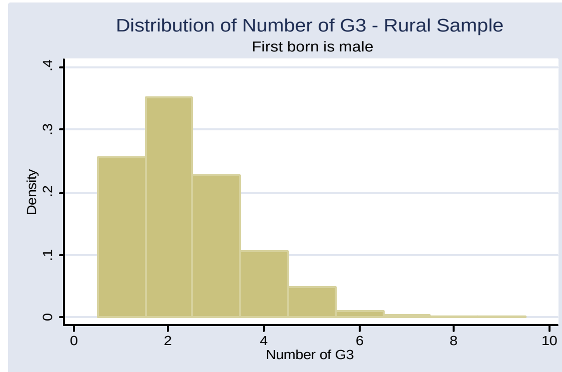


Figure 2c

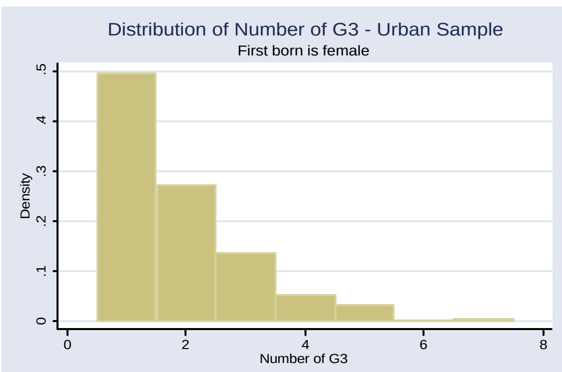
Distribution of N_i – by Gender of the First Birth

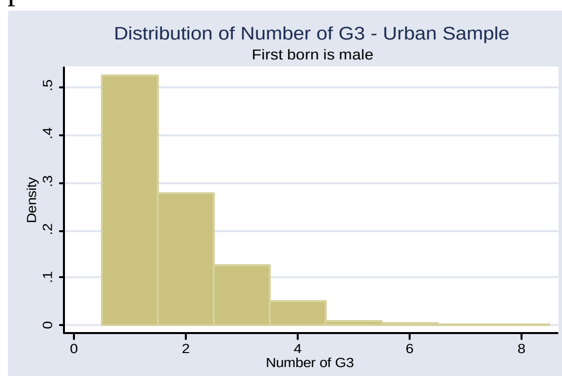
Rural Sample



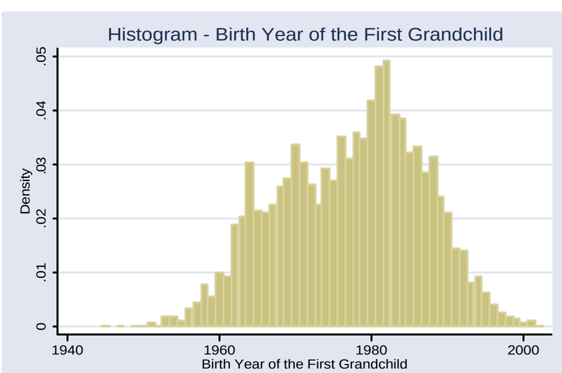


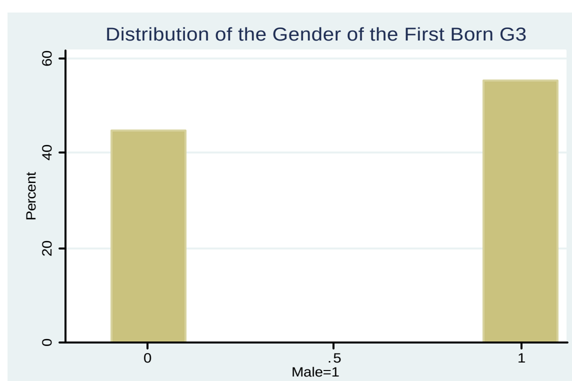
Urban Sample





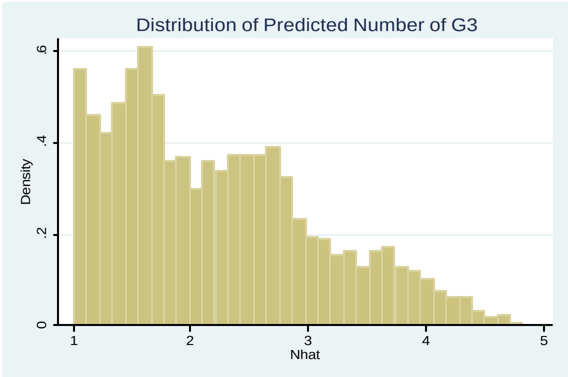
Distribution of the Birth Year and Gender of the First G3

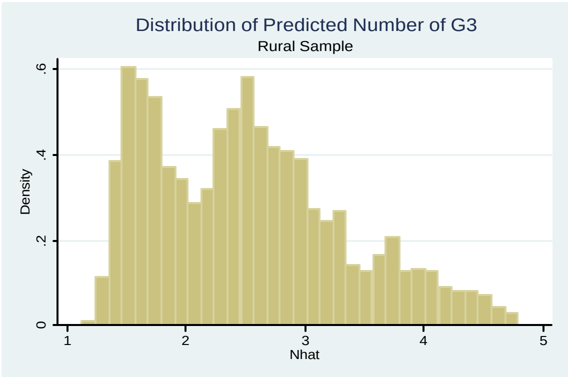


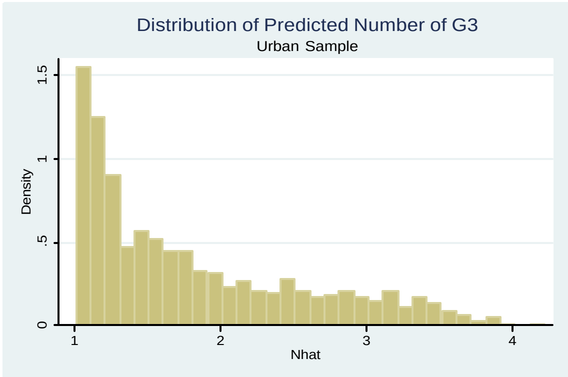


A1 - Figure 3

Distribution of *Nhat$_i$* – Predicted Numbe r of G3 Using Ordered Probit







Appendix A2 : Tables

Table T1
Summary Statistics

Variables	Pooled Sample Mean	Pooled Sample Std. Dev.	Rural Sample Mean	Rural Sample Std. Dev.	Urban Sample Mean	Urban Sample Std. Dev.
Age of G1	83.42	10.93	83.78	11.05	82.92	10.73
Gender of G1 (male=1)*	0.47	0.50	0.46	0.50	0.48	0.50
Han (Ethnicity)*	0.91	0.29	0.88	0.32	0.93	0.25
Years of Education - G1	2.28	3.55	1.54	2.64	3.33	4.33
Pension - G1*	0.24	0.42	0.08	0.26	0.46	0.50
G1's Annual Retirement Salary	899.82	2309.50	222.72	1125.26	1853.45	3083.89
Married - G1*	0.35	0.48	0.33	0.47	0.38	0.49
Severely Disabled - G1*	0.24	0.43	0.22	0.41	0.26	0.44
Moderately Disabled - G1*	0.45	0.50	0.42	0.49	0.48	0.50
Cognitively Disabled - G1*	0.02	0.15	0.02	0.13	0.03	0.17
Live Alone - G1*	0.12	0.33	0.14	0.34	0.10	0.30
Nursing Home - G1*	0.01	0.12	0.01	0.10	0.02	0.13
Gender of G2 (male=1)*	0.70	0.46	0.74	0.44	0.63	0.48
Age of G2	50.30	8.63	50.48	8.69	50.05	8.54
Years of Education - G2	7.23	3.94	5.98	3.42	9.00	3.94
Employed - G2*	0.75	0.43	0.84	0.36	0.61	0.49
Health - G2 (1=the best)	2.03	0.77	2.02	0.78	2.04	0.76
Spouse Employed - G2*	0.67	0.47	0.75	0.43	0.56	0.50
Monthly Household Income - G2	1719.97	1938.35	1364.99	1415.57	2219.78	2408.51
Number of Siblings - G2	3.04	1.82	3.13	1.80	2.92	1.84
G1 Co-resides with G2*	0.47	0.50	0.46	0.50	0.48	0.50
G1 Lives in the Same Community with G2*	0.33	0.47	0.42	0.49	0.19	0.39
Monetary Transfer (Yuan) from G2 to G1 in 2001	356.19	629.15	272.99	464.39	473.62	791.73
Amount of Money G1 gave G2 in 2001	127.63	688.78	38.94	314.56	252.53	988.36
Domestic Care G1 Provided to G2 in 2001	26.43	82.69	25.27	79.17	28.05	87.39
Child Care G1 Provided to G2 in 2001	12.14	56.57	11.37	54.12	13.24	59.85
G2's Evaluation on Long Term Care (5=Highest)	4.08	0.69	4.02	0.69	4.17	0.68
Number of Grandchildren (G3)^	2.16	1.30	2.47	1.33	1.74	1.11
Youngest G3 below 18*	0.35	0.48	0.37	0.48	0.33	0.47
First G3 Born before 1977*	0.56	0.50	0.52	0.50	0.61	0.49
Gender of the 1st G3 (Male=1)*	0.55	0.50	0.57	0.49	0.53	0.50
Number of Observations	4364		2252		1812	

* indicates dummy variable.

G1 refers to the first generation in the 3-generational family; He is the elderly parents of G2 and the grandparent of G3.

G2 is the adult child of G1. For every G1 only one adult child is chosen for the survey.

^: These grandchildren refer only to the children of G2. It does not include children of G2's siblings.

Table T2
Simple Statistics on Monetary Transfer (T_i) from G2 to G1 in 2001 (in *Yuan*)

	Unconditional Statistics			Conditional on Positive Transfer		
	Pooled Sample	Rural Sample	Urban Sample	Pooled Sample	Rural Sample	Urban Sample
Mean	356.19	273.00	473.62	481.86	360.54	663.51
Standard Deviation	629.15	464.39	791.73	689.17	503.27	867.33
Number of Observations	4348	2545	1803	3214	1927	1287

Table T3
First Stage Ordered Probit Regression
Independent Variable: Number of G3 (N_i)

Variables	Pooled Sample	Rural Sample	Urban Sample
		Estimated Coefficients	
Han (Ethnicity)	-0.092	0.016	-0.266**
	(0.069)	(0.084)	(0.122)
G2's Health (1=best)	0.020	0.040	-0.047
	(0.028)	(0.034)	(0.048)
G2's Employment Status	-0.038	0.026	-0.049
	(0.049)	(0.068)	(0.071)
Number of Siblings of G2	0.009	-0.003	0.029*
	(0.010)	(0.013)	(0.017)
Monthly Income of G2's Household	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)
G2's Education	-0.026***	-0.029***	-0.031***
	(0.006)	(0.007)	(0.010)
G2 Spouse's Health (1=best)	0.017	0.030	-0.002
	(0.029)	(0.037)	(0.049)
G2 Spouse's Education	-0.175***	-0.161***	-0.192***
	(0.017)	(0.025)	(0.026)
G2 Spouse's Employment Status	-0.090**	-0.118**	-0.082
	(0.044)	(0.059)	(0.069)
First child (G3) born before 1977	-1.320***	-1.179***	-1.582***
	(0.044)	(0.054)	(0.076)
Gender of the first child (male=1)	-0.388***	-0.460***	-0.279***
	(0.037)	(0.046)	(0.062)
City Dummy	-0.899***		
	-0.065		
Town Dummy	-0.365***		
	(0.049)		
Number of Observations	3934	2311	1623
Pseudo R-Square	0.2341	0.1761	0.2691
Prob>Chi2	0.0000	0.0000	0.0000

Childless observations are not included.
Province fixed effects are included in the regressions to account for possible unobserved heterogeneities across provinces.
G2 refers to the second generation in the 3-generational household, they are the adult children of the elderly;
G3 refers to the third generation of the 3-generational household; they are the grandchildren of the elderly and children of G2.
Standard errors are in the parentheses. *, ** and *** indicate significance levels of 10%, 5%, and 1% respectively.

Table T4
Marginal Effects Estimated by Tobit Model - Second Step Regression
Dependent Variable *Ti* = Monetary Transfer from G2 to G1 in 2001

Variables	Pooled Sample		Rural Sample		Urban Sample	
	Marginal Effect	**Std. Error**	**Marginal Effect**	**Std. Error**	**Marginal Effect**	**Std. Error**
G1's Age	-1.732*	0.997	-0.397	0.998	-2.546	2.062
G1's Gender (male=1)	29.550*	16.560	34.721**	16.888	3.049	33.618
G1 receives pension	-131.034***	23.429	-28.720	34.947	-175.898***	41.297
G1 married	-44.379**	18.930	-36.506*	19.426	-35.597	37.400
G1 lives in nuring home	84.462	72.216	-83.428	67.396	217.070*	130.670
G2 gender (male=1)	-11.580	18.213	-34.933*	20.586	5.899	33.399
G2's age	3.843**	1.640	0.614	1.615	8.372**	3.565
G2 employed	57.441***	18.836	14.165	22.416	111.986***	33.644
G2 spouse employed	-42.199**	17.805	-44.641**	19.854	-35.695	32.548
Years of Education - G2	10.831***	2.330	9.170***	2.479	11.731***	4.516
Number of G2's siblings	-7.630*	4.059	-8.879**	4.237	-7.991	7.804
G2's monthly household income	0.034***	0.004	0.050***	0.006	0.028***	0.006
G1 co-resides with G2	-93.810***	22.010	-39.200^	27.124	-152.646***	37.795
G1 lives in the same neighborhood with G2	-44.514**	20.976	-6.010	24.698	-83.587**	38.457
G2's subjective valuation on long term care	33.701***	10.521	31.642***	10.719	29.704	20.861
The youngest G3 is below 18	-37.340*	20.549	-32.840^	20.633	-27.372	42.063
E(*Ti*) predicted by the model	384.436		304.576		478.968	
Number of Observations	3765		2207		1558	
Number of Left Censored Obs	956		511		445	
Prob>Chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.0142		0.0167		0.0141	

Marginal effects are calculated at sample mean.
*, ** and *** indicate significance levels of 10%, 5%, and 1% respectively. ^ indicates a significance level of 15%
Province fixed effects are included in the regressions to account for possible unobserved heterogeneities across provinces.
G1 refers to the first generation in the 3-generational family; they are the parents of G2 and grandparents of G3.
G2 refers to the second generation in the 3-generational family; they are the adult children of the elderly;
G3 refers to the third generation of the 3-generational family; they are the grandchildren of the elderly and children of G2.

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