Who Coreside with Parents?
An Analysis based on Sibling Comparative Advantage

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Abstract

We analyze theoretically and empirically how old parents coreside with their economically independent adult children. We show that family decisions on with which child the parents coreside can be rationalized. To be specific, we find evidence suggesting division of labor among family members through the choice of coresidence. Theoretically, we show that when parents can help children with housework, they will choose to coreside with higher educated children whose opportunity cost of housework is higher. On the other hand, when parents need help from children in housework labor, they will choose to coreside with lower educated children whose opportunity cost of housework is lower. The two hypotheses are confirmed by analysis of a dataset from China containing information on parents and all of their adult children. The probability of coresidence is positively associated with relative education of the children when parents can provide help and negative when parents need help.

1. Introduction

In developed countries, coresidence between elderly parents and economically independent adult children is not a common phenomenon. In the United States, only 18% individuals aged 65 and over live with adult children (Kreider 2007). However, in developing countries, especially East Asian societies, coresidence is much more common. According to the 2005 China Inter-Census Survey data, two thirds of people aged 65 and over live with their adult children (Zeng and Xie 2011). Similar high parent-child coresidence rates are also reported in Taiwan, Japan and South Korea (Chu, Xie and Yu 2011; Kim 2010; Takagi and Silverstein 2011). Thus it is practically important to understand how these huge numbers of families make decisions on the patterns of coresidence and how their choices would affect their welfare. Also, coresidence choice can be viewed as a sample to help us generally understand family decision making processes.

Economists have long been trying to understand family decisions within the rational choice framework (Becker, 1982; Ashenfelter and Heckman, 1974; McElroy and Horney, 1982; Manser and Brown 1980; Pezzin and Schone, 1999). In this research, we show that the decision problem that with which child old parents coreside, can be described as if the family is making rational choices. Specifically, when the whole extended family[2] faces different resource constrains, we manage to observe different patterns of division of labor according to sibling comparative advantage. Consequently, we argue that division of labor according to comparative advantage is a strong indicator of rationality in family decision making process.

Theoretically, we model family choice as maximizing the utility of all family members through allocation of labor endowment to either labor market or housework service. Under this framework, coresidence is modeled as parents sharing their own labor endowment and housework service demand with the child they coreside. Under certain assumptions, we find that the pattern of coresidence is associated with labor endowment of the parents. When parents' labor endowment is high, parents tend to coreside with relatively higher educated children. On the other hand, when parents' labor endowment is low, parents tend to coreside with relatively lower educated children. The intuition of the

[2] An extended family is composed of parents and all children's nuclear families.

results is associated with children's opportunity cost of providing housework service, which is foregone labor market income and supposed to be positively associated with education level of the children. When parents have high labor endowment, which exceeds their own needs, parents can help children with housework[3]. Thus it will be more efficient from the view of the whole family to let parents help children whose opportunity cost of housework is higher. Then we should observe high labor endowment parents coresiding with higher educated children who have comparative advantage in labor market. In contrast, when parents' labor endowment is low, parents may need help from children in housework service. Then we should observe the contrary that parents coreside with lower educated children whose opportunity cost of housework is lower and have comparative advantage in housework.

Empirically, we use an extended household fixed-effect logistic model and a dataset from China to test above two main hypotheses. We find that the probability of coresiding with parents for a specific child is positively associated with his/her education level relative to his/her siblings' when parents are young and healthy (high labor endowment). However the positive coefficient decreases and finally becomes negative as the health status of the parents decreases and age of the parents increases (labor endowment decreases). The observations are generally supportive to our hypotheses.

Applying the family rational choice framework, our study complements researches on coresidence between elderly parents and adult children. Most of studies on this subject address issues in East Asian Societies, where coresidence is more common than Western Societies. Therefore, these studies usually focus on the cultural and institutional differences between Eastern and Western societies (Chu, Xie and Yu 2011; Takagi and Silverstein 2011; Kim 2010; Zeng and Xie 2012). However, our study, using samples from China, reveals that besides cultural and institutional uniqueness, family decisions in Eastern Asian society also possess some common features which can be fitted into the general rational choice model of family.

We also have a methodology contribution in our empirical strategy. To the best of our knowledge, we are the first research to use an extended family fixed-effect model in the study of coresidence. This model helps us to study how the characteristics of one

[3] We suppose parents' labor cannot be inputted into labor market to model the situation that parents are old and already retired from work.

child relative to his/her siblings' affect family choices. This empirical model fits well with our theoretical model because "comparative advantage" is our main concern. We believe the same method can also be applied in other context to extend the scope of the study of family choice problem.

Finally, we hope our theory and empirical evidence could provide some micro foundations for our understanding of macro trends in the change of coresidence patterns, such as the famous decreasing trend of coresidence in modern societies (Lee, Parish and Willis 1994; Ruggles, 2007). As the famous theory by Adam Smith that "*Division of labor is limited by the extent of the market*", further increases of efficiency through specialization are still confined by the family boundaries. Thus, pursuit of efficiency may finally terminate the function of coresidence as a way of sharing family labor, replacing it with a more socialized and market based system, for instance housework market and social elderly support services.

The rest of our paper is organized as follows: the second part reviews related literature; the third part presents our theoretical framework and two main hypotheses; the fourth part discusses our data and empirical methods; the fifth part presents our empirical results and the final part concludes.

2. Related Literature

Our research is related to the following four strands of literature.

Firstly, we show that family decisions on coresidence can be fitted into the economic model of family choice, which was initiated by Becker (1982) and followed by a growing literature (Ashenfelter and Heckman, 1974; Lundberg and Pollak, 1994; McElroy and Horney, 1981; Manser and Brown 1980; Pezzin and Schone, 1999 as examples). Our theoretical analysis shows that rational choice economic models can be useful in uncovering new hypothesis regarding family decisions. Furthermore, our empirical analysis supports the rational choice hypothesis. Thus we are contributing new evidence to support the validity of using economic approach in the study of family.

Secondly, our analysis may be interesting to sociologists and demographers who are specialized in the study of coresidence between elderly parents and adult children. In existing literature, most of the analyses focus on factors that determine whether elderly parents coreside with adult children or live independently. A lot of factors from both the

parents' side (DaVanzo and Chan 1994; Takagi and Silverstein 2011; Englehardt et al. 2005; Ruggles 2007) and the children's side (Lee, Parish and Willis 1994; Chu, Xie and Yu 2011; Takagi and Silverstein 2011) are carefully examined. These studies usually employ an "inter-household" comparison approach, which compares characteristics of individuals from different families. Besides determinants of whether to coreside or not, we also find in previous literature some concluding remarks on the question that with which child the parents will coreside. For example, Lee, Parish and Willis (1994) and Takagi and Silverstein (2011) find that education and income of children are negatively correlated with coresidence with parents. The authors claim that it provides indirect evidence that more affluent children may purchase privacy by shifting the duty of coresidence to their poorer siblings. However, we argue that the authors' claim are neither deducted from a clear theoretical framework nor concretely supported by empirical evidence, because the studies are "inter-household" comparison in nature, but the question requires an "intra-household" comparison. Specifically, we show through theory that when parents make the decision of with which child they coreside, it is the "relative" rather than the "absolute" characteristics of children that really matters ("comparative" rather than "absolute" advantage). Therefore we think the "inter-household" comparison framework in current literature is inadequate in addressing this issue and thus develop an "intra-household" comparison approach. Basically, we collect data on almost all adult children in the extended family and then use an extended household fixed effect model. In the next step, we estimate how the characteristics of each child relative to his/her siblings affect the decision of coresidence.

Third, our research is also related to studies on living with parents and labor supply of the children (Ettner 1995; Maurer-Fazio et al. 2011; Sasaki 2002; Pezzin and Schone, 1999; Mutchler and Baker, 2009). These studies reveal that parents who are capable of housework could increase labor force participation rates of females in the coresidence family. Also, disabled parents may reduce market labor supply of the household. On one hand, our analysis is based on the empirical findings of these works. On the other hand, our study shows that labor supply and coresidence are jointly determined by an extended family decision process. Thus these studies might suffer endogenity problem if the decision process is neglected.

Finally, our study is associated with literature on children provided elderly support to their aging parents. To the best of our knowledge, no rigorous empirical study on this topic has been conducted in western developed countries, which is probably due to the fact that western parents are not that dependent on children in their old age. However, in the body of literature discussing intergenerational relationships in East Asia, how children support parents under the indoctrination of filial piety is most frequently studied. It is revealed that sons rather than daughters are most obliged to support elderly parents (Whyte 2004; Whyte and Xu 2003). Correspondingly, East Asian parents are also found to be more likely to coreside with sons than daughters (Logan and Bian 1999; Takagi and Silverstein 2006). However, with regard to monetary transfer, evidence shows that nowadays it is actually daughters rather than sons who give more money to parents (Xie and Zhu, 2009). Unfortunately, except for gender difference, previous studies pay little attention to the division of labor among siblings. Therefore, in this study, we try to shed some light on how the burden of elderly support is shared among siblings.

What's more, our paper shows that we can synthesize into one general theoretical framework the situation that parents help children and the situation that parents are burden. We use parents' labor endowment as an analytical concept and show that our rational choice framework can help to understand both situations.

3. Theoretical Framework and Hypotheses

In this section, we derive our main hypotheses from rational choice theory of family. The literature on rational choice theory of family basically falls into two categories. The "unitary" approach, represented by Becker (1982) and Ashenfelter and Heckman (1974), assumes that the family makes decision as a single agent. Thus, family choices are modeled as if to maximize the total utility of all family members. Since the "unitary" approach is found to be inconsistent with many empirical findings, a second approach, the "bargain" approach is developed (McElroy and Horney, 1981; Manser and Brown 1980; Pezzin and Schone, 1999). In the "bargain" approach, each family member makes his/her own rational decisions and the outcome for the family is the result of family members bargaining. In our studies, we will take both approaches. We will show that under certain assumptions, both ways of modeling family behavior can lead to our main

empirical hypotheses.

3.1. Basic assumptions:

To begin with, we make several basic assumptions.

(1) Family structure: each extended family has one representative parent and N children. Each child holds his/her own nuclear family.

(2) Endowment assumption: parent has exogenous labor endowment: $L^p, L^p \geq 0$. Each child has exogenous labor endowment $L_n^c, L_n^c \geq 0$.[4] Children can either work in the labor market or doing housework while the parent's labor can only be inputted to housework.[5]Each child has exogenous human capital endowment $H_n, H_n \geq 0$. Labor market wage corresponding to human capital H_n is suppose to be W_n. Without loss of generality, suppose $H_n \geq H_{n-1} \geq \cdots \geq H_2 \geq H_1$, thus $W_n \geq W_{n-1} \geq \cdots \geq W_2 \geq W_1$.

(3) Behavior Assumption: Coresidence in this model is defined as parent sharing housework labor with the child they choose to coreside with. Suppose the parent choose to coreside with the ith child and form a new family. From the supply side, the labor endowment of the coresided family becomes $L^p + L_i^c$; From the demand side, the housework demand of both the ith child and the parent should be satisfied with this labor supply.

(4) Family members benefit from two goods: consumption goods that can be purchased by labor market income and housework service, which can be produced by housework labor input. A key assumption is that family members from an extended family can transfer income across nuclear families, while housework labor is not transferable. In other words, housework service can only be produced by the labor endowment of the nuclear family. We also assume that human capital endowment will only positively affect market production but do not affect housework production. We will maintain these assumptions throughout this paper.

[4] Since the trade-off between consumption and leisure is not essential in our model, we treat labor supply as exogenous to simplify our model.

[5] Thus we are trying to model a situation where parents got retired and no longer work at the labor market.

3.2. The Unitary Approach

In the unitary approach, it is assumed that the large extended family including the parent and all children behaves as if there is a family planner that maximizes the utility of all family members.

Suppose the parent coresides with the ith child, the family planner's problem could be described as follows:

$$\underset{\{C_1,\cdots,C_n,C_p;L_1^{ch},\cdots,L_n^{ch};L^{ph}\}}{Max} U(C_1,\cdots,C_n;L_1^{ch},\cdots L_n^{ch};C_p,L^{ph})$$

Subject to:

(1) $C_1+C_2+\cdots+C_n+C_p \le \sum_{k=1}^{n} W_k L_k^{cc}$

(2) $L_n^{cc}+L_n^{ch} \le L_n^c$ for all $n \ne i$

(3) $L_i^{cc}+L_i^{ch}+L^{ph} \le L_i^c+L^p$

(4) $C_n>0; C_p>0; L_n^{cc}>0; L_n^{ch}>0; L^{ph}>0$

where C_n denotes the consumption of the nth child; L_n^{ch} denotes housework service for the nth child; C_p denotes consumption of the parent; L^{ph} denotes housework service for the parent and L_n^{cc} denotes market labor input of the nth child.

The first constrain is saying that total consumption of the extended family should not exceed total market revenue. The second and third constrains require that labor input should be smaller than or equal to labor endowment for each nuclear family. The key part of this model is the constrain for the coresidence child. The third constrain shows that the sum of labor inputted to the market, labor inputted to the production of child's housework service and production of parent's housework service should be smaller than or equal to the endowment of the child plus the endowment of the parent.

From this maximization problem, the planner should derive indirection utility function V^i, which is the maximum utility level that could be achieved when parent coresides with the ith child. We suppose the planner will compare all V^is and make decisions of with which child the parent should coreside in order to maximize V^i.

In the following part of this section, we impose some constrains on the form of utility

function to deduct some testable hypothesis from this model.

Utility Function Assumptions:

(1) Utility function of the family planner is of the following form:

$$U = \sum_{k=1}^{n} C_k + C_p + \sum_{k=1}^{n} h(L_k^{ch}) + h(L^{ph});$$

(2) $h'(x) > 0, h''(x) < 0;$

(3) $\lim_{L \to 0} h'(L) = \infty$, $\lim_{L \to \min(L, \frac{L+L_p}{2})} h'(L) = 0$.

We show in the first assumption that the utility function is additive separable and quasi-linear in consumption. Assuming additive separable is for the convenience of computation. The quasi-linear property comes from the fact that income is transferable across nuclear families. Thus what is important for the planner is only total income. The second assumption implies that the utility from housework labor service is concave and therefore has diminishing returns. The third assumption is a purely technical assumption to ensure the existence of interior solutions. This assumption can be relaxed to incorporate the situation that some children only specialize in housework. We also assume all children have same labor endowment when doing calculation.

PROPOSITION: Under basic assumptions and utility assumptions, the solution to the unitary model is that the parent either coresides with the lowest educated child or the highest educated child. There is a threshold value L_p^*, when $L_p > L_p^*$, the parent coresides with the highest educated child; when $L_p < L_p^*$, the parent coresides with the lowest educated child.

Proof. See the Appendix.

To develop an intuitive understanding of this proposition, we think it is helpful to look at the indirect utility function which is the maximum level of utility that could be achieved when the parent coresides with the ith child

$$V^i = \sum_{k=1}^{n} w_k (L - G(w_k)) + \sum_{k=1}^{n} h(G(w_k)) + w_i (L_p - G(w_i)) + h(G(w_i)) \qquad (1)$$

where $G(x) = h'^{-1}(x)$.

Notice that the first two terms of equation (1) are invariant to coresidence decision. Therefore we focus on the last two terms. We can verify that the third term is increasing with w_i. Thus it implies the benefits of coresiding with higher educated children. When the parent helps these children with housework, the children's labor would be liberated and earn higher income from the labor market. It looks as if the parent's labor endowment L_p is earning the wage of the coresidence child. However, coresiding with higher educated children also have cost which is summarized in the fourth term. The fourth term is decreasing with respect to w_i (G is decreasing with respect to w_i). This term shows that when the parent coresides with higher educated children, because of the higher opportunity cost of housework labor, in equilibrium, less housework service will be provided to the parent, reducing utility from the welfare of the parent. Therefore, the key trade-off of our model is how households balance the benefits and costs. When L_p is high, benefits obviously overweigh costs, thus the parent will coreside with the highest educated child. When L_p is low, however, benefits could be smaller than costs. The coresidence pattern could also be completely reversed.

3.3. The Bargain Approach

In the bargaining approach, we assume that each family member has his/her own utility maximization problem and family members react rationally to the choices of other family members. Suppose the utility function of the parent and a representative child is:

$$U^p(C_1,\cdots,C_n;L_1^{ch},\cdots L_n^{ch};C_p,L^{ph})$$

$$U_n^c(C_1,\cdots,C_n;L_1^{ch},\cdots L_n^{ch};C_p,L^{ph})$$

Notice that the utility of a family member will not only be affected by the consumption and housework service of his own but also his relatives'. Following Becker (1982), we use this utility functional form to model altruism among family members.

Further we assume that each child can choose to transfer market revenue to the parent and other siblings. Transfers to parent from the ith child is denoted as T_i^p and net transfer from the nth child to the mth child is denoted as T_{nm}.

We use a non-cooperative game theory framework[6] to characterize the interaction between the parent and all children. The sequence of decisions is as follows:

(1) The parent decides with which child he/she will coreside.

(2) All Children decide simultaneously market labor supply, housework labor supply and transfers.

A Nash Equilibrium can be acquired through backward induction. We define the equilibrium solution as follows:

DEFINITION: The equilibrium solution to the bargaining approach is defined as parent's choice of i^* (with the ith child he/she coreside); Non coresidence children's choice of L_n^{cc*} (market labor), L_n^{ch*} (housework service), T_{nm}^* (net transfers to other siblings) and T_n^{p*} (transfers to the parent); Coresidence child's choice of $L_i^{cc*}, L_i^{ch*}, T_{im}^*, T_i^{p*}$ and L^{ph*} (parent's housework service);

Such that:

(1) Given i^*, all other children's choices of $L_n^{cc*}, L_n^{ch*}, T_{nm}^* \; T_n^{p*}$ and coresidence child's choice of L^{ph*}, non coresidence child k chooses $L_k^{cc*}, L_k^{ch*}, T_{km}^*, T_k^{p*}$ to maximize utility

$$U_k^c(C_1,\cdots,C_n;L_1^{ch},\cdots L_n^{ch};C_p,L^{ph})$$

where $C_n = W_n \times L_n^{cc*} - \sum_{m=1}^{n} T_{nm}^* - T_n^{p*}$ for all n and $C_p = \sum_{k=1}^{n} T_k^{p*}$.

Under constrains:

$L_k^{cc*} + L_k^{ch*} \le L_k^c$, $C_k \ge 0$, $T_k^{p*} \ge 0$;

(2) Given i^* and all non coresidence children's choices of $L_n^{cc*}, L_n^{ch*}, T_{nm}^* \; T_n^{p*}$, coresidence child i choose $L_i^{cc*}, L_i^{ch*}, T_{im}^*, T_i^{p*}$ and L^{ph*} to maximize utility

$$U_i^c(C_1,\cdots,C_n;L_1^{ch},\cdots L_n^{ch};C_p,L^{ph})$$

Under constrains:

$L_i^{cc*} + L_i^{ch*} + L_i^{ph*} \le L_i^c + L^p$, $C_i \ge 0$, $T_i^{p*} \ge 0$;

(3) Given children's equilibrium reaction to the parent choice of i, $L_n^{cc*}(i)$, $L_n^{ch*}(i)$,

[6] If family members cooperate, we suppose they can achieve the unitary approach results.

$T^{*}_{nm}(i)$, T_n^{p*} (i) and L^{ph*} (i), parent choose i^{*} to maximize utility

$$U^{p}(C^{*}_{1}(i),\cdots,C^{*}_{n}(i);\quad L_1^{ch*}(i),\cdots L_n^{ch*}(i);\quad C^{*}_{p}(i),L^{ph*}(i))$$

where $C^{*}_{n}(i)=W_n\times L_n^{cc*}(i)-\sum_{m=1}^{n}T^{*}_{nm}(i)-T_n^{p*}(i)$ and $C^{*}_{p}=\sum_{k=1}^{n}T_k^{p*}(i)$

The solution to the bargaining approach depends on the specification of altruism and the functional form of utility function. In the simplest case, if we assume all family members share the same utility function as specified in the unitary approach, the solution to the unitary approach is also the solution to the bargain approach. The empirical implications described in the proposition of previous section still hold. However, this coresidence pattern is no longer sustained by a family planner or family member negotiation, but by the voluntary transfer of income among siblings and parents because of altruism. We will use a simple example to illustrate this point. In this case, the parent has low L_p and thus needs help from children. There are two children in the family with one higher educated. According to our theory, we should observe that the parent chooses to coreside with the less educated child. On the other hand, the more educated child will contribute transfer to the coresided child and the parent. When children make decisions non-cooperatively, both of them find it beneficial from their own interest to let the less educated child take care of the parent and the educated contribute monetary transfer. This is because all family members know that other members are altruistic and will transfer income to increase the welfare of all members and the higher educated child obviously has ability to provide more monetary transfer to the parent and other siblings. The parent knows that children could make such an agreement and therefore will choose to coreside with the less educated child. As a result, the division of labor is formed that the higher educated child provide monetary income and the less educated child provide housework service for the parent. It looks as if the higher educated child is “buying” housework service of the lower educated child, which is a point discusses in previous literature (Lee, Parish and Willis 1994).

3.4. Empirical Hypotheses

To sum up, we restate our hypotheses formally as follows:

Hypothesis 1: When parents have high labor endowment (could be approximated for example by health and age), they are more likely to live with children with higher human capital endowment (measure by education), because these children have higher opportunity cost of providing housework labor

Hypothesis 2: When parents have low labor endowment, they are more likely to live with children with lower human capital endowment (measure by education), because these children have lower opportunity cost of providing housework labor.

4. Data and Methods

In order to test our hypotheses, we use data from the mainland China sample of "Panel Study of Family Dynamics (PSFD)". This survey was conducted in 2004 by Taiwan Academia Sinica. The sample was drawn using a stratified three-stage random sampling procedure, from Shanghai, Zhejiang and Fujian. In each observation, one of the children of the extended family is picked up as respondent. Then the respondent is asked about his/her own characteristics, his/her parents' characteristics and as many as 5 of his/her siblings' characteristics. Then the respondent is asked whether he/she is coresiding with parents. If not, the respondent is asked which child the parents are coresiding with and the coresidence child's characteristic if not previously reported. Given this data structure, we can acquire information on as many as six children of the extended family as well as the parents[7]. And we can make sure that the information on coresidence children is included. Therefore, we think the data could meet our research purpose very well.

To construct our analytical sample, we reshape the data and make each child of the family as an observation. For example, if the respondent reports information of his four siblings, we could obtain as many as five observations for that extended family in our analytical sample (four siblings and the respondent). Then, we match children with the characteristics of their parents accordingly. We further restrict our sample by the

[7] For the majority of respondents, information on at most five siblings was collected. However, if the birth order of the parents-coresidence sibling is larger than six, his or her information will be collected by a set of separate questions in the survey. If father and mother coreside with different children, the dummy dependent variable "coresidence with parents" will be coded as 1 for both cases.

following criteria: (1) At least one parent is still alive; (2) Parent(s) coreside with at least one of their children; (3) Families have at least two children; (4) Parent(s) age 50 or beyond; (5) Children (siblings) age 18 or beyond[8]. In total, we construct an analytical sample of 6,124 observations from 1,481 respondents (extended households).

We use a household fixed-effect logistic regression model (McFadden, 1974; Woodridge, 2001) to test above two hypotheses. The fixed-effect model makes it possible to conduct within family comparisons. All extended family specific effects are already controlled in the model, such as the average education level of the family. Thus we are able to explore how differences among children within the same family affect the decision of coresidence.

Our empirical model is presented as follows:

$$p(y_{ij}=1 \mid x_{ij}, c_j; \beta) = \frac{\exp(x'_{ij}\beta + c_j)}{1+\exp(x'_{ij}\beta + c_j)}$$

$$x'_{ij} = (1, edu_{ij}, edu_{ij} \times PHealth_j, edu_{ij} \times PAge_j, CH_{ij})$$

where the subscript j denotes extended households, and subscript i denotes the i[th] child in the j[th] household. The dependent variable y_{ij} of this study is a dummy indicating whether the child is coresiding with at least one of the parents (1 for coresidence and 0 otherwise). Thus, our empirical model addresses how the independent variables will affect the probability of coresidence with parents. Among all of our independent variables: *edu* refers to years of schooling of children; *PHealth* is self-reported health status of the parents (From 1 to 5; higher value of this variable represents poorer health condition). We try to use this variable to measure labor endowment of the parents (unhealthy parents have less labor endowment). Since parents' health status may be endogenous to the decision of coresidence (coresidence may affect health), we also tried parents' age as an alternative measurement, because age could be regarded as exogenous to family member's choices[9]. We expect to observe the main effect of *Yedu* is positive, indicating that healthy and young parents tend to coreside with highly educated children. On the

[8] For most individuals in the analytical sample, they were born before the strict implements of the one-child policy in China.

[9] When we have two parents alive, we record health status of the less healthy parent and age of the older parent.

other hand, the coefficients of the interaction terms (*Yedu*PHealth* and *Yedu*PAge*) should be negative, indicating that when the parents become unhealthy and old, the possibility of living with highly educated children will decrease. *CH* is a vector of control variables that differ from one child to another within family; c_j is extended family fixed effect, which captures observable and unobservable characteristics that are common to all children from the same extended family.

5. Empirical Results

5.1 Descriptive Statistics

Table 1 reports descriptive statistics of our analytical sample. For the purpose of demonstrating how coresidence children differ from non-coresidence children in terms of various characteristics, we present means and standard deviations for not only the full sample but also the conresidents and non-coresidents samples separately. It shows that around one thirds of individuals in our analytical sample are currently living with at least one alive parent. The proportion of female is approximately 47% in the full sample, 15% in the coresident sample and 63% in the non-coresident sample. Such distributions suggest that sons are much more likely to live with parents than daughters in contemporary China. The average age of children (sibling) is very similar across the three samples—40 for children. In addition, statistics also show that coresident children are more likely to be firstborn sons and they on average receive one more year of schooling than non-coresident children. In terms of parents' characteristics, they turn out to be similar across different samples. While the health status of most parents is "so-so", the average age of parents is around 70. Finally, Table 1 also informs us that for the majority of individuals in our analytical sample, their parents do not own much wealth themselves.

5.2 Main Results

Table 2 reports our major findings. In order to compare our findings with previous studies, we run both conventional logistic regressions (inter-family comparison) and extended household fixed-effect logistic regressions (intra-family comparison). Model 1 is the baseline model, in which only the key independent variable—years of schooling—as well as some control variables are included. It is shown that the effect of

years of schooling is positive and significant under the conventional logit model but it turns out to be negative and insignificant under the fixed-effect model. Such inconsistent finding suggests that without taking into account the household level unmeasured characteristics, the logit estimation is biased. What's more, we also learn from the insignificant coefficient under the fixed-effect model that no systematic pattern about sibling comparative advantage could be found if we do not consider parents' characteristics. On the basis of the baseline model, we use parents' health status to approximate parents' labor endowment in Model 2. In Model 3, we use parents' age as an alternative measurement and finally in Model 4, we include both measures. Overall speaking, results estimated by household fixed-effect models are more supportive to our hypotheses. In Model 2 and Model 3 under the fixed-effect estimation, the coefficients of education's main effect are positive and significant, indicating that parents tend to coreside with children whose human capital endowment are higher when they are healthy (young). The coefficients of the interaction between education and health status (age) are negative, indicating that as parents become less healthy (older), education level of the children they coreside with also decreases. Similar results could also be found in Model 4, where both measures are included. In sum, the signs of coefficients of all models under the fixed-effect estimation are qualitatively consistent with the predictions of our hypotheses[10].

In Figure 1 and Figure 2, we report marginal effects of years of schooling by different health status and age groups of parents. In both figures, the overall trends are declining. We could tell from the statistics that as parents' health condition deteriorates or as they get old, the marginal effect of years of schooling on coresidence become more and more negative. These two figures give us some more sense about the magnitude of the effect of children's education on coresidence with parents.

5.3 Rural Origin V.S. Urban Origin

In our model, we unrealistically assume that a labor market for elderly care does not exist. However this is not the case in contemporary China, especially in the urban area. Since we do not have information on elderly care market utilization of the individuals in

[10] As a result, in all Tables below, only results estimated by fixed-effect models will be presented.

the data, the best we can do is to confine our analysis on people from the rural area, where labor market is less developed than urban area. Therefore, in this section,we reexamine our major hypotheses among individuals with rural origin and individuals with urban origin separately. In the absence of a direct measure, we use "mother's *hukou* status at the age of 16" to define one's social origin, because *hukou* status is generally inherited from his/her mother's side. If one's mother holds a rural *hukou*, he/she is very likely to grow up in the rural area. In Table 3, we could tell from different model specifications that our major arguments only hold among people with rural origin. Similar with our main results, the main effect of education is positive and significant, but the two interaction terms (education*parents' health status and education*parents' age) turn out to be significant negative. In sharp contrast, effects of all the three key independent variables appear to be insignificant among individuals with urban origin. Such findings suggest that the division of labor to provide elderly support based on sibling comparative advantage is more commonly practiced in rural areas than in urban areas. Our tentative explanation is that without regular income, peasants are more dependent on their children in the old age, while the urban elderly may have other ways to take care of themselves.

5.4 Male V.S. Female

In this section, we try to investigate gender differences in coresidence pattern, which serves two main purposes. First, given that traditionally, China is a very typical patrilocal society, sons and daughters may play different roles in family division of labor. To analyze these differences, we introduce interactions between the female dummy and other key independent variables to the original fixed-effect models and show results in Model 5~7 in Table 4. Our statistical results show that among families with both sons and daughters, the pattern of coresidence based on sibling comparative advantage holds, but it is more evident among sons than daughters. For example, Model 7 suggests that among sons, the main effect of years of schooling is positive significant, while the two interactive effects—schooling * parental health status and schooling * parental age—turn out to be negative significant. However, the three way interaction shows that in comparison with their poorly-educated brothers, daughters with the same level of education are not that likely to coreside with their parents when parents are getting old.

Such result reveals that in a family with both sons and daughters, daughters are still less likely to participate in family division of labor than their brothers. Second, our empirical analysis maybe flawed by lacking information on spouses. Since spouses' labor endowment also affect family decision, without controlling for this information may result in omitted variable bias. Our strategy to deal with this problem is that we re-do our main analysis on subsamples of extended families that have only sons or only daughters. The rationale of this subsample analysis is that compared with a son-in-law, a daughter-in-law is more likely to involve in house work service in China. Therefore the omitted variable bias is more serious among the male sample. If we observe the only daughter sample, the bias can be corrected to some extent, because daughters are directly involved in house work service provision in the nuclear families. Statistical analysis in Table 4 confirms our conjecture. It shows that among families with only sons, the sibling comparative hypotheses are not supported by empirical data. Coefficients of all key independent variables turn out to be statistically insignificant. However, when it comes to families with only daughters, the division of labor we predict occurs again. Coefficients of the main effect and two interaction effects are strongly significant with the predicted signs, indicating that when parents are young and healthy, they tend to live with their more educated daughter; when they are getting old and their health condition deteriorates, they are more likely to live with their less educated daughter. This finding seems to contradict our previous conclusion that for families with both sons and daughters, sons are more involved in division of labor. However, we argue that for families with only daughters, they have to violate the traditional social norm that sons are major caregivers to aging parents, so they practice the division of labor based on sibling comparative advantage among daughters as we propose.

5.5 Robustness Checks

In the paragraphs above, we show the pattern of parent-child coresidence based on sibling comparative advantage and how it varies by urban/rural origin and gender. However, we are still very concerned about the robustness of our major findings under different model specifications. Does the division of labor really exist, or does it only happen by chance? In order to test the robustness of our results, we conduct a series of

sensitivity checks. Specifically, we want to examine whether or not the pattern we have found is driven by age cutting points and parents' wealth.

Given that our analytical sample includes children age 18 or older and parents age 50 or older, which is not very restrictive, it may not serve our research purpose well. As a result, in Table 5, we display our main results by three different combinations of children's age cutting point and parents' age cutting point: 1) children age 25 or older & parents age 50 or older; 2) children age 18 or older & parents age 60 or older; 3) children age 25 or older & parents age 60 or older. Overall speaking, the coefficients (sign and significance) of all key independent variables remain qualitatively the same across subgroups, indicating that our major findings are robust no matter which age cutting point is chosen.

In addition to robust age cutting points of both children and parents, we also check if parents' wealth affects their coresidence with adult children. According to our theoretical framework, we actually assume that except the housework they provide, parents have no other attractive attributes to their children. However, the reality is that besides family labor, parents may also directly transfer resources to their children so as to "purchase piety" (Takagi and Silverstein, 2011). Therefore, we are also interested to know if parents' wealth ownership affects the decision of parent-child coresidence within an extended family. Based on available information in the *PSFD* data, we divide our analytical sample into two subgroups—1) parents do not own wealth and 2) parents own wealth[11]. Our empirical results show that the positive main effect of years of schooling and the negative effects of two interaction terms could be found regardless of parents' wealth ownership. This finding suggests that even though some parents could provide their children with something more than family labor, they still do not challenge the major argument of this study.

6. Conclusion and Discussion

To conclude, our research proposes a new explanation on the patterns and reasons of coresidence between adult children and their parents. Our viewpoint emphasizes the

[11] The first subgroup includes individuals whose parents have already distributed all wealth to children or have no wealth to distribute to begin with. The second subgroup includes individuals whose parents have not yet distributed all their wealth.

opportunity costs of each family member in providing housework service and how different costs shape the pattern of coresidence. Specifically, we could conclude this study from four aspects. First, we discover that the coresidence patterns in China do differ when parents have different labor endowments. Second, to some extent, the division of labor within an extended family is indeed based on sibling comparative advantages. Third, by conducting a series of subgroup analyses, we also reveal that the pattern of sibling comparative advantage is more evident among rural citizens, which is probably due to the fact that urban citizens are easier to acquire alternative supply of housework labor from the market. Finally, we find that in extended families that have both sons and daughters, the division of labor is more significant among sons. This is possibly caused by the social norm that sons rather than daughters should participate in family division of labor. Yet, we also discover that in families with only daughters, the pattern of division of labor is more significant than families with only sons. This is because women have to attend division of labor if they are the only daughters in the family and women are less likely to get help from their husbands in housework service labor.

Beyond the specific conclusions, this study also has important theoretical and practical implications. From a theoretical perspective, the sibling comparative advantage framework we proposed can be regarded as an extension of Gary Becker's husband-wife comparative advantage framework. We demonstrate that regarding parent-child living arrangement, families actually make very rational decisions, even in a country strongly emphasizing filial piety such as China. Furthermore, our study may also shed some light to policymakers. Even though parent-child coresidence based on sibling comparative advantage turns out to be the most efficient way to provide housework within a family, it is not feasible in the long run. As fertility rate declines and geographic mobility increases worldwide, the traditional division of labor within an extended household is not very likely to sustain, and this would be particularly true in China due to its One-Child Policy. In the near future, a serious question has to be asked—who will take care of the only child's parents?

Finally, our research could still suffer from several limitations and it could be improved in following directions. First, our theory is a very simplified version of reality. It is still need to be found whether our conclusions are robust to more realistic constrains. Second, in our empirical analysis, as discussed in the paper, some important information (e.g. the information of spouse) that may affect our conclusions is missing in the dataset. This is because we have very limited information on the primary respondent's siblings in our current analytic sample. On one hand, we are trying to extract more information from the original dataset and on the other hand find a new data source containing more information on the siblings of the respondent.

Table 1: Means and Standard Deviations of Dependent and Independent Variables

Variables	The Full Sample		Coresidents		Non-Coresidents	
	Mean	SD	Mean	SD	Mean	SD
Coresidence with Parents	0.32	0.47				
Female	0.47	0.50	0.15	0.36	0.63	0.48
Age	41.84	9.81	39.52	10.09	42.96	9.47
Firstborn Son	0.13	0.34	0.19	0.39	0.10	0.30
Years of Schooling	7.51	3.80	8.20	3.38	7.17	3.95
Health Status of Parents	2.67	0.94	2.62	0.93	2.69	0.94
Age of Parents	71.66	9.76	70.02	10.03	72.45	9.53
Parents Own Some Wealth	0.35	0.48	0.39	0.49	0.34	0.47
Number of Observations	6,158		1,971		4,187	
Number of Households	1,488					

Table 2: Determinants of Parent-Child Coresidence, Between-Family V.S. Within-Family Comparisons

Variables	Model 1		Model 2		Model 3		Model 4	
	Logit	Fixed-Effect	Logit	Fixed-Effect	Logit	Fixed-Effect	Logit	Fixed-Effect
Years of Schooling	0.022*	-0.018	0.043***	0.084*	0.086*	0.252*	0.096*	0.320**
	(0.009)	(0.014)	(0.013)	(0.042)	(0.041)	(0.102)	(0.042)	(0.107)
Years of Schooling * Parental Health Status			-0.008*	-0.036**			-0.007*	-0.033*
(Health Status: 1 to 5; 5 is the poorest)			(0.004)	(0.014)			(0.004)	(0.014)
Years of Schooling * Parental Age/100					-0.088	-0.367**	-0.076	-0.335*
					(0.055)	(0.138)	(0.055)	(0.139)
Female	-2.336***	-2.666***	-2.341***	-2.663***	-2.349***	-2.666***	-2.353***	-2.664***
	(0.083)	(0.098)	(0.083)	(0.098)	(0.083)	(0.098)	(0.084)	(0.098)
Age	-0.048***	-0.070***	-0.048***	-0.070***	-0.043***	-0.070***	-0.043***	-0.070***
	(0.003)	(0.008)	(0.003)	(0.008)	(0.006)	(0.008)	(0.006)	(0.008)
First-born Son	-0.017	-0.076	-0.027	-0.071	-0.062	-0.086	-0.065	-0.081
	(0.090)	(0.107)	(0.090)	(0.107)	(0.094)	(0.107)	(0.094)	(0.107)
Constant	1.950***		1.920***		1.707***		1.714***	
	(0.168)		(0.170)		(0.249)		(0.249)	
Observations	6,158							
Number of households	1,488							

Notes: Logit regressions allow clustering at the household level;
Standard errors are in parentheses;
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1.

Table 3: Determinants of Parent-Child Coresidence, Rural Origin V.S. Urban Origin

Variables	Rural Origin				Urban Origin			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Years of Schooling	-0.029+	0.073	0.199+	0.278*	-0.025	0.126	0.239	0.313
	(0.016)	(0.049)	(0.121)	(0.127)	(0.031)	(0.091)	(0.214)	(0.221)
Years of Schooling * Parental Health Status		-0.037*		-0.035*		-0.053+		-0.048
(Health Status: 1 to 5; 5 is the poorest)		(0.016)		(0.016)		(0.030)		(0.030)
Years of Schooling * Parental Age/100			-0.315+	-0.290+			-0.344	-0.264
			(0.165)	(0.165)			(0.275)	(0.284)
Female	-3.182***	-3.185***	-3.183***	-3.186***	-1.509***	-1.488***	-1.517***	-1.495***
	(0.130)	(0.130)	(0.130)	(0.130)	(0.164)	(0.163)	(0.164)	(0.164)
Age	-0.073***	-0.074***	-0.074***	-0.075***	-0.077***	-0.075***	-0.075***	-0.074***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.017)	(0.017)	(0.017)	(0.017)
First-born Son	-0.038	-0.031	-0.044	-0.036	-0.101	-0.101	-0.124	-0.117
	(0.124)	(0.124)	(0.124)	(0.124)	(0.223)	(0.223)	(0.224)	(0.224)
Observations	4,924				1,216			
Number of households	1,169				313			

Notes: Standard errors are in parentheses;

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1.

Table 4: Determinants of Parent-Child Coresidence, by Families with Different Sex Composition

Variables	All Families			Families with only Sons			Families with only Daughters		
	Model 5	Model 6	Model 7	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Years of Schooling	0.061	0.164	0.232*	-0.022	-0.202	-0.142	0.308**	0.808***	1.130***
	(0.044)	(0.109)	(0.113)	(0.058)	(0.144)	(0.150)	(0.105)	(0.245)	(0.286)
Years of Schooling * Parental Health Status	-0.043**		-0.033*	-0.024		-0.026	-0.101**		-0.113**
(Health Status: 1 to 5; 5 is the poorest)	(0.015)		(0.015)	(0.019)		(0.019)	(0.037)		(0.040)
Female * Years of Schooling * Parental Health Status	0.048***		-0.003						
	(0.007)		(0.011)						
Years of Schooling * Parental Age/100		-0.335*	-0.303*		0.147	0.166		-1.068**	-1.108**
		(0.146)	(0.147)		(0.191)	(0.192)		(0.335)	(0.343)
Female * Years of Schooling * Parental Age/100		0.295***	0.303***						
		(0.033)	(0.049)						
Female	-3.683***	-4.369***	-4.356***						
	(0.189)	(0.232)	(0.232)						
Age	-0.069***	-0.070***	-0.070***	-0.078***	-0.077***	-0.077***	-0.072**	-0.072**	-0.072**
	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)	(0.024)	(0.024)	(0.024)
First-born Son	-0.102	-0.107	-0.100	-0.061	-0.065	-0.058	-0.175	-0.120	-0.143
	(0.108)	(0.108)	(0.108)	(0.126)	(0.125)	(0.126)	(0.234)	(0.234)	(0.236)
Observations		6,158			2,328			644	
Number of households		1,488			798			211	

Notes: Standard errors are in parentheses;

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1.

Table 5: Determinants of Parent-Child Coresidence, by Different Age Cutting Points

Variables	Child > = 25 and Parent > = 50			Child > =18 and Parent > = 60			Child > = 25 and Parent > = 60		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Years of Schooling	0.076+	0.212+	0.280*	0.055	0.291*	0.340*	0.055	0.269*	0.319*
	(0.043)	(0.109)	(0.114)	(0.045)	(0.130)	(0.134)	(0.045)	(0.131)	(0.135)
Years of Schooling * Parental Health Status	-0.035*		-0.032*	-0.027+		-0.024	-0.028+		-0.025
(Health Status: 1 to 5; 5 is the poorest)	(0.014)		(0.014)	(0.015)		(0.015)	(0.015)		(0.015)
Years of Schooling * Parental Age/100		-0.317*	-0.286+		-0.415*	-0.391*		-0.388*	-0.363*
		(0.146)	(0.148)		(0.171)	(0.173)		(0.172)	(0.174)
Female	-2.703***	-2.703***	-2.700***	-2.635***	-2.632***	-2.630***	-2.657***	-2.654***	-2.653***
	(0.101)	(0.101)	(0.101)	(0.106)	(0.106)	(0.106)	(0.107)	(0.107)	(0.107)
Age	-0.063***	-0.063***	-0.063***	-0.069***	-0.069***	-0.069***	-0.066***	-0.066***	-0.066***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
First-born Son	-0.107	-0.117	-0.113	0.012	0.007	0.010	-0.006	-0.011	-0.008
	(0.108)	(0.108)	(0.108)	(0.116)	(0.116)	(0.116)	(0.116)	(0.116)	(0.116)
Observations		5,946			5,311			5,265	
Number of households		1,443			1,226			1,220	

Notes: Standard errors are in parentheses;

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1.

Table 6: Determinants of Parent-Child Coresidence, by Whether or not Parents have Distributed Wealth to Children

Variables	Wealth Distributed			Wealth Not Yet Distributed		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Years of Schooling	0.127*	0.311*	0.401**	-0.006	0.305*	0.336*
	(0.053)	(0.140)	(0.145)	(0.070)	(0.156)	(0.165)
Years of Schooling * Parental Health Status	-0.044*		-0.041*	-0.020		-0.014
(Health Status: 1 to 5; 5 is the poorest)	(0.018)		(0.018)	(0.024)		(0.024)
Years of Schooling * Parental Age/100		-0.409*	-0.377*		-0.522*	-0.512*
		(0.184)	(0.185)		(0.218)	(0.220)
Female	-2.645***	-2.642***	-2.639***	-2.700***	-2.715***	-2.715***
	(0.126)	(0.126)	(0.126)	(0.160)	(0.161)	(0.161)
Age	-0.074***	-0.074***	-0.074***	-0.070***	-0.070***	-0.070***
	(0.010)	(0.010)	(0.010)	(0.015)	(0.015)	(0.015)
First-born Son	0.145	0.134	0.139	-0.440*	-0.468**	-0.463*
	(0.135)	(0.135)	(0.135)	(0.181)	(0.181)	(0.182)
Observations	3,912	3,912	3,912	2,180	2,180	2,180
Number of households	903	903	903	568	568	568

Notes: "Wealth Distributed" refers to two situations: 1) All wealth has been distributed; 2) No wealth could be distributed.
"Wealth Not Yet Distributed" refers to two situations: 1) All wealth has not been distributed; 2) A portion of wealth has not been distributed.
Standard errors are in parentheses;
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1.

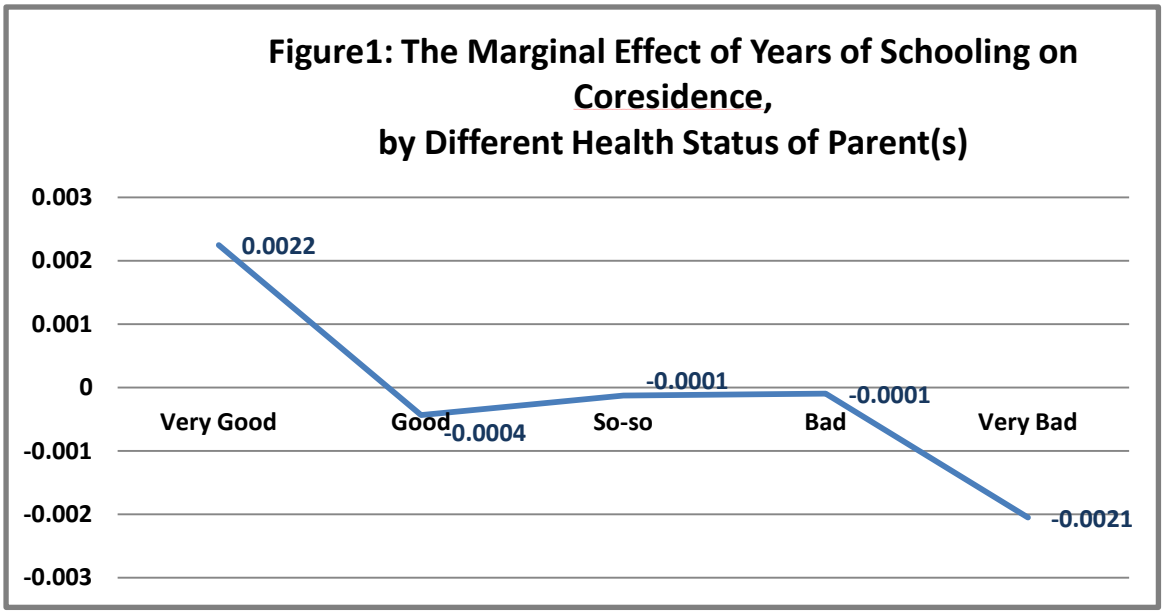
Figure1: The Marginal Effect of Years of Schooling on Coresidence,
by Different Health Status of Parent(s)
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
0.0022
-0.0004
-0.0001
-0.0001
-0.0021
Very Good
Good
So-so
Bad
Very Bad

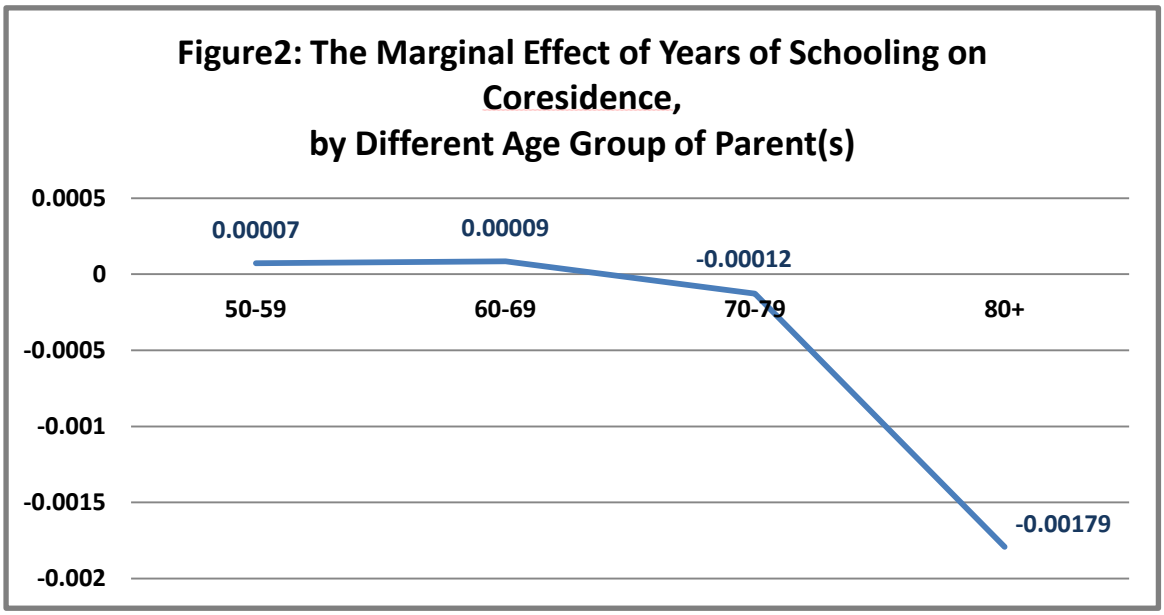
Figure2: The Marginal Effect of Years of Schooling on Coresidence,
by Different Age Group of Parent(s)
0.0005
0
-0.0005
-0.001
-0.0015
-0.002
0.00007
0.00009
-0.00012
-0.00179
50-59
60-69
70-79
80+

Reference:

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Appendix I:

Proof of Proposition 1:

First order conditions of the constrained maximization problem are as follows:

$$w_k = h'(L_k^{ch}) \quad \text{all } k \qquad (1)$$

$$w_i = h'(L^{ph}) \qquad (2)$$

From (1), (2), we can get $L_i^{ch} = L^{ph}$.

Define $G(\bullet) = h'^{-1}(\bullet)$.

Plug (1) and (2) into the utility function and we get:

$$V^i = \sum_{k=1}^{n} w_k (L - G(w_k)) + \sum_{k=1}^{n} h(G(w_k)) + w_i (L_p - G(w_i)) + h(G(w_i))$$

The first two terms are invariant to coresidence decisions so we analyze:

$$Y^i = w_i (L_p - G(w_i)) + h(G(w_i))$$

Notice by envelop theorem:

$$\frac{dY^i}{dw_i} = L_p - G(w_i) = L_p - L_i^{ch} \quad ;$$

Since $G(w_i)$ decreases with w_i, $\frac{d^2 Y^i}{dw_i^2} > 0$, maximized value of Y^i are at two extreme values: $w_{\max}$ and $w_{\min}$.

Comparing the two extreme values, we can get:

$$L_p^* = \frac{w_{\max} G(w_{\max}) - w_{\min} G(w_{\min}) - h(G(w_{\max})) + h(G(w_{\min}))}{w_{\max} - w_{\min}} > 0$$

When $L_p > L_p^*$, the parent coresides with the highest educated child. When $L_p < L_p^*$, the parent coresides with the lowest educated child.