ESSAYS ON FAMILY STRUCTURES, EDUCATION, HEALTH AND WELL-BEING IN OLD AGE IN CHINA

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ESSAYS ON FAMILY STRUCTURES, EDUCATION, HEALTH AND WELL-BEING IN OLD AGE IN CHINA

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Abstract: The first chapter investigates the health and social impacts of a new pension system in China. China initiated the new rural pension scheme targeting the large rural population in 2009. This new scheme was claimed to be a huge improvement to the previous welfare institution and a strong defense to rural people's elderly life. Using panel data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), I apply the PSM-DID approach to identify causal relationships between the pension and multiple covariates at the individual level. I have found that the pension significantly reduced systolic and diastolic pressures, as well as improved overall health and life quality of participants. I acknowledge the positive influences of China's new rural pension on elderly life of the rural population, and discuss potential directions for future research.

The second chapter explores the impacts of co-residing grandparents on children from a Chinese perspective. The matrilateral bias hypothesis (MBH) implies that children may expect more supports from their maternal grandparents. Nevertheless, the current literature has not shed much light on how different genders are affected by grandparental lineage under the multi-generational coresidence context. In this chapter, I document and discuss lineage heterogeneity of grandparental impacts on grandchildren, and as well explore whether girls benefit more from the maternal grandparents than boys do. To resolve endogeneity bias where the standard IV approach is infeasible, I fit panel data from the China Family Panel Studies (CFPS) into a fixed effects model and then apply the heteroskedasticity-based instruments of Lewbel (2012) as a robustness check. The results suggest that compared to direct interaction with coresiding grandparents, grandchildren are more likely to be influenced through parents. There are no consistent evidences for the MBH found.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER I

HOW DID CHINA'S NEW RURAL PENSION SCHEME AFFECT THE AGED RURAL POPULATION? AN EMPIRICAL EVALUATION WITH THE CLHLS DATA

1.1 Introduction

As aging rapidly, China is moving fast on expanding the old-age pension system to catch up with the aging speed. For the past decades, China has achieved remarkable improvements in the coverage expansion of the old-age pension. However, before 2009 the focus was primarily on urban areas. Then as formally announced in the October of 2009, the Chinese government launched a new pension program aiming to provide basic life supports to the elderly living in rural areas.

China has the largest elderly population in the world. According to the most recent statistical yearbook, the elderly population took 11.4% of the total population in China, more than half of which were living in rural areas holding a rural Hukou (a system of household registration, used to regulate migration across regions). In 2017, the old-age dependency ratio in rural China was 19.62% and 3.94% higher than in urban regions. On the other hand, the poverty rate in rural China was comparatively high as well. In 2010, the poverty rate among the old people living in rural communities was as high as 22.3%, compared to 4.6% among the urban old people and 3.4% among the general urban residents (Vilela, 2013). Accompanied by the economic inequality were discrepancies in health status. Cao et al. (2019) disclosed significant inequalities in diabetes caused by unequal socioeconomic statuses in China.

He et al. (2019) showed that the prevalence of frailty (both a risk measure of adverse health outcomes and/or mortality as well as a necessity measure of health-care) in the older Chinese in rural areas was 5.1% higher than in urban areas. Besides physical healthiness, Hu et al. (2019) revealed a discrepancy in mental healthiness between the elderly living in rural and urban locations in China.

To improve the well-being of the old-age people living in rural areas, the Chinese government initiated a new pension scheme in 2009. This new pension system was named China's New Rural Pension Scheme (NRPS) and launched in 314 pilot counties of 30 provinces on October 1, 2009. One year later, it was officially signed into a policy and being promoted nationwide. By the end of 2012, over 90% of the counties in China had been covered. The most significant difference between the old and new pension schemes lies in the contribution mechanism. The old pension system almost completely relies on personal savings, while the new one utilizes a combination of personal savings, community contributions and government subsidies. This mechanism lessens the burden to participate. Once a participant has reached age 60, she starts to receive monthly pension income.[1]

A natural question would be how this new pension system benefited beneficiaries' lifestyles and well-being. Despite a large amount of literature on related topics, most of which only used data before 2012. There are two drawbacks of solely taking observations before 2012 into consideration. Firstly, the NRPS was implemented in not so many counties before 2012; the relatively small sample size tended to generate measurement errors and lacked external validity. Secondly, such a time-span choice resulted in the fact that we could only observe short-term effects. Therefore, a large fraction of the previous literature merely shed light on the instantaneous outcomes such as labor supply, intergenerational co-residence habit and financial dependency on adult children. Chen et al. (2018) and Cheng et al. (2018b) both showed that the

[1]This monthly pension income is a fixed amount within each administrative region yet may differ across regions. The minimum amount was 55 RMB (about 8 USD) in 2009.

NRPS affected the co-residence habit which was popular among the elderly in rural China and encouraged them to live independently. You and Niño-Zarazúa (2019) found that the pension income benefited wealthier families; moreover, the intergenerational transfer behavior found in their study was consistent with the research of Duflo (2003). Li and Wu (2018b) demonstrated an increase of the political trust in government which was brought by the NRPS implementation.

Short-term data could lead to some contradictory conclusions. Consequently, there has been an argument regarding effects of the NRPS on the enrollees' labor supply. Xie (2015), Zhao et al. (2016) and Ning et al. (2016) claimed that the NRPS did not have any significant impacts on altering labor supply. On the contrary, Chen et al. (2015), Huang and Zhang (2016) and Li et al. (2018) provided evidence that the NRPS decreased labor supply of the elderly in rural areas. Several papers tried to resolve this disagreement. Lin et al. (2018) proposed an explanation to the conflict by dividing labor supply into formal and informal labor supply. Lin (2018) applied heterogeneity in gender to reconcile the contradictory findings in the literature. This kind of literature discrepancy also appeared on health effects of the NRPS. Xie (2015) presented a close-to-zero impact of the NRPS on the participants' mental health in comparison with Zhang et al. (2019), who identified an improvement in the mental health of the elderly caused by the NRPS. Although different identification and estimation strategies could be a reason of the conflicting results, it was also highly possible that the opposite observations were due to lack of data, non-persistent short-term effects and/or heterogeneity in geographic location. Thus, our goal was to explore the effects of the NRPS on healthiness-related variables using a nationwide scope.

This paper was aiming to investigate the effects of the NRPS on multiple outcomes. Our primary interest was to check how the NRPS program affected the health and well-being of enrollees. We used the Chinese Longitudinal Healthy Longevity Survey (CLHLS) from 2005 to 2014 as our empirical data to work on (Zeng et al., 2017).

This dataset is nationwide and contains health outcomes after the expansion of the NRPS program, which could help resolve the issue of lacking external validity. Taking advantage of the most recent wave of survey, we observed the health outcomes of participants after at most five years of the pension initiation. Besides, we also observed people's participation decisions in two waves of the sample and could distinguish people who initially enrolled in the program at different times or quit at different times. This underlying time gap gave us a chance to investigate how the effects of the NRPS evolved over time. We exposed that the NRPS had significant and robust effects on decreasing both the systolic and diastolic pressures, which had been evolving differently for the two measures of blood pressure, and improving life qualities. The latter result was consistent with the study of Liu et al. (2015), where the authors showed that the NRPS improved the life quality measured by a quality scale of the World Health Organization (WHO) in Guangdong, China. We also found a significantly negative correlation between the NRPS enrollment and the financial dependency on grandchildren in long term. On the other hand, we showed that despite the enrollment in each round had positive influences on health (both self- and interviewer-evaluated), which turned out to be hardly prominent after being disentangled and reexamined with respect to each particular round of survey. This finding gave us a clue about the adverse selection problem in a dynamic process of enrollment in the NRPS.

Challenges in estimating the effects of the NRPS lied in two aspects: potential self-selection and existence of other health-relevant policies. To deal with these two problems, we adopted the PSM-DID method to conduct a difference-in-difference regression following a matching based on the propensity scores. The PSM and DID procedures jointly took care of the endogeneity concern. Other than that, the unique feature that our data exclusively contain individuals older than 60 years helped with getting rid of the first challenge, as participants aged 60 and above automatically

qualified for the minimum pension at the time of implementation without paying any premiums.

People might also have concerns on possible disturbances from the co-existing policies. One major concern was the effects of the New Rural Cooperative Medical Insurance (NRCMS). The NRCMS was first introduced in 2002 and then significantly enhanced in the health-care reform in 2009, namely the year when the NRPS was launched. The contribution mechanism of the NRCMS is similar to the one of the NRPS, and as well has been designed to lessen financial burdens of obtaining better health-care for people living in rural regions. By covering parts of the medical costs, the NRCMS had substantially improved the health-care access and utilization among the participants (You and Kobayashi, 2009; Babiarz et al., 2010). Although the designs and goals are comparatively alike between the NRPS and NRCMS, we believe that our results would not be affected by the very existence of the NRCMS. Firstly, several research projects showed that the NRCMS did not significantly reduce the out-of-pocket payments from participants (Wagstaff et al., 2007; You and Kobayashi, 2009; Sun et al., 2009; Lei and Lin, 2009). Therefore, the extra pension income from the NRPS, which is essentially a positive income shock, could still be considered to have strong enough impacts on one's health. Secondly, using the difference-in-difference method with fixed effects controlled at the individual level, we filtered out the irrelevant factors in time trends including the effects of the other policies.

This paper contributes to the growing literature on the impacts of the NRPS on the well-being in old age in rural China, especially to the few works of literature exploring the health effects of the NRPS. Previously, most papers paid major attention to mental health, as in Xie (2015) and Zhang et al. (2019). The others focused on the effects of a general pension program. Ding et al. (2018) showed the overall positive impacts of micro-finance programs managed by government on people's health outcomes; while Huang and Zhang (2016) described the positive effects of pension

insurance on health in terms of disability, weight and height in multiple countries. Among the literature which mainly discussed the effects of the NRPS, Zhang et al. (2018) found improvements in chronic diseases induced by the NRPS through reducing food poverty. The most similar paper to ours is the study of Cheng et al. (2018a), where the authors pinned down the positive effects of the NRPS on multiple health and well-being measures including life quality using a panel-IV approach on two waves of the CLHLS. We expanded the time horizon of analysis and selected four waves of the CLHLS. In this way, we could check how the effects eventually evolved. Besides, we provided a new perspective with a different identification strategy. Our overall results are highly consistent with the Cheng et al. (2018a) paper, which supplies evidence to the robustness of our results.

The rest of this paper is organized as follows: the second section introduces the data and variables we chose in details; the third section explains our fundamental identification method; the fourth section reports our findings and robustness tests; and finally the last section concludes the paper and discusses potential limitations.

1.2 Data and Variables

1.2.1 Data Source

This study used data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS). The CLHLS is a survey aiming to collect a representative sample of the elderly Chinese in a nationwide range. The researchers fielded the baseline wave in 1998 and six waves thereafter. The baseline survey sampled 8,959 individuals, who were followed up every two to three years. At each wave, survivors from the last wave were re-interviewed, yet deceased interviewees were replaced with new participants. The survey waves were fielded face to face, and each wave took about a year to finish. The seven waves were conducted in 1998, 2000, 2002, 2005, 2008-2009, 2011-2012 and 2014, respectively.

There are several advantages to use the CLHLS data. First, it is a nationwide dataset, through which we could explore the effects of the NRPS on health outcomes in a national domain and avoid the problems of lacking external validity. Second, this dataset places a greater weight on the elderly in the sample-selection process, especially on people aged above one hundred. According to Koenig (2001), until 2001, the CLHLS included the largest sample of centenarians in the world. Thirdly, utilizing consistent survey questionnaires, this dataset covers several years both before and after the implementation of the NRPS. Therefore, we ended up with direct observations on changes in health and welfare outcomes for the participants.

We employed four waves from the survey dataset in our research. These four waves document a set of various demographic variables from the year 2005 (four years before the pilot launch of the NRPS) to the year 2014 (five years after the experimental implementation and two years after the national coverage of the NRPS). Information of the participants after the official announcement on the NRPS are contained in the last two waves (2011-2012, 2014).

1.2.2 Enrollment in the NRPS

To participate in the NRPS, each individual needed to register in person to set up a personal account. This participation information was collected in our sample since the third wave. Since the policy was first introduced to some pilot regions by the end of the second wave of survey, which was basically done at that time, the sample failed to capture observations on the participants until the third wave began. Thus, our records on participation decisions were derived from the last two waves of survey distributed at the end of the year 2011 and 2014, respectively. In this paper, we processed these two post-policy waves as two rounds of registration following the nationwide promotion of the new pension policy, which was in 2010, right before the first round (2011-2012) of registration.

From figure 1, we could see that the NRPS covered all the 23 provinces included in the CLHLS sample. The participation rates in most provinces were above 15%. There were few provinces with a large population that achieved a more than 40% participation rate in the NRPS. The participation rate of the second post-policy round (four years after the expansion of the NRPS) significantly increased in almost every province or municipality except for Beijing, Shanghai, Heilongjiang and Hainan. The second panel in figure 1 visualized the proportions of participants from different provinces, where we observed that those provinces with a larger population relying heavily on the agricultural economy (e.g., the Shandong province) usually took a more substantial proportion in the participation sample. The demographic distributions of the round 1 and 2 registrations were similar. From figure 2, the gender ratios among the NRPS participants in both rounds were balanced and comparable to the overall gender ratio of the elderly in China. Moreover, most participants were living in rural and town areas.[2]

Figure 3 and 4 gave us a taste of the likely motivations of participating in the NRPS. In figure 3, most participants did not enroll with other pension programs and were in good health conditions. This result seemed to be contradictory to the adverse selection theory. However, considering that many of the participants also enrolled in the New Rural Cooperative Medical System (NRCMS), we could infer that those who were willing to enroll in an extra pension program cared more about healthiness. In addition, since we did not observe the exact time point of participation, there might be a simultaneous two-way relationship between the NRPS enrollment and the self-reported health. Therefore, this distribution was unable to imply any causal relationships between health and willingness to participate. From figure 4, most participants were self-employed and did not have a stable post-retirement income source. The underlying situation was that the primary source of financial support

[2]The neighborhood classifications were defined using the current living location instead of the Hukou (a household registration system) location.

to the elderly, or at least the elderly in rural regions, was still their adult children. Before the participants retired, most of their income was from agricultural activities, which confirmed our knowledge that the NRPS was designed for and easily accessible to people with a rural Hukou.

The similar distributions of demographic characteristics in round 1 and 2 made it more solid to compare the influences of the NRPS on the first- and second-round participants. The difference in participation timings gave us an excellent resource to explore how the effects of this pension scheme on health and well-being outcomes evolved. For those who enrolled before or in round 1 (the first post-policy round), we tracked their health outcomes for two to three years after the enrollment; yet for those who participated in round 2 (the second post-policy round), we could only test for short-term effects, which we expected to be at most significant on some instantaneous outcomes.

1.2.3 Measures of Health and Well-being of the Elderly

To quantify the interviewees' healthiness, we utilized six variables: heart rate, systolic pressure, diastolic pressure, self-rated health, self-reported sleep quality, and interviewer-rated health status. The first three measures are objective and have strong correlations with the common chronic diseases, which were more likely to be affected by income (Zhang et al., 2018). These data are easy to collect for interviewers with portable medical equipments and are essential indicators of the health risks faced by the elderly. Heart rate is an index for risk towards cardiovascular diseases; while systolic and diastolic pressures are both used in hypertension diagnosis. According to the most recent aging and health report published by the World Health Organization (World Health Organization, 2015), in 2015 the prevalence of hypertension among people aged 60 and over was 66.9% in China and the self-reported annual rate of myocardial infarction among the elderly was 1.3%, which both belonged to the most

common diseases affecting mortality risk and life quality of the elderly.

The self-reported health and sleep quality are subjective measures of health. Due to the nature of self assessment, these two values reflected not only the health condition but also the level of satisfaction on the current status of each survey participant. The other health measure we chose was the health status reported by the interviewer. This variable reflected an impression of outsiders on the participants' health and could be seen as an adjustment to the self-assessed values.

Besides the indexes for health, we incorporated some other covariates to explore how the well-being and financial independence of the elderly responded to the implementation of the NRPS. We used self-rated life quality as a measure of the well-being. For the financial independence, we took net transfers from children and grandchildren, decision power in the household, and preference towards independent living as proxies. These variables were included to evaluate how the NRPS affected the participants' overall level of satisfaction on life, living arrangement preference as well as intergenerational financial interactions.

1.3 Methodology

1.3.1 The Basic Model

The basic regression model is :

$$\begin{aligned} y_{it} &= \tau \cdot treatment_{it} + \lambda \cdot policy\_year_t \\ &+ \delta_{did} \cdot treatment_{it} \cdot policy\_year_t + X'_{it}\beta + \alpha_i + \gamma_t + \mu_{it} \end{aligned} \tag{1.1}$$

In the equation, y_{it} indicates outcome variables, namely the variables on which we wanted to explore the effects of the new pension scheme. We employed twelve variables in this study, which covered multiple aspects of the elderly life that had not been addressed sufficiently in the current literature. The variables may be categorized

into four types.

- Physical measures of the elderly including heart rate, systolic and diastolic pressures provide a basic and dynamic overview of the health conditions.
- Intergenerational transfers including net annual transfers from children and grandchildren document the cross-generational supports received.
- Subjective evaluations including self-rated health, interviewer-rated health, life quality and sleep quality are a set of five-level numerical scales that quantitatively reflect respondent's or interviewer's views on the current situation.
- Self-management abilities including decision-making power over household spending and personal matters as well as preference for independent living are ordinals that indicate the level of confidence in fulfilling daily tasks.

The variable $treatment_{it}$ marks the treated from the untreated. The variable $policy\_year_t$ equals 0 for rounds before the policy, and 1 after the policy. The product of $treatment_{it}$ and $policy\_year_t$, namely the DID estimate, is what we were interested in. X'_{it} is a vector of individual controls.[3] To accommodate the panel structure, we also introduced the individual fixed effects α_i and the round dummies γ_t. The error term is denoted by μ_{it}.

1.3.2 Exogeneity of the Treatment and Determinants of the Participation

A unique feature of our data might add extra credibility to the identification of inference. The panel only contained people aged 60 and above. Per the pension schedule, uninsured people who had reached 60 at the time of implementation automatically qualified for the minimum pension without paying any premiums (they might still

[3]Including: gender, age, age squared, ethnicity, community location, province, education, pre-retirement career, average household income, household size, times being seriously ill, alternative pension participation, number of children, major financial source, type of staple food, quantity of staple food consumed per day, and the BMI index.

choose to pay if they wished to receive higher compensations).[4] This design made the pension a quasi-exogenous intervention to the sample.

Nevertheless, we were still concerned by rationality of the exogeneity claim as whether the acceptance was driven by any covariates was the key in this case. We thus regressed the choice of enrollment on a series of controls we believed to be influential over the decision using the entire sample. These controls were the same as what we used in the main model. Besides that, we developed different modules to test some of the outcome variables that seemingly correlated with the decision one at a time and at last all together.[5]

Table 1 reported the regression results of the selected potential determinants for each module. The estimates on the outcome variables were relatively small and listed at the bottom of the table. All the modules incorporated the individual fixed effects and had variances clustered at the individual level. We could see that the estimates were very consistent across modules, so the outcome variables hardly interfered with the decision-making. The positive effect of age suggested that the probability of participation increased as age increased. People had stronger interests in the pension as getting older.

We employed a variable indicating the major financial sources of respondents. All the clearly stated alternatives implied a smaller likelihood of participation compared to the base group: retirement wage. Enrollment in other available pensions significantly lessened the probability of joining the new scheme. Choosing a mix of rice and wheat over-consuming rice only could be a sign of less income and hence raised the participation probability. A larger quantity of staple food consumed per day usually was related to more disposable income, which would ease the eagerness for receiving transfer payments. Overall, the above findings confirmed our knowledge that the

[4]They merely needed to set up a pension account at their Hukou locations and would begin to receive payments since the second month.

[5]The outcome variables are "making decisions of family spending", "net transfers from children", and "net transfers from grandchildren".

target crowds were uninsured and without constant external supports. Surprisingly, the impacts of household income were very small and could be neglected.

The outcome variables showed significant correlations with the decision. Since each single round of the survey was a post-decision cross-section of the timeline, we could not make any strong causal inference here. However, there were still some interesting facts revealed. Compared to having no idea of how often oneself determined family spending (likely caused by cognitive incapability), the interviewee's tendency to participate became clearer as her power over spending decisions became stronger. Net transfers from children were positively correlated with the decision, yet those from grandchildren were negatively correlated. Given that financial support from children is still the major form of old-age support, additional transfers from grandchildren might be considered as a type of double insurance.

Although we could not completely rule out endogeneity of the decision, our identification still holds. Moreover, the questionable covariates and the individual fixed effects were accounted for in our model at the first place.

1.3.3 Identification: PSM-DID

In this study, we applied the difference-in-difference regression following a propensity score matching (PSM-DID) to achieve identification. The rationale of this approach is that it satisfies the presumption of DID through pairing treated and untreated individuals who are similar in major characteristics. Without the intervention, the matched individuals would have developed along parallel paths. Therefore, any additional divergence in outcome variables has to be caused by the only difference between the treatment and control groups, the pension in this case.

To ensure a convincing identification, we were careful with the time window selection. On one hand, we wanted to allow enough time for the pensions to take effects on the enrollees. It usually takes time for some health measures and behavioral pat-

terns to evolve. On the other hand, we would like to track the enrollees back to an early pre-policy year to exclude any potential disturbances in the matching process. Even the policy has not been officially implemented, informal information or personal forecasts could alter people's actions. However, given the gap of two to three calendar years between every two rounds of the CLHLS surveys, it is difficult for a fixed sample of the aged population to survive through too many rounds. A time span covering two rounds before and after the policy respectively is a reasonable choice.

First we filtered out respondents who presented in all the four rounds of surveys. With the major cause of exit in the middle being decease, the sample shrank by about four-fifths yet stilled formed a strictly balanced and considerably representative panel. Then we tagged the early enrollees from the third round, namely the first round after the policy was announced, and matched them to non-participants in the first round based on propensity scores calculated from a set of covariates that we were going to use in our basic analysis. Finally, we dropped the off-support individuals and non-participants not paired with any participants and obtained a sample that contains treated and untreated individuals highly resembling each other except for the pension enrollment.

Figure 5 exhibited the matching results. The standardized percentages of bias across covariates for the matched sample basically located inside the $\pm 5\%$ band. Within the matched sample, differences by covariate were all greatly insignificant. Judging as well from the bar graph of the propensity scores, we considered the matching balanced and successful.

We conducted a t-test on pre-policy sample means of the outcome variables for the treatment and control groups before the matching. Table 2 presented the results. We could see that there were significant inter-group differences for self-rated health, sleep quality, deciding family spending and personal matters. If the matching were effective, some differences should be removed afterward.

Table 3 presented the sample composition after matching. We ended up with four rounds of observations on 1,380 individuals. There were 788 females and 592 males. Starting from the third round, enrollees of the new pension showed up in the panel. Female enrollees were more than male enrollees. The total number of enrollment increased by 89 from the third round to the fourth one. Based on the third-round participation, we separated treatment and control groups for all the four waves.

Before running the regression, we once again did simple t-tests of the dependent variables over the two groups. Using the policy as a time cutoff, this time we reported t-test statistics of sample means before and after the cutoff in table 4. In the pre-policy test, most mean differences were insignificant. Compared to the test before our matching, except for influence on family spending, the rest of the discrepancies were successfully removed. The results served as a side proof to the effectiveness of matching, since both the treated and untreated exhibited remarkable similarity in the outcome variables as well (in addition to the controlled covariates). The post-policy test marked systolic pressure, diastolic pressure, health rated by the interviewer, health rated by self, and life quality as significantly different at the 5% level and above. An average non-participant had higher systolic and diastolic pressures, lower ratings of health and life quality than a participant. Given these differences following the announcement of the new rural pension, we were showing to what extent the changes may be accredited to enrollment in the pension scheme in the section below.

1.4 Empirical Results

1.4.1 General DID

Table 5 and 6 reported the results from our DID model. As predicted in the previous t-tests, the pension reduced both systolic and diastolic pressures of participants within the normal range and hence improved their health conditions. The systolic decreased by 2.7 and the diastolic by roughly 2.4. Systolic and diastolic pressures

are indicators for potential hypertension diseases. They measure how much force the heart needs to pump blood through one's arteries when it contracts. Even when these two indicators locate in a normal range, lowering them helps reduce the risk of hypertension. Recently researchers also confirmed the relationship between mortality rate and the systolic/diastolic pressure. Taylor et al. (2011) and Sherazi and Zaręba (2011) both showed that one could use the systolic and diastolic pressures as predictors for mortality.

The self-appraisal of life quality was raised by a little more than 0.16. The interviewer-rated health was as well raised by about 0.1. The estimates aligned with each other and together revealed the positive impacts of this new pension. China's rural population has long been a group of low earnings. The pension increased old people's disposable income, and consequently led to a more balanced and healthy meal plan. Based on our findings, we concluded that the new pension scheme effectively improved the health conditions and daily life of the participating elderly.

Previous experience taught us that policy impacts are usually difficult to identify within the beginning of several years. Therefore, for the impacts to fully emerge, we used the third-round enrollment status as the principal indicator. Nevertheless, an accompanying concern was that the enrollment status was not invariant through the entire time span. Some enrollees dropped out of the program in the fourth round, yet some non-enrollees joined. This particular issue did not necessarily undermine our results. As we discussed, changes in behavioral patterns do not happen as soon as income rises. Participants might wait for a few months or even longer before withdrawing from the pension account. In order to understand the mechanism more comprehensively, we were going to explore heterogeneity in pension impacts by the length of participation in the following section.

Besides policy effects, we also observed some other correlations or causations. Rural residents seemed to favor living independently more the elsewhere residents

did. An increase by one *Liang* (50 grams) in daily consumption of staple food slightly improved sleep quality, interviewer-rated and self-rated health by less than 0.02. The frequency of serious illness in the past year brought down all the subjective well-being measures just as expected.

1.4.2 DID with Respect to the Length of Enrollment

We created a variable to document the length of enrollment for each individual. It arranged individuals into three categories: new enrollees in the fourth round, enrollees who left before the fourth round, and all-time enrollees. Then we interacted each category with $policy\_year_t$ to capture the length-specific effects in the model. Table 7 and 8 exhibited what we obtained.

The decrease in systolic pressure grew to 3.55 for the all-time enrollees, yet lost significance for those who only enrolled in one period. Diastolic pressure decreased by about the same size as before for the third-round participants who then quit, while surprisingly increased by 2.07 for the new members in the fourth round. According to Taylor et al. (2011), for people older than 50 years, the systolic pressure is a more precise predictor for hypertension, compared to the diastolic pressure. Thus we believe in the long term, the NRPS still would have significantly positive effects on cardiovascular health. Preference for living independently rose by 0.13 for the last-round participants. The all-time enrollees received a 0.19 higher rating of life quality on average, while no particular effects were spotted for the new enrollees who entered in the fourth round.

The third-round participants were rated 0.11 healthier by interviewers. All the single-period enrollees experienced a decrease ranging from 0.21 to 0.27 in decision-making power over family spending following enrollment in the pension. Loss of influence in expenditure decisions might be more apparent for old people whose pension account was set up and managed by someone on behalf, yet faded out in regression on

the whole sample. Net transfers from grandchildren to the all-time enrollees dropped by 350 Yuan. It could be that the elderly refused some supports from their grandchildren, or the grandchildren cut the transfers after observed a reliable and consistent support to their grandparents.

Despite the heterogeneity in the pension impacts, the results overall supported our findings in the general DID module. Here we propose a hypothetical explanation for the diastolic pressure increase of the new enrollees in the fourth round. In the long run, we believe that a permanent income raise will improve nutrition balance, while in the short run, especially within one year following the raise, increased consumption of certain food may lead to high salt intake and push up average diastolic pressure.

1.4.3 Robustness Check of the DID Results

The validity of DID relies on several assumptions that need to be tested. In this section we report the test outcomes. To summarize in advance, our sample had a satisfying performance in all the examinations and offered more ground to the identification strategy.

Table 9 tabulated the results of the parallel trends test without controls. Among all the dependent variables, merely heart rate and net transfers from children failed the test, suggesting the very existence of pre-policy discrepancies between the two groups.

Table 10 displayed the test results of the parallel trends assumption with the full set of controls. This time net transfers from children as well as interviewer-evaluated health to a mild extent refuted the assumption. The significant estimates in the general DID module, namely systolic pressure, diastolic pressure and life quality, once again successfully passed the test, and hence provided persuasive proof to the identification.

We wanted to make sure that our setup of the groups based on the third-round

enrollment status was plausible, so we verified and reported the results in table 11. If the segmentation was solid, the pension impacts should solely manifest to the treatment group, and the control group could not be affected at all. To do the test, we randomly selected 300 individuals from the control group and assigned them to the new treatment group, and the rest were sent to the new control group. We then used the same model to estimate "counter-factual" DID effects. Just like expected, except for an increase of 2.56 in diastolic pressure which was significant at the 5% level, no other significant estimates presented. Since we found that the pension reduced diastolic pressure for the participants, a rise of diastolic pressure to the non-participants could be seen as a double verification of our findings on the pension impacts.

Moreover, we developed table 12 to show the influence dynamics of the pension scheme by separating the average effects into round-specific effects. For participants, diastolic pressure decreased in the third round by about 2, and then decreased even more in the fourth (by 2.9). Given that, the impacts of pension on diastolic pressure probably were the most apparent and credible. The reduction in systolic pressure was insignificant at first, and then became significant and larger (-3.76) in the fourth round. Quality of life increased approximately by 0.21 in the third round only. The improvement of interviewer-appraised health was about 0.11 in the third round, yet turned insignificant in the following round. Solely for the third round, self-evaluated health rose by approximately 0.16, while net transfers from grandchildren dropped by 220 Yuan. In summary, table 12 offered a perspective on the paths along which the pension took effect.

1.5 Conclusion and Discussion

In this study we applied the PSM-DID approach on a CLHLS panel to explore the impacts of China's New Rural Pension Scheme (NRPS). Our design achieved a valid and clean identification and successfully exposed a few causal relationships. We found

that the pension effectively lowered the participants' systolic and diastolic pressures, as well as improved their overall health status and life quality. Moreover, participation of the pension discouraged net transfers from grandchildren. In conclusion, the new pension scheme played a critical role in providing basic supports to the uninsured old people from rural China.

There were some limitations in our research, which could become contributions of future studies on the NRPS. Firstly, due to incompleteness and inconsistency of the records on monthly payment and compensation in our sample, we were unable to account for these variations in the model. Without any doubt, controlling for the premium payment (if any) and the actual amount received would give us extra insight into the topic. Depending on the availability of such data, future studies may find rationales of the current fee schedule and compensation standard, estimate income elasticities of old people's life characteristics, or scrutinize patterns in intra-household allocations and intergenerational transfers.

Secondly, many outcome variables employed in this study were arbitrary numbers given be either interviewers or interviewees. Such measures likely contained both useful information and biases from human judgment, as they were estimations based on personal recognition instead of objective observation after all. Most of the time the sign of estimate on such a variable carries more practical significance than the actual magnitude. When we see an estimate of 2.175 on impacts on happiness, we will easily interpret that the people have become happier, but we can hardly imagine what "2.175 happier" means. Therefore, quantities like heart rate that can be directly measured yet imply the conditions of interviewees minimize survey biases, and should have priority over personal ratings in variable selection if available.

Thirdly, we made a hypothetical explanation pending verification for the changes in systolic and diastolic pressures. If researchers have the chance to incorporate detailed daily food consumption or nutrition intake, which we do not have, into the

study, they will gain a more comprehensive understanding of the influence channels of the pension.

Lastly, our latest data were from five years ago and could not reflect the most recent adjustments in the policy. We are eager to see analyses with updated data to extend the scope and disclose more interesting facts regarding how China's new rural pension fulfills its social functions.

CHAPTER II

LINEAGE DISCREPANCY IN GRANDPARENTAL IMPACTS: DO GIRLS BENEFIT MORE FROM THE MATRILATERAL BIAS? AN EVALUATION USING CHINESE HOUSEHOLD DATA

2.1 Introduction and Literature

2.1.1 Grandparents as Childcare Givers

Grandparents play crucial roles in families. Neugarten and Weinstein (1964) summarized these roles into four major types: "fun seeker, formal carer, reservoir of family wisdom and surrogate parent" (Lou and Chi, 2012). More recent studies (Kornhaber, 1996; Thiele and Whelan, 2006; Sheehan and Petrovic, 2008) have integrated more functions of grandparents and described them as "daily life helpers, advisors, educators and transmitters of tradition" (Lou and Chi, 2012). Without any doubt, Grandparenthood is an important potential source of family support and ties (Barranti, 1985).

Among all the said functions, the duty of childcare giver stands out. Grandparents are usually the major caregivers other than parents, both in the developed world and the developing countries such like China (Goh, 2006; Goh and Kuczynski, 2010; Chen et al., 2011; Chen, 2014). Across Europe, 44% of grandmothers and 42% of grandfathers helped give childcare, whether regularly or occasionally (Glaser et al., 2013). While in America, close to 7% of all grandparents provided extensive grandchild care-giving (Fuller-Thomson and Minkler, 2001). Families from the developing countries rely even more on intergenerational support. Sichimba (2015) found

"rather high prevalence of grand-parental involvement in childcare" in Zambia. Jiang et al. (2007) confirmed that "grandparents were the primary caretakers of children in the three-generation families" in urban China. 58% of Chinese grandparents provide childcare to their grandchildren (Ko and Hank, 2014), which is considered a very high ratio, and spend as much time as the mother does when live with their grandchildren (Chen et al., 2011). The inevitable use of co-residing grandparents in daily childcare reemphasized their roles "in terms of home education of the young, workforce support for young parents, cultural identity within families and community capacity building" (Nyland et al., 2009), which have been evolving over time as demographic features keep changing and modernization undergoes (Hsu, 1985; Shek, 2006; Settles et al., 2009). No matter how the grandparental functions are worded, the essence always lays in the connection to their grandchildren, and deserves deeper understanding under this particular living arrangement.

2.1.2 Grandparental Impacts in Multi-generational Households

Grandparents generally affect grandchildren from two channels. One is direct involvement through their presence in the household, and the other one is through parents. Parents as the middle generation, and mothers particularly, play a critical role in developing grandparent-grandchildren relations (Holladay et al., 1998). It is reasonable to assume that education received and beliefs inherited from grandparents, along with interaction patterns between grandparents and parents would somehow help shape the relationship of parents and their own kids and hence indirectly influence the kids. In this paper, I focus on the first channel, namely the direct involvement in multi-generational households.

Pérez et al. (2007) showed that coresidence with grandparents improved human capital accumulation and health care of grandchildren in Brazil and Peru. Jiang et al. (2007) emphasized the dominant position of grandparents in "shaping children's eating

behavior in some three-generation families in Chinese urban areas". According to Zeng and Xie (2014), co-residing rural Chinese grandparents had direct influence on their grandchildren's schooling, and the size of which was even close to the size of parental effect. It was also found in Taiwan that grandparents living in the same household positively affected educational achievement of grandchildren (Pong and Chen, 2010; Chiang and Park, 2015). Based on the findings of Li et al. (2015), grandparental involvement and domination of diet habit significantly contributed to an increase in probability of children overweight/obesity. Reynolds et al. (2018) found that living with grandparents improved children's language development using Chilean data.

Grandparental effects allegedly differ by the lineage of grandparents. Maternal grandparents, particularly maternal grandmothers, cared about child well-being more than did paternal grandparents (Euler and Weitzel, 1996; Danielsbacka et al., 2011; Tanskanen and Danielsbacka, 2012; Danielsbacka et al., 2015; Pashos, 2017a,b; Daly and Perry, 2017). In a survey of Harwood (2000), maternal grandparents felt significantly closer to their grandchildren than did paternal grandparents. Pollet et al. (2009) exhibited using a UK dataset that compared with paternal grandparents, maternal grandparents "provided a significantly wider range of financial benefits" for the newborn. Sear et al. (2000) tested a sample from rural Gambia and found that only maternal grandmothers might "improve the nutritional status of children significantly". Similarly, Tanskanen and Danielsbacka (2012) showed that only maternal grandparents' involvement was positively associated with better psychological health of children. Kirchengast and Putz (2016) analyzed 272 students at University of Vienna and concluded that maternal grandmothers had the highest level of solicitude, while paternal grandfathers the lowest. Theoretically, this lineage heterogeneity in grandparental bonds was addressed by proposing the matrilateral bias hypothesis, which is introduced in the subsection below. This paper aims to reapproach the said hypothesis and explore its interlinkage with child gender within the coresidence

setting where grandparents inevitably communicate to children more or less.

2.1.3 Matrilateral Bias Hypothesis (MBH)

The matrilateral bias in grandparental solicitude and involvement, which has been repeatedly recognized by anthropologists, psychologists and sociologists, is believed from the evolutionary perspective to root in the fact of patrilineal uncertainty (Gaulin et al., 1997; Chrastil et al., 2006; Tanskanen et al., 2011; Perry and Daly, 2017). Compared with female, male faces larger uncertainty in and hence higher opportunity costs to verify whether his offspring indeed carry his genetic information. The hypothesis indicates that paternal kin have subconsciously developed a tendency to invest less in the offspring either emotionally or financially to minimize potential losses. This statement may also receive support from the field of economics. Rational and risk-averse people always act in a way of controlling possible losses in risky situations. On the contrary, without such uncertainty, maternal kin are consistently willing to support and invest in the offspring. We can say that the observed bias originates not from the overinvestment of maternal side, but rather from the underinvestment of paternal side.

Well-educated modern generations will perhaps find the above reasoning ridiculous and unacceptable under increasingly complete social norms and moral codes that promote equality over genders. However, humans as animals after all, have the instinct deep down in the subconscious to spread and pass down their genes. A particular individual could neither have any idea of nor act in line with such an instinct, and even abhor similar thoughts. But individual preference does not necessarily contradict the certain pattern showing up in groups, cohorts and populations. With that said, I do not doubt that the contemporary morality helps suppress this tendency and shrink the gap in investments on children.

Empirically, researchers were able to identify this bias but having difficulty fully

interpreting it in terms of the hypothesis. For example, Chan and Elder (2000) confirmed a bias from the maternal side by exploring rural Iowan data, which was simply due to higher sample frequency of parental intimacy with maternal grandparents. Pashos (2017a, 2018) acknowledged that matrilateral relatives provide more childcare, yet he attributed the difference to "cultural variety" and a more solid mother-to-maternal-relatives relationship. Considering the huge challenge of proving the subconscious functioning, I am not surprised by the current findings.

2.1.4 Coresidence and Son Preference in China

China has a rather large proportion of multi-generational coresidence. The Confucian morality and emphasis on filial piety, which have been incorporated into social norms for thousands of years, praise adult children for living with and well serving their elderly parents (Yan et al., 2003; Pimentel and Liu, 2005; Shek, 2006; Zhang et al., 2014). Being constantly advocated by national media, it is believed to be a noble virtue to take good care of one's own parents and in-laws as well. In such a context, coresidence of three or more generations remains common in many Chinese families (Logan et al., 1998; Pimentel and Liu, 2005; Goh, 2006; Chen et al., 2011) and also preferred by elderly parents (Sereny, 2011; Yu and Yan, 2016) as an institution of elder support. Although economic growth and urbanization would have increased the number of nuclear families, Tsui (1989) predicted that "a rapid decrease in stem families is not likely in the near future" under impacts of social, cultural and traditional norms. Moreover, Wang (2014) found a large fall in the share of nuclear families and an increase in the share of linear families in rural China since 2000 using the sixth national census data. A more recent research by Lei et al. (2015) indicated that "roughly 41% of Chinese aged 60 and over live with an adult child", and another 48% live close to their children. As pointed out by Davis and Harrell (1993), locationally separated households may still function as a whole. These closely located households

form a small and intimate network where families provide support to each other, and to some extent can be seen as a coresidence arrangement (quasi-coresidence). The proximity of the grandparent(s), according to Whitbeck et al. (1993) and Kennedy (1992), did strongly increase grandparent-grandchild communication and closeness. Thus China, with a background of wide coresidence, is an ideal domain for researchers to explore the evolution in the grandparental roles as well as observe the co-residing impacts on children through grandparent-grandchild interactions.

Chinese families, like many in developing areas, are established on patrilineality and patrilocality (Pimentel and Liu, 2005; Chen, 2014). The male members (sometimes the firstborn male) of each generation define the family lineage and have the right to inherit properties. Females were traditionally described as "spilt water" as they would ultimately, at least in most cases, leave the original family and stay with the husband's family after marriage. A married female was no longer seen as a member of her original family but rather of the one she married into, where she was expected to do daily chores, take care of her in-laws, and give birth to children bearing her husband's surname. The historical yet absurd virtue standard for women was to be submissive to father before marriage, to husband after marriage, and to son in widowhood, respectively. Such a cultural background underrepresents the values of girl, and tends to cultivate son preference which stems from the Confucian ideology (Arnold and Liu, 1986) and has been especially prevalent in rural China (Tsui and Rich, 2002; Pimentel and Liu, 2005; Wang, 2005; Jin et al., 2007; Murphy et al., 2011). Son preference implies discrimination against girls and imbalanced allocation. Compared with girls, boys are better nourished, educated and taken care of. Gong et al. (2000); Wang (2005); Murphy et al. (2011) verified that families with the preference invest more resources in boys. Park and Rukumnuaykit (2004) identified strong son preference and gender bias in nutrition allocation from poorly educated rural fathers. Song and Burgard (2008) confirmed a height advantage in male Chinese children (af-

ter controlling for physiological differences) and this advantage became more obvious in rural areas. Other than those, indirect son preference was as well spotted from the way other household members were treated. For rural, one-child, and low-income families, having a first-born son improved the mothers' bargaining power and nutrient status (Li and Wu, 2011). Girls with male sibling(s) were less schooled than were girls with female sibling(s)(Lee, 2012), and would have a significantly lower height-for-age score before eight years old in rural China (Kubo and Chaudhuri, 2016).

2.1.5 Interplay of Matrilateral Bias and Child Gender

Given the context, I wonder if maternal grandparents hold a different attitude toward their granddaughter. Since maternal grandparents have raised their own daughter, would they perceive the value of their granddaughter more comprehensively? In a country with prevailing son preference like China, how would they influence the intra-household distribution? Would they encourage balanced allocation of resource among all children, or surprisingly biased investment toward girl? Could presence of maternal grandparents in families, although rather rare, narrow down gender gaps in children growth?[1] Despite the claim of no such influence channels along "traditional kinship lines[2]" by Creasey and Koblewski (1991), I wish to examine this major issue with Chinese data from a new angle. Nevertheless this paper principally focuses on addressing and discussing heterogeneities of grandparental influences by lineage in multi-generational families.

The paper is organized as follows: the next section describes the data and methodology; the third section demonstrates the regression and robustness check results; and the last section presents the explanations as well as limitations and finally concludes the paper.

[1]The elderly parents tend to live with their sons (Lei et al., 2015); living with adult daughters is uncommon (Cong and Silverstein, 2008).

[2]For example: granddaughter-maternal grandmother; grandson-paternal grandfather.

2.2 Data and Methodology

2.2.1 Data

The dataset used in the analysis is from the China Family Panel Studies (CFPS) (Institute Of Social Science Survey, 2019). The CFPS is a nationwide biannual survey on selected communities, households, and individuals in mainland China. Initially launched by Peking University in 2010, it collects detailed longitudinal data on multiple demographic, socioeconomic and ethnic variables. All members over age 9 from each selected household unit are interviewed and considered core members of the household. For members below age 9, their proxy respondents (usually parents) are interviewed instead. There are routine follow-ups of core members and a core member would be left out only if dead or outside the survey region. Detailed design and questionnaires can be found at the official website of the CFPS[3].

This current panel covers 499 counties of 31 provinces in China and contains four waves of survey: 2010, 2012, 2014 and 2016. Over this time horizon, 13,202 children below age 16 or their proxy respondents from 8,891 households were interviewed. The initial and subsequent surveys have together yielded a sample of 29,683 observations and 2.25 observations per child on average. Table 13, 14 and 15 give a general idea on the sample size by combinations of a few criteria: gender, age, presence of grandparents, and the community type. Table 13 lists the observation amounts by gender and age cohorts in each year, where we can apparently see that children aged 6 to 12 are the majority. Given the long-confirmed skewed sex-ratio and son preference in China, the sample is relatively gender-balanced. Table 14 shows the numbers of kids with co-residing grandparents in their households by grandparent lineage and child gender in each year. In the header row, "No GP" indicates no grandparents in the household, while "Both Sides" simply implies the presence of both paternal and maternal grandparents. When grandparents indeed show up, the paternal side is much

[3]http://www.isss.pku.edu.cn/cfps/en/documentation/questionnaires/index.htm

more common. This was well expected and already discussed earlier. To summarize, women in a patrilineal and patrilocal society (like Chinese society) usually either stay with the husband's family or form a new household after getting married. From this table, we see no obvious connections between lineage of co-residing grandparents and child gender. Table 15 exhibits the sample's distribution over grandparent lineage and the community types. There are almost twice as many paternal-side-only households in rural communities as in urban ones. The number of rural households without any grandparents is as well larger than the one of urban households. As for the maternal-side coresidence, no discernible patterns in the community location are found.

2.2.2 The Regression Model

The basic regression model is :

$$\begin{aligned} y_{iht} = \tau_1 \cdot paternal_{ht} + \tau_2 \cdot maternal_{ht} + \lambda_1 \cdot paternal_{ht} \cdot girl_i \\ + \lambda_2 \cdot maternal_{ht} \cdot girl_i + X'_{iht}\beta + Z'_{ht}\delta + \alpha_h + \gamma_t + \mu_{iht} \end{aligned} \tag{2.1}$$

The model employs the fixed effects estimator with standard errors clustered at the community(village) level. The subscript i denotes individual, h household, and t time. y_{iht} is the outcome variable we need to explain. $paternal_{ht}$ equals one if any paternal grandparent presents, and zero otherwise. $maternal_{ht}$ is a similar indicator for maternal grandparent. $paternal_{ht} \times girl_i$ and $maternal_{ht} \times girl_i$ are interacts of the paternal and maternal dummies with child gender, respectively. Therefore, estimates τ_1, τ_2, λ_1, and λ_2 are what we have interests in. X'_{iht} and Z'_{ht} are vectors of individual and household controls. I included common controls like child gender, child age, its square and even cube, parental education, parental age and squared age, grandparental education and age, etc., and also specific controls for the survey design like parental devotion to education, eagerness to communicate, and expectation on educational attainment. α_h is the unobservable time-invariant factor at household

level that causes the dependent variable to change. γ_t captures year effects in the multi-period sample. And at last, μ_{iht} represents the error term.

The outcome variables can be categorized into two groups. Group 1 contains weight, height, weight-for-age z-score and height-for-age z-score, which are all objective measures. The weight-for-age and height-for-age z-scores are growth measures standardized using the WHO Anthro macro modules. To have a better understanding of the construction method, readers are welcome to read the online manual from the WHO website[4]. Group 2 contains observables mainly assessing parental investment and child's self-recognition, which are self-rated health status, total educational expenditures, self-evaluation on how good and capable a child is as a student and a student cadre, respectively. Group 1 utilizes the whole sample, while group 2 only applies to the subsample of school-aged children. Detailed descriptive statistics can be found in table 16.

2.2.3 Sources of Endogeneity

The unbiasedness and efficiency of an estimator rely on a critical assumption: the decision of coresidence is exogenous. However, this assumption seems not so plausible on second thought. The living arrangement among generations is an internal matter to a household, and supposedly associates with some core characteristics that would absolutely affect the child development. Theoretically, I consider that multigenerational cooccupation of a housing unit is determined by three major factors : parental income, grandparental income, and family bonds/traditions.

1. Parental income influencing the coresidence decision: The middle-aged generation usually is the main income source of a household. The bullet points below assume some cases where the parents may choose to live with elders to cut costs under the constraint of income. In these cases, the financial status of parents is

[4]https://www.who.int/childgrowth/software/en/

the key motive for coresidence and sets an upper boundary of resources available to the children.

- The parents cannot afford a separate housing unit.
- The parents cannot afford a babysitter so use the grandparents as caregiver.
- The parents cannot afford a private nurse for taking care of their elderly parents.

2. Grandparental income influencing the coresidence decision: it has been a widely spotted phenomenon that the old generation supports their adult children with income, pension, or annuity. Hence grandparental income affects the growth of grandchildren indirectly. The elders may choose to stay with their children when the following occasions present, where income is again the pivotal determinant.

   - The grandparents do not have or have lost income sources.
   - The grandparents are too old or sick to take care of themselves, and are unable to afford a private nurse.

3. Family bonds/traditions influencing the coresidence decision: The cultural and social values, as well as personal preference matter too. Sometimes several generations live together simply because they have solid emotional bonds or local traditions do not encourage separation of a household.

   - The parents are morally obliged to live with and take care of their elderly parents.
   - The family share strong internal bonds and cherish a unified multi-generational household.

All the factors have either straightforward or latent influences on child growth, which need to be addressed in the model. Tables 17 and 18 summarize the most popular predictors of living arrangement used in literature. Age, income, physical needs,

and marital status of the elderly, housing costs, social norms, and economic growth are some major covariates. Among all the relevant variables, income and intergenerational support are what actually have direct influences on growth measures. To avoid any potential bias from the entangled two-way interplay between living condition and family/individual income, instead of using the actual income, I used education as a proxy.

Table 19 showcases the correlation between grandparental coresidence and some of the major covariates. Other than the "paternal" and "maternal" dummies introduced earlier, another indicator "GP" was also analyzed. "GP" equals one if any grandparent, regardless of lineage, stays in the household, and zero if no grandparents. For each indicator I ran two modules. Module 1 utilizes the same set of covariates used in the main equation, and module 2 adds in parental income on the basis of module 1. Nevertheless, the additional covariates did not yield any big differences. Although statistically significant, the correlation estimates are way too small.

In general, the results nicely align with our knowledge of coresidence in China. Grandchild's gender shows no obvious correlations. Older age and better health of grandchild are negatively associated with grandparental stay-around, especially of the paternal side. As a kid gets older and is in good health condition, grandparental assistance would be less needed in the household. Moreover, the increase in age of either kid or parent beyond some certain cutoffs implies a higher probability of grandparental decease. The presence of mother is negatively associated with paternal-side coresidence but positively with maternal-side. It may suggest that in most cases where mother is absent it is paternal grandparents that step in to take domestic responsibilities, yet maternal grandparents incline to enter the family through the mother. The amount of maternal siblings negatively correlates to maternal grandparent's presence, and the amount of paternal ones to paternal grandparent's. With more parental siblings, the chance of taking grandparents into one's household is smaller as every

sibling shares the obligation more or less. Mother's education is negatively related to paternal grandparent's presence while positively to maternal grandparent's. Better educated women favor forming a new household and living independently. Last but not least, urbanization has negative correlation with the elder generation's stay-around. Hiking land price restricts home space available to common families and deprives the ground of multi-generational coresidence.

2.3 Empirical Results

2.3.1 A Simple OLS Setting

Before applying the fixed effects approach, I ran a simple OLS estimation on the controlled covariates. The results are shown in table 20. The weight-for-age and height-for-age z-scores range from -6 to 5 and -6 to 6, respectively. They are physical records generalized and standardized across the entire sample. Their values mark relative positions of individuals in the sample's distribution rather than reflecting actual body statistics. Therefore, they are expected to be less sensitive to controls at individual and household levels (for example, a very small R^2) yet more explainable to provincial characteristics. Health status is a 1-to-7 scale for subjective evaluation of health. In table 20, paternal grandparent is overall related to less weight, smaller height-for-age, and worse health. One conjecture is that grandparent's help with childcare is requested when child develops at a little slower pace, and paternal grandparent is the more common option. However, paternal grandparent is positively correlated with weight and maternal grandparent with weight-for-age when the kid is a girl. Parent's devotion to child's education and expectation on child's educational attainment are positively correlated to the physical measures. Kids with better educated parents or grandparents develop better, and urban kids are significantly taller. Regarding how successful and capable a school-aged kid considers herself, girls on average generate a higher rating. Maternal grandparent is a sign of more educational

investment overall, yet less for girls. Higher parental expectation on educational attainment implies extra investment and better self assessment of child. Larger amount of investment likely takes place in households where parents or grandparents have nicer educational background. Given the inequality in educational resources between urban and rural regions, urban students are unsurprisingly invested more.

The purpose of the OLS practice is to draw a big picture of underlying mechanisms between the outcome variables and the determinants. At this stage, no causal inferences can be made. The signs of estimates are more informative than the sizes as they imply directions of comovement.

2.3.2 A Fixed Effects Setting

Table 21 exhibits the estimates of the main regression model. Many previously identified correlations lost significance after incorporating the household fixed effects. The change suggests that the correlations were probably driven by the unobservable yet broadly influential household characteristics.

Girls physiologically weigh less by about half of a kilogram than boys, yet a 0.16 negative impact of being a girl on weight-for-age signifies that girls are worse nourished in an institutional way. Presence of paternal grandparent enhances an average child's weight by 0.8. Unexpectedly, presence of maternal grandparent brings a decrease of 0.5 that cannot be ignored to the pooled weight-for-age. This could be resulted from sample features or some unknown reasons. For example, a maternal grandparent only moves into her daughter's home when she has no external supports at all. Then such a move-in is equivalent to a negative income shock to the family. Other than the sample-wide impacts, no particular grandparental impacts on girls' physical measures were singled out.

Parent's eagerness to communicate mildly improves child's health scale by one fifth. Active communication typically builds up a solid parent-child relationship and

helps parents gain trust from their kids. Therefore, parents who are enthusiastic to communicate are able to learn their children's needs and conditions more easily and promptly. Parent's expectation on higher educational attainment ensures that daily necessities of child are well satisfied, hence through which slightly adjusts height, height-for-age, and weight-for-age.

Girls show more confidence in carrying duties of student cadre with an extra 0.3 in self rating of capability. Maternal grandparent has a positive impact of 1.8 across the whole sample on the said rating, which is enough for a clean upgrade. Interestingly, this impact turned negative when it comes to girls only. Thus, we can imagine that the encouragement for becoming a student cadre from maternal grandparents to boys must be even larger than 1.8. On the other hand, maternal grandparent does make girl's self evaluation of well-behaving as a student (not including academic performance) increase by 0.56. In the following subsection I would discuss an explanation that reconciles these seemingly contradictory findings.

Mother's educational level lowers self evaluation of cadre competency. "Paternal grandparents' highest education" represents the highest educational achievement between the couple, either dead or alive, in the family or not. It places an upward tendency on self acknowledgment of being a remarkable student. In China, grandparents usually have an image of being spoiling. They give grandchildren whatever they ask, overcompensate them for punishments received from their parents, and defend them whenever they argue with parents. Grandparents can be the moderator between two generations. They make children's life easier when parents are too strict and resolve lurking conflicts before they strike.

2.3.3 Robustness Check Using Lewbel's Heteroskedasticity-based Instruments (HBIV)

Lewbel (2012) introduced this identification strategy for linear models as an alterna-

tive to the conventional IV approach when the latter is unavailable, and I happened to have this problem. The basic idea is to construct internal instruments based on heteroskedastic errors and the product of which needs to be uncorrelated with the chosen regressors to achieve identification. The only requirement is mostly satisfied in many models and especially applies to mine, where endogeneity arises from some unobservable common factors. Later in 2018, Lewbel (2018) proved that the strategy is as well valid for endogenous treatment indicators. This paper does not intend to theoretically justify the method at this time as the job has been done by quite a few papers. For better knowledge, Quiroga (2018) discussed pros and cons of the strategy in details and Baum and Lewbel (2019) elaborated some caveats for application.

Many researchers have already applied the HBIV approach and obtained robust findings. Mishra and Smyth (2015) compared it with the standard IV in a study of returns to schooling using urban China samples and found the estimates were "plausibly similar". Posso (2017) employed it to examine child Labor's effect on long-run earnings and reported consistent results across multiple trials. Emran and Hou (2013) and Radoias and Kim (2015) as well supplemented the rationale with additional convincing outcomes based on this identification. Accordingly, I used the said method to test the robustness of my analysis from a different perspective.

Table 22 summarizes what I got. The one fifth downward bias on girl's weight-for-age confirms the existence of an institutional nourishment gap between boys and girls. The paternal-side coresidence has a small yet significant negative impact on child's health status, which is inconsistent with the fixed effects model. Other than that, there are no evident grandparental effects on body measures.

Parent's devotion to child's education gently increases height, height-for-age and health status. Parent's eagerness to communicate raises health status by about 0.2. Parent's expectation on educational attainment improves height by 0.77 cm, weight-for-age, height-for-age, and health status slightly as well. The widespread positive

impacts from these factors, though some are insignificant, reconfirm the results of the basic model, and also reveal an important fact. Parents' attitudes toward children greatly depend on the attitudes of their parents toward them. It is unconvincing to say that the said factors are not affected by grandparents at all. Rather than directly imposing influences on grandchildren, grandparents unintentionally deliver their impacts through parents. The positive impacts of parent's and grandparent's education also speak for this argument.

Girls on average have better self evaluation of student's well-behaving and cadre capability than boys. The presence of paternal grandparents raises self appraisal on cadre capability by 0.1. Total education expenditures increase by 1,248 yuan for all at the presence of maternal grandparent, while decrease by 1,555 yuan for girls only. A reasonable explanation is that maternal grandparents shift many educational resources form girls to boys, either by their own decisions or through manipulating parent's decisions. If we recall the conflicting fixed effects estimates of maternal grandparent's influences on girl's self-rated fulfillment of student duties and competence of being a cadre, we may see the possible underlying logic here. Maternal grandparents expect girls to develop in a way where they merely abide by student codes, behave well at school, and accomplish repetitive tasks everyday, but do not stand out to run for a cadre position, pursue an unnecessary educational attainment, or demonstrate their talents and creativity. Maternal grandparents want girls to "stay low" rather than to catch others' attention. This belief could be from protective minds or conservative preferences deep down, which we do not know for sure.

Unsurprisingly, parent's high hope on educational attainment has significant and wide impacts on child's overall performance relating to school. Children are receiving more investment on education and more confident in self assessments. Parent's and grandparent's level of education has a positive effect on the educational investment in children. Among the four covariates mother's education is the most influential,

whose one unit advance adds 434 yuan to the average expense.

Some statistics from the first stages and the joint tests are exhibited in the bottom part of table 22 for each outcome variable. Cragg and Donald (1993) promoted the Cragg-Donald F-statistic as an improvement to the standard one. Yet in my case, with more than one endogenous regressors being instrumented for and standard errors clustered at the community level (namely the sample is not *i.i.d.*), the Cragg-Donald F-statistic is no longer valid. I instead report the Sanderson-Windmeijer statistic for the weak-identification test of a particular variable (Sanderson and Windmeijer, 2016). The Sanderson-Windmeijer test can be seen as a more generalized procedure than the Cragg-Donald test, as it addresses both the situations of multiple endogenous variables and robust standard errors. In the "special" case of a single endogenous variable, the Sanderson-Windmeijer statistic is identical to the Cragg-Donald statistic (if the sample is *i.i.d.*) or the Kleibergen-Paap rk Wald statistic (if the sample is clustered).[5] The test statistics of the four endogenous regressors are significant for all the outcome variables, which indicate the rejection of weak identification. To test whether the models are overall underidentified, the Kleibergen-Paap rk LM procedure has been invoked (Kleibergen and Paap, 2006). The null hypothesis suggesting underidentification is rejected at all levels for every model. At last, the Sargan-Hansen test statistic whose joint null hypothesis implies the validity of instruments is reported. Based on the P-values of Hansen's J-statistics[6], I fail to reject that these instruments are valid. To summarize, the first-stage statistics have offered plenty of supports to the reliability of Lewbel's method, and the findings from HBIV basically agree with those of the main model except for the specific impacts of paternal grandparent on a child's physical measures. In the section below, I discuss the implications and limitations of the results.

[5]Kleibergen and Paap (2006) proposed a variation to the Cragg-Donald statistic to release the *i.i.d.* presumption embedded in the latter one.

[6]The Hansen's J-statistic is presented as the consistent statistic with a clustered sample.

2.4 Conclusion and Discussion

Using data from the China Family Panel Studies (CFPS), I found no strong and consistent supports for direct grandparental influences on selected characteristics of grandchildren, nor for the matrilateral bias hypothesis. However, there were signs of indirect grandparental impacts through the middle generation. Regarding the hypothesis, literature holds a few counter-examples. Pashos (2000) showed that the direction of lineage bias changes across geographical locations. In Germany and urban Greece, maternal grandparents gave more solicitude; while in rural Greece, it was paternal grandparents who provided more care. Dubas (2001) found that granddaughters did not feel closer to maternal grandparents than did grandsons, and grandsons did not hold more intimate relations to maternal grandmothers than to paternal grandmothers. Smorti et al. (2012) found that relative to maternal grandparents, paternal grandparents spent more time with grandchildren using an Italian sample. Kaptijn et al. (2012) examined both Dutch and Chinese data, and the findings validated the hypothesis in the Netherlands while denied it in China. These studies left a question mark on the existence of the supposedly universal matrilateral bias. If the bias does exist, it does not necessarily strengthen relationships between maternal grandparents and grandchildren.

As for the context of this research, one must realize that patriarchy still dominates Chinese families nowadays (Jankowiak and Moore, 2016; Chien and Yi, 2014). A married female would leave her original household and stay with her husband's family members, if not establish a new household. Chinese value the pass-down of family name, yet there is not much help from girls whose children carry the family name of their spouse. The conservative norms undermined people's appreciation of female, forged female's image as "negative equity" and emphasized female's inferior social position. For example, parents, especially rural parents, regard marriage by a certain age as the first priority for their daughter, and often disagree with pursuit of

higher educational attainment (Wang, 2005). In such a context where discrimination was institutionalized, any investment in a girl beyond necessity could be considered irrational and meaningless.

My conjecture of maternal grandparents as parents of girls showing extra solicitude or "sympathy" to granddaughters found no grounds and remains for further examination. One or two estimates suggest that maternal grandparents favor grandsons over granddaughters and incline to shift resources to boys. The maternal grandparents may occasionally feel "losing twice" when look at their granddaughters, and hence attempt to compensate themselves for inability to raise their own son through cutting investment in granddaughters or showing more care toward grandsons. We can boldly imagine that the "sense of failure" is even augmented in families restricted by the one-child policy, which leaves no space for future "correction". Unlike what my assumption implies, the experience of raising a daughter could reinforce the stereotypes instead of eliminating them after perceiving the socioeconomic inferiority more acutely.

One's life experience does not always make a person reflect on and correct the mistreatments she received. It may turn out to intensify any existing obsession. Although off topic, we have seem many real world examples. Women who suffered from their mother-in-laws are even more harsh to their daughter-in-laws; who were discriminated against as a girl show more hatred to their own daughters; and who could not choose freely deprive their daughters' right to choose. After all, it is much easier to strengthen one's beliefs than to alter them.

Deeper understanding of this topic will help improve gender equality and increase national investment in primary education. Although the rapid modernization and urbanization in China attenuate son preference to a degree, gender discrimination still has its roots in rural areas. With agricultural jobs being the main income source, male population stands for potential labor force, namely more wealth in the future.

Therefore, to eliminate gender discrimination inevitably relies on comprehensive and complete modernization and urbanization.Murphy et al. (2011) also emphasized that son preference is likely to die off over time as income grows.

This paper has its limitations and leaves space for future improvements. Forming a multi-generational household can hardly be an exogenous decision. It is related to the internal conditions of a family. One way to bypass the endogeneity issue is to restrict the sample to households with co-residing grandparents long before the first kid was born. Regardless of the specific reason of living together, the presence of grandparents can be seen as exogenous when the kid was born. This is infeasible for the CFPS dataset as the restricted sample is too small to yield any valid estimate. There are plenty studies on grandparental impacts in the U.S. and Europe where son preference is not prevalent, and it may as well be inspiring to take a look at other developing countries with gender preference. Last but not least, to sort out households into "boys only", "girls only", and "both genders" and then examine each type separately will no doubt add more credits to the current research. Since my approach relies on fixed effects at household level, one drawback of which is that information of households with only one child or children of the same gender is excluded as it generates no household-level variations. This is a trade-off situation. Including fixed effects at least would remove disturbances from unobservable factors relating to family traditions, yet given the aforementioned concern, separation of the sample according to gender constitution of children is meaningful. This practice was not conducted for the current dataset because a large decrease in sample size could further undermine the universality of analysis.

This paper has its contributions to the literature regarding household structures and intergenerational relationships. First, it clearly summarized the determinants of coresidence decision identified so far from an aged person's perspective for future reference. Second, it completed a trial of verifying the MBH using a dataset on

China, whose conclusions call for further examination of validity of the hypothesis and deeper understanding of Chinese family formation. Third, it addressed both direct and indirect channels where grandparents may impose influences on grandchildren and suggested that compared to direct connections, indirect channels could be more predominant.

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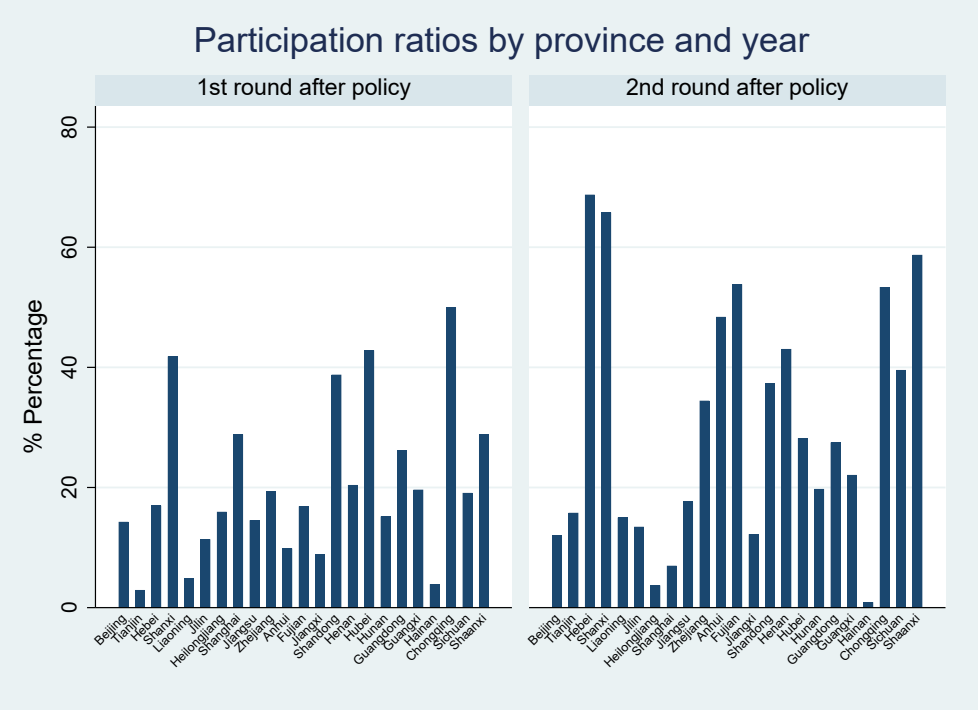
APPENDICES

Figure 1: The distribution of the post-policy sample: participation ratio in each province and percentage of total enrollment by province



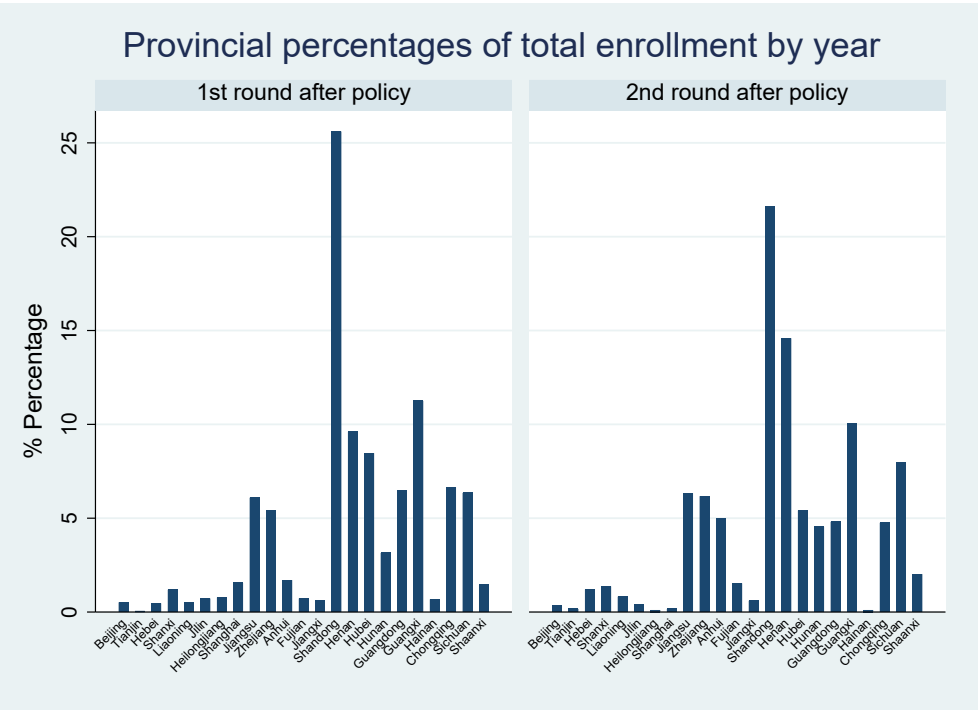


Figure 2: The distribution of the post-policy sample: gender and living location

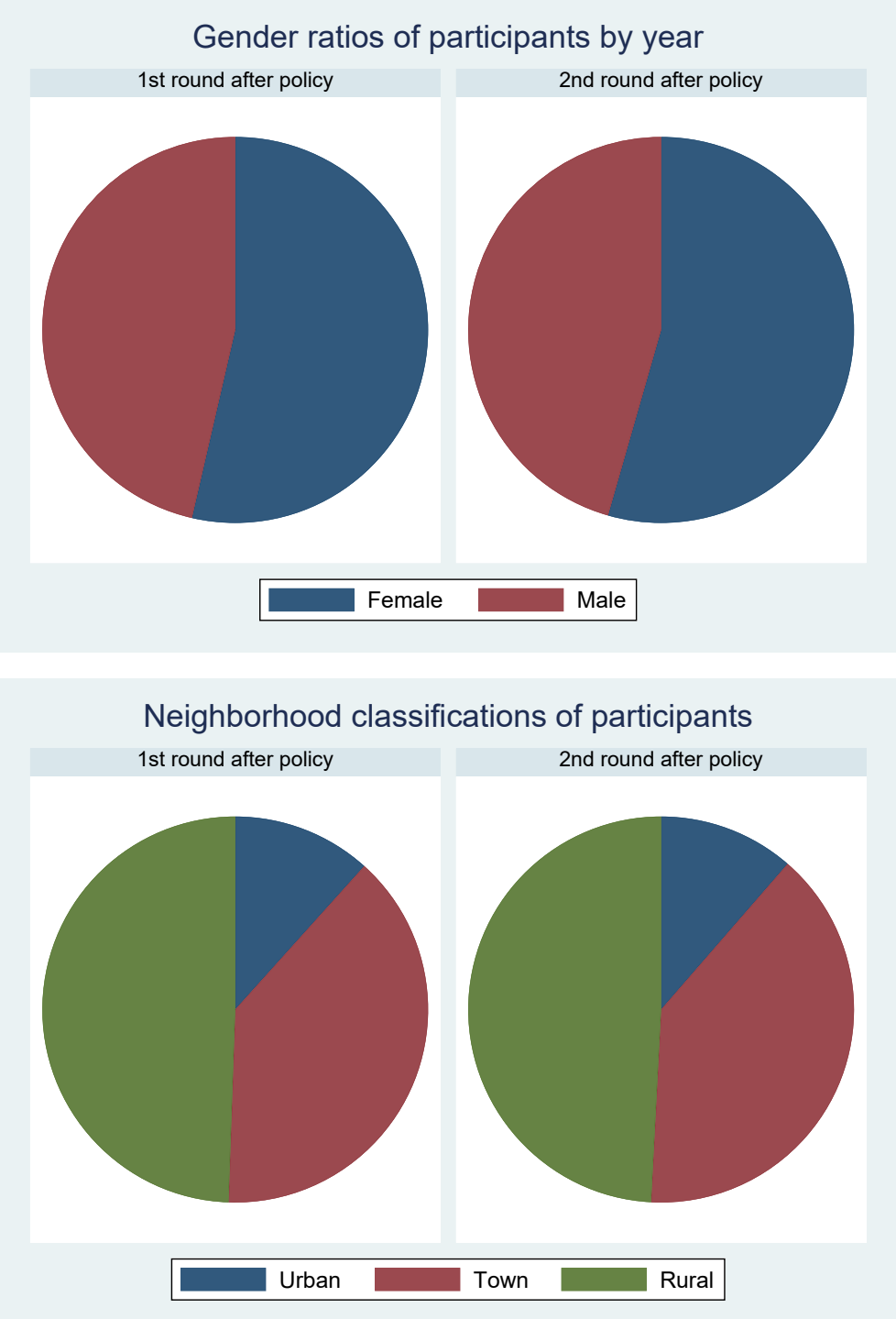


Figure 3: The distribution of the post-policy sample: self-evaluated health and alternative pension enrollment

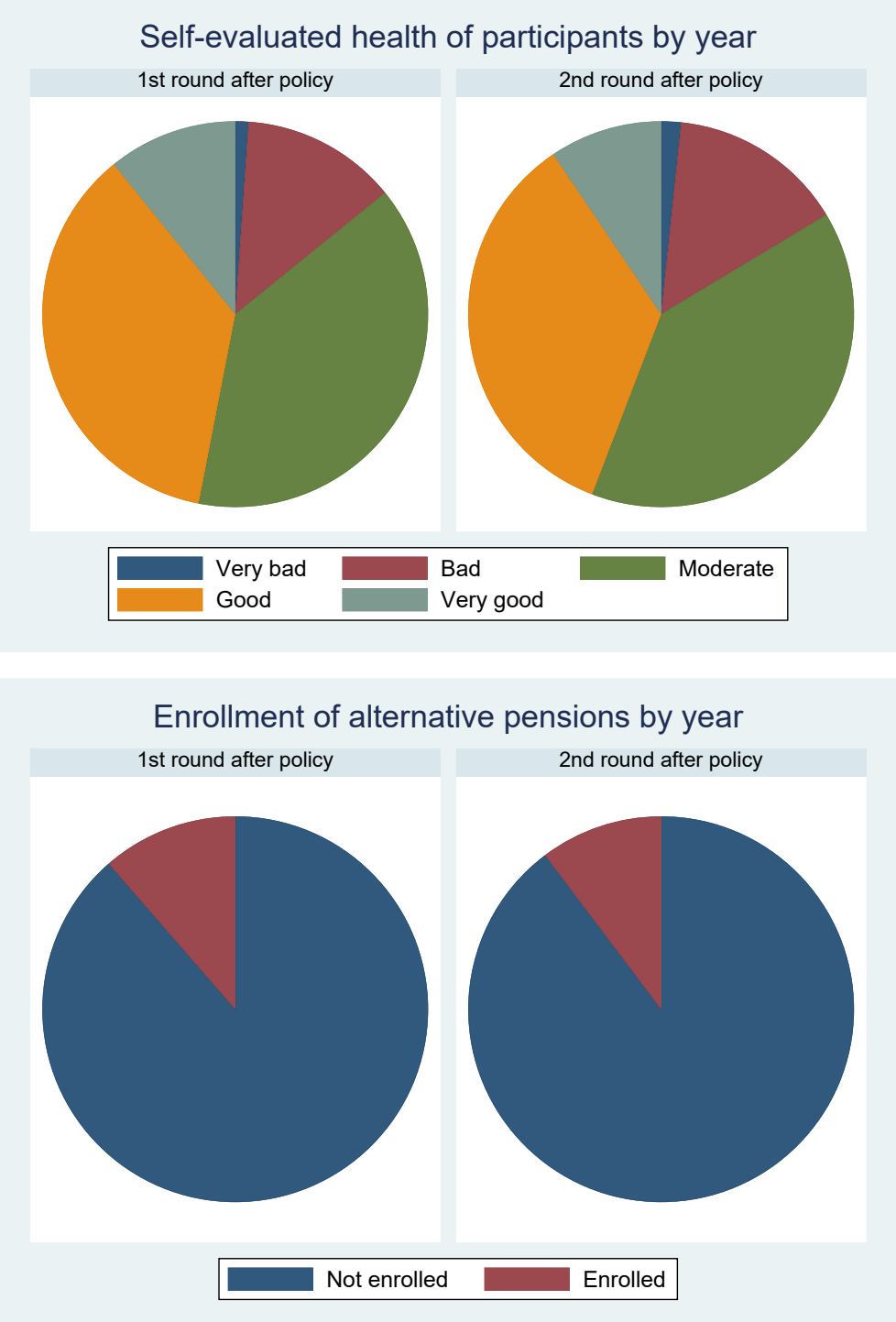


Figure 4: The distribution of the post-policy sample: pre-retirement career and major support source

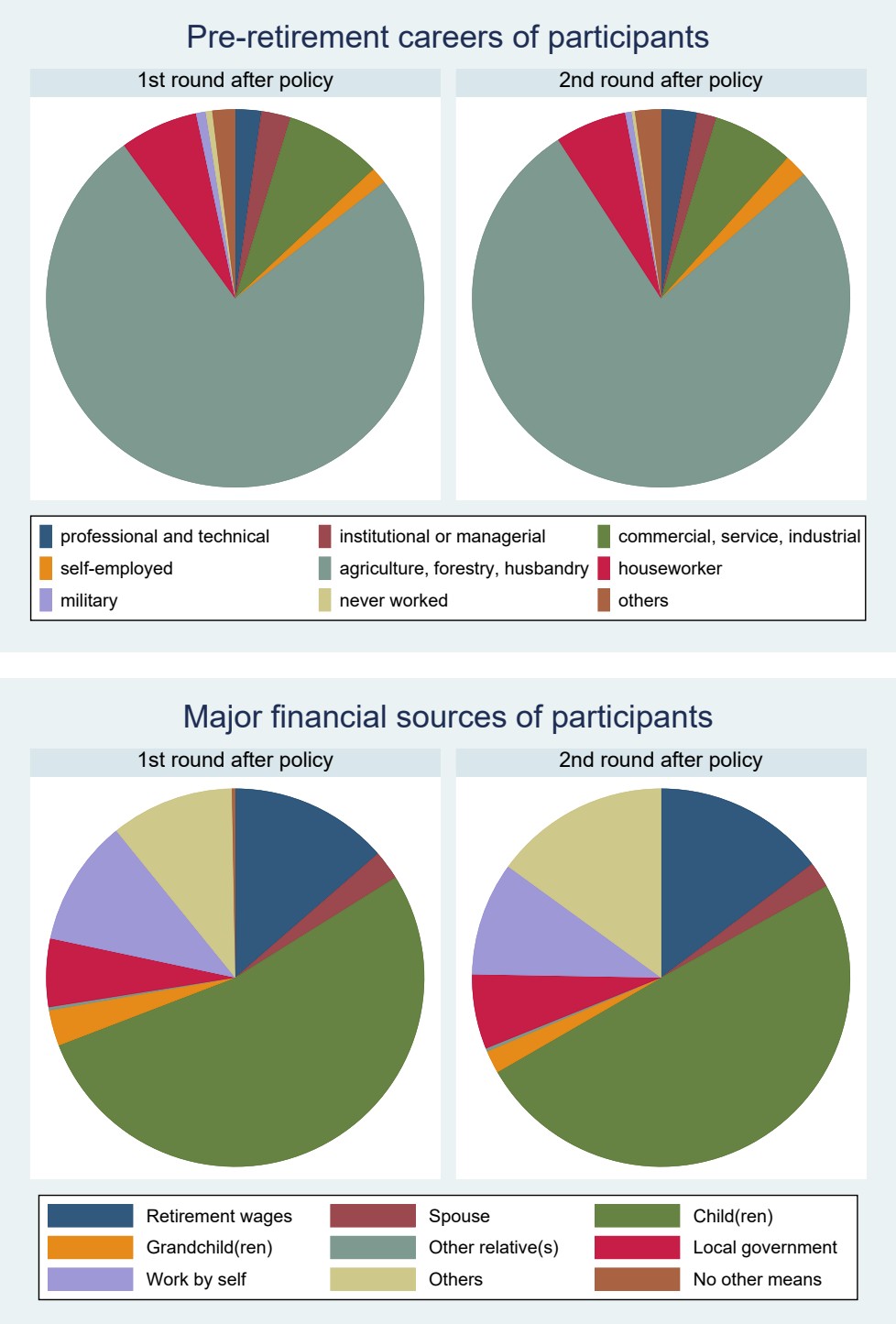


Figure 5: The matching results based on the selected explanatory variables

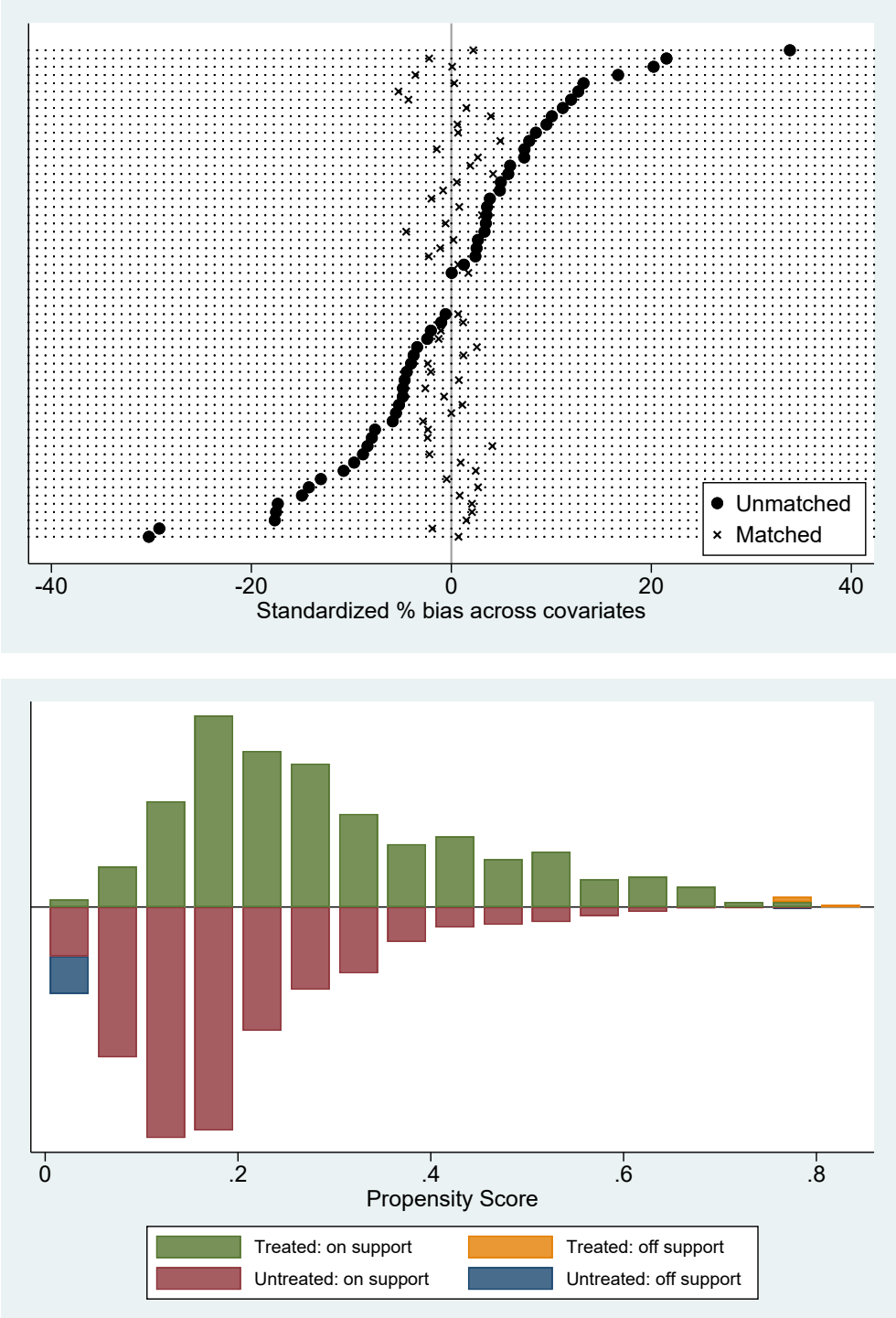


Table 1: Potential determinants of the enrollment decision

	Enrollment	Enrollment	Enrollment	Enrollment
Age	0.086**	0.051	0.106**	0.082
	(0.040)	(0.052)	(0.044)	(0.056)
Financial Support:	-0.288***	-0.387***	-0.258***	-0.370***
Spouse	(0.068)	(0.089)	(0.073)	(0.097)
Financial Support:	-0.305***	-0.360***	-0.261***	-0.316***
Child(ren)	(0.046)	(0.062)	(0.050)	(0.070)
Financial Support:	-0.384***	-0.430***	-0.358***	-0.381***
Grandchild(ren)	(0.072)	(0.080)	(0.079)	(0.094)
Financial Support:	-0.451**	-0.567**	-0.419*	-0.588*
Other Relative(s)	(0.178)	(0.277)	(0.237)	(0.339)
Financial Support:	-0.335***	-0.384***	-0.281***	-0.324***
Local Government	(0.054)	(0.074)	(0.059)	(0.081)
Financial Support:	-0.309***	-0.426***	-0.285***	-0.408***
Work by Self	(0.051)	(0.069)	(0.055)	(0.077)
Household Income Per	0.006*	0.009**	0.006*	0.007
Capita	(0.003)	(0.004)	(0.004)	(0.005)
Other Pensions	-0.182***	-0.204***	-0.149***	-0.140*
	(0.049)	(0.069)	(0.052)	(0.073)
Rice + Wheat	0.072**	0.096**	0.060*	0.073*
	(0.031)	(0.040)	(0.033)	(0.043)
Daily Consumption	-0.008**	-0.007	-0.009***	-0.008*
of Staple Food	(0.003)	(0.004)	(0.004)	(0.005)
# of Serious Illness	-0.004*	-0.003	-0.005**	-0.003
	(0.002)	(0.003)	(0.002)	(0.004)
Decide My Own		0.122*		0.161*
Spending		(0.068)		(0.083)
Decide Self & Some		0.151**		0.199**
Household's Spending		(0.077)		(0.091)
Decide Almost		0.177**		0.224**
Every Spending		(0.080)		(0.095)
Net Transfers from			0.029	0.064**
Children			(0.023)	(0.031)
Net Transfers from			-0.087**	-0.129***
Grandchildren			(0.041)	(0.031)
Observations	8466	6488	7610	5862
R^2	0.112	0.131	0.118	0.144

Standard errors in parentheses, clustered at individual level.

Net transfers are in ten-thousand Yuan.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Tests of differences between participants and non-participants using a pooled sample (before matching)

Before the policy

Variables	G1(0)	Mean1	G2(1)	Mean2	MeanDiff
Heart Rate	3298	72.760	857	72.978	0.217
Systolic Pressure	3299	132.182	856	133.025	0.842
Diastolic Pressure	3291	80.594	853	80.760	0.166
Health (Interviewer Rated)	3332	3.240	868	3.271	0.030
Health (Self Rated)	3275	3.493	858	3.561	0.067*
Life Quality	3274	3.594	858	3.638	0.044
Sleep Quality	3329	3.649	868	3.706	0.057*
Net Transfers from Children	3220	0.150	822	0.160	0.009
Net Transfers from Grandchildren	3235	-0.000	824	0.004	0.004
Deciding Family Spending	3104	2.541	810	2.735	0.193***
Deciding for Self	3332	3.672	868	3.774	0.103**
Preference for Independent Living	3249	1.649	855	1.651	-0.003

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: G1(0) is the number of non-participants; G2(1) is the number of participants.

Note: Net transfers are in ten-thousand Yuan.

Table 3: Number of observations by gender and enrollment in each round

	Female			Male			Total		
Round	Not enrolled	Enrolled	Total	Not enrolled	Enrolled	Total	Not enrolled	Enrolled	Total
1	788	•	788	592	•	592	1,380	•	1,380
2	788	•	788	592	•	592	1,380	•	1,380
3	550	238	788	408	184	592	958	422	1,380
4	488	300	788	381	211	592	869	511	1,380

Note: •indicates no applicable observations.

Table 4: Tests of differences between matched participants and non-participants using a pooled sample

Before the policy

Variables	G1(0)	Mean1	G2(1)	Mean2	MeanDiff
Heart Rate	1904	73.098	837	72.986	-0.113
Systolic Pressure	1903	132.591	836	133.109	0.518
Diastolic Pressure	1898	80.305	833	80.795	0.491
Health (Interviewer Rated)	1916	3.263	844	3.271	0.008
Health (Self Rated)	1889	3.522	835	3.557	0.034
Life Quality	1888	3.614	835	3.631	0.017
Sleep Quality	1915	3.693	844	3.697	0.003
Net Transfers from Children	1858	0.164	802	0.160	-0.003
Net Transfers from Grandchildren	1867	-0.003	804	0.004	0.007
Deciding Family Spending	1774	2.601	789	2.741	0.140***
Deciding for Self	1916	3.729	844	3.773	0.044
Preference for Independent Living	1873	1.652	833	1.649	-0.002

After the policy

Variables	G1(0)	Mean1	G2(1)	Mean2	MeanDiff
Heart Rate	1894	74.448	834	74.283	-0.165
Systolic Pressure	1899	109.341	836	107.914	-1.426**
Diastolic Pressure	1893	108.851	835	107.234	-1.617***
Health (Interviewer Rated)	1903	3.074	840	3.171	0.098***
Health (Self Rated)	1857	3.298	820	3.417	0.119***
Life Quality	1856	3.657	819	3.816	0.158***
Sleep Quality	1912	3.595	840	3.642	0.047
Net Transfers from Children	1794	0.228	782	0.225	-0.003
Net Transfers from Grandchildren	1714	0.016	770	0.010	-0.006
Deciding Family Spending	1503	2.460	652	2.592	0.132***
Deciding for Self	1912	3.691	844	3.774	0.083
Preference for Independent Living	1822	1.668	809	1.663	-0.005

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: G1(0) is the number of non-participants; G2(1) is the number of participants.

Note: Net transfers are in ten-thousand Yuan.

Table 5: Difference-in-difference estimates of pension effects on the elderly

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
Policy Begins	4.317	-15.503*	13.344*	0.374	-0.890*	-0.334
	(5.502)	(8.671)	(6.874)	(0.386)	(0.466)	(0.439)
DID	0.113	-2.721**	-2.412**	-0.006	0.161***	0.077
	(0.691)	(1.245)	(1.006)	(0.050)	(0.061)	(0.066)
Age	-0.484	0.142	0.795	0.066	0.051	0.040
	(0.775)	(1.328)	(1.053)	(0.056)	(0.067)	(0.070)
Rural	0.932	-1.961	-1.017	0.118*	-0.097	-0.030
	(1.108)	(2.017)	(1.562)	(0.071)	(0.093)	(0.099)
Schooling	-0.706*	-1.078**	-0.466	-0.012	0.006	-0.043
	(0.387)	(0.521)	(0.582)	(0.035)	(0.027)	(0.028)
Household Income Per Capita	-0.021	0.176	0.125	-0.015***	0.015**	-0.002
	(0.072)	(0.125)	(0.097)	(0.005)	(0.006)	(0.006)
# of Co-residing People	0.051	-0.063	-0.067	-0.086***	0.019*	0.005
	(0.106)	(0.202)	(0.158)	(0.011)	(0.010)	(0.011)
Daily Consumption of Staple Food	0.096	0.014	-0.164	0.005	-0.000	0.013*
	(0.071)	(0.134)	(0.103)	(0.005)	(0.007)	(0.007)
# of Serious Illness	0.011	0.205	0.063	-0.005	-0.011	-0.024***
	(0.082)	(0.159)	(0.161)	(0.008)	(0.008)	(0.008)
BMI Index	-0.008	0.169*	0.078	-0.004	0.008**	0.004
	(0.051)	(0.089)	(0.063)	(0.004)	(0.004)	(0.006)
Constant	95.355*	141.991*	7.414	-0.217	-1.797	2.227
	(49.650)	(80.161)	(63.875)	(3.556)	(4.201)	(4.172)
Observations	4648	4650	4638	4562	4607	4677
R^2	0.361	0.622	0.729	0.539	0.444	0.479

Standard errors in parentheses, clustered at individual level; income is in ten-thousand Yuan.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Difference-in-difference estimates of pension effects on the elderly (Ctd.)

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
Policy Begins	-0.385	-1.391***	0.284	-0.043	0.097	0.049
	(0.298)	(0.454)	(0.596)	(0.660)	(0.208)	(0.076)
DID	0.091**	0.103	-0.052	-0.022	0.032	-0.016
	(0.045)	(0.068)	(0.085)	(0.094)	(0.030)	(0.019)
Age	0.108**	0.169**	-0.012	0.230**	-0.014	-0.008
	(0.047)	(0.070)	(0.088)	(0.103)	(0.033)	(0.015)
Rural	-0.040	-0.065	-0.036	-0.146	-0.007	0.007
	(0.068)	(0.094)	(0.146)	(0.160)	(0.044)	(0.018)
Schooling	0.002	0.013	0.010	0.003	-0.005	-0.006
	(0.021)	(0.037)	(0.036)	(0.045)	(0.018)	(0.019)
Household Income Per Capita	0.006	0.007	-0.016*	0.011	0.006	-0.002
	(0.004)	(0.007)	(0.009)	(0.010)	(0.005)	(0.002)
# of Co-residing People	0.002	0.023**	-0.071***	-0.045**	-0.002	-0.000
	(0.007)	(0.011)	(0.015)	(0.018)	(0.006)	(0.002)
Daily Consumption of Staple Food	0.018***	0.015*	0.004	-0.001	0.004	0.000
	(0.006)	(0.008)	(0.009)	(0.011)	(0.002)	(0.001)
# of Serious Illness	-0.022***	-0.024**	-0.022***	-0.040***	-0.004	0.001*
	(0.007)	(0.010)	(0.006)	(0.011)	(0.004)	(0.001)
BMI Index	0.006**	0.002	0.005	0.006	0.002	-0.000
	(0.003)	(0.005)	(0.006)	(0.007)	(0.002)	(0.001)
Constant	-1.397	-6.720	5.177	-2.671	-0.117	0.377
	(2.794)	(4.229)	(5.447)	(6.139)	(1.974)	(0.850)
Observations	4670	4609	4071	4680	4479	4415
R^2	0.463	0.463	0.571	0.427	0.402	0.296

Standard errors in parentheses, clustered at individual level; income and net transfers are in ten-thousand Yuan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Difference-in-difference estimates of pension effects on the elderly by membership length

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
Policy Begins	4.305	-15.404*	13.169*	0.362	-0.882*	-0.322
	(5.501)	(8.696)	(6.881)	(0.385)	(0.466)	(0.439)
DID for Round 4 Enrollees	0.634	-1.417	2.070*	0.126**	-0.026	-0.045
	(0.826)	(1.611)	(1.228)	(0.063)	(0.078)	(0.081)
DID for Round 3 Enrollees	-0.246	-2.666	-2.351*	0.053	0.106	-0.014
	(0.919)	(1.683)	(1.405)	(0.069)	(0.089)	(0.100)
DID for Round 3 & 4 Enrollees	0.757	-3.550**	-1.318	0.016	0.191**	0.127
	(0.930)	(1.676)	(1.331)	(0.066)	(0.077)	(0.083)
Age	-0.528	0.225	0.676	0.060	0.052	0.041
	(0.776)	(1.325)	(1.057)	(0.056)	(0.067)	(0.070)
Rural	0.921	-1.965	-1.010	0.122*	-0.100	-0.034
	(1.106)	(2.023)	(1.552)	(0.072)	(0.093)	(0.099)
Schooling	-0.696*	-1.095**	-0.444	-0.012	0.007	-0.042
	(0.389)	(0.520)	(0.587)	(0.035)	(0.027)	(0.028)
Household Income Per Capita	-0.022	0.178	0.122	-0.015***	0.015**	-0.002
	(0.072)	(0.125)	(0.097)	(0.005)	(0.006)	(0.006)
# of Co-residing People	0.050	-0.061	-0.069	-0.086***	0.018*	0.005
	(0.106)	(0.201)	(0.158)	(0.011)	(0.010)	(0.011)
Daily Consumption of Staple Food	0.097	0.013	-0.163	0.006	-0.000	0.013*
	(0.071)	(0.133)	(0.103)	(0.005)	(0.007)	(0.007)
# of Serious Illness	0.011	0.205	0.062	-0.005	-0.010	-0.024***
	(0.082)	(0.160)	(0.160)	(0.008)	(0.008)	(0.008)
BMI Index	-0.008	0.171*	0.075	-0.004	0.008**	0.005
	(0.052)	(0.091)	(0.062)	(0.004)	(0.004)	(0.006)
Constant	97.543**	137.789*	13.352	0.124	-1.820	2.189
	(49.680)	(79.985)	(63.873)	(3.533)	(4.190)	(4.174)
Observations	4648	4650	4638	4562	4607	4677
R^2	0.362	0.622	0.729	0.540	0.444	0.479

Standard errors in parentheses, clustered at individual level; income is in ten-thousand Yuan.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Difference-in-difference estimates of pension effects on the elderly by membership length (Ctd.)

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
Policy Begins	-0.388	-1.388***	0.338	-0.033	0.099	0.048
	(0.298)	(0.454)	(0.586)	(0.661)	(0.209)	(0.076)
DID for Round 4 Enrollees	0.012	0.009	-0.214**	-0.051	-0.014	-0.016
	(0.057)	(0.082)	(0.104)	(0.118)	(0.040)	(0.016)
DID for Round 3 Enrollees	0.106*	0.072	-0.263**	-0.079	0.029	-0.003
	(0.060)	(0.101)	(0.118)	(0.129)	(0.041)	(0.035)
DID for Round 3 & 4 Enrollees	0.086	0.134	0.005	-0.004	0.026	-0.035**
	(0.060)	(0.085)	(0.111)	(0.125)	(0.039)	(0.017)
Age	0.107**	0.168**	-0.007	0.232**	-0.013	-0.007
	(0.047)	(0.070)	(0.087)	(0.103)	(0.033)	(0.015)
Rural	-0.039	-0.066	-0.051	-0.150	-0.007	0.008
	(0.068)	(0.095)	(0.146)	(0.160)	(0.044)	(0.018)
Schooling	0.002	0.014	0.012	0.003	-0.005	-0.007
	(0.021)	(0.037)	(0.035)	(0.045)	(0.018)	(0.019)
Household Income Per Capita	0.006	0.007	-0.016*	0.011	0.006	-0.002
	(0.004)	(0.007)	(0.009)	(0.010)	(0.005)	(0.002)
# of Co-residing People	0.002	0.023**	-0.071***	-0.045**	-0.002	-0.000
	(0.007)	(0.011)	(0.016)	(0.018)	(0.006)	(0.002)
Daily Consumption of Staple Food	0.018***	0.015*	0.004	-0.001	0.004	0.000
	(0.006)	(0.008)	(0.009)	(0.011)	(0.002)	(0.001)
# of Serious Illness	-0.022***	-0.024**	-0.022***	-0.040***	-0.004	0.001*
	(0.007)	(0.010)	(0.006)	(0.011)	(0.004)	(0.001)
BMI Index	0.006**	0.002	0.005	0.006	0.002	-0.000
	(0.003)	(0.005)	(0.006)	(0.007)	(0.002)	(0.001)
Constant	-1.379	-6.672	4.957	-2.761	-0.159	0.300
	(2.804)	(4.239)	(5.359)	(6.147)	(1.968)	(0.852)
Observations	4670	4609	4071	4680	4479	4415
R^2	0.463	0.463	0.573	0.427	0.402	0.297

Standard errors in parentheses, clustered at individual level; income and net transfers are in ten-thousand Yuan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Test of the parallel trends before the policy: no controls

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
Placebo DID	1.163*	-0.195	-0.235	-0.006	-0.043	-0.041
	(0.639)	(1.318)	(0.908)	(0.050)	(0.058)	(0.061)
Pseudo-indicator	0.446	4.854***	-4.827***	0.057**	-0.034	-0.030
	(0.375)	(0.785)	(0.492)	(0.028)	(0.031)	(0.035)
Constant	72.664***	130.349***	82.913***	1.624***	3.643***	3.716***
	(0.152)	(0.317)	(0.208)	(0.012)	(0.013)	(0.014)
Observations	2741	2739	2731	2706	2723	2759
R^2	0.007	0.040	0.094	0.004	0.003	0.002

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
Placebo DID	-0.074	-0.066	-0.059	-0.016	-0.063**	-0.005
	(0.046)	(0.065)	(0.087)	(0.098)	(0.025)	(0.006)
Pseudo-indicator	-0.075***	-0.060	-0.020	-0.136**	0.047***	0.005
	(0.025)	(0.038)	(0.047)	(0.053)	(0.017)	(0.005)
Constant	3.314***	3.573***	2.662***	3.812***	0.149***	-0.003
	(0.010)	(0.015)	(0.018)	(0.022)	(0.006)	(0.002)
Observations	2760	2724	2563	2760	2660	2671
R^2	0.018	0.006	0.001	0.007	0.007	0.001

Standard errors in parentheses, clustered at individual level; net transfers are in ten-thousand Yuan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Test of the parallel trends before the policy: full controls

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
Placebo DID	1.173	0.663	0.155	0.016	-0.030	-0.034
	(0.717)	(1.483)	(1.008)	(0.053)	(0.062)	(0.068)
Pseudo-indicator	-0.196	-0.737	-13.110***	0.208	-0.172	0.213
	(2.388)	(5.212)	(3.241)	(0.170)	(0.198)	(0.220)
Constant	70.835	110.035	-60.622	-1.019	2.638	11.680*
	(74.949)	(156.579)	(98.276)	(5.013)	(5.819)	(6.529)
Observations	2493	2490	2482	2463	2480	2509
R^2	0.035	0.072	0.140	0.104	0.043	0.031

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
Placebo DID	-0.100*	-0.106	-0.045	0.029	-0.056*	-0.004
	(0.052)	(0.072)	(0.090)	(0.105)	(0.029)	(0.008)
Pseudo-indicator	-0.043	-0.122	0.203	-0.155	0.009	0.017
	(0.164)	(0.235)	(0.289)	(0.337)	(0.091)	(0.028)
Constant	-2.557	-3.144	8.573	-14.855	-0.477	1.003
	(4.625)	(6.875)	(8.611)	(10.449)	(2.539)	(0.643)
Observations	2510	2481	2356	2510	2430	2437
R^2	0.066	0.044	0.089	0.066	0.027	0.012

Standard errors in parentheses, clustered at individual level; net transfers are in ten-thousand Yuan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Test of the validity of the control group

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
Counterfactual DID	0.437	1.230	2.560**	0.015	-0.066	-0.029
	(0.813)	(1.447)	(1.073)	(0.055)	(0.072)	(0.074)
Round 2	1.464	5.990*	-9.918***	0.140	-0.330**	-0.112
	(1.913)	(3.124)	(2.453)	(0.136)	(0.165)	(0.157)
Round 3	3.085	-20.448***	14.491***	0.321	-0.571*	-0.180
	(3.678)	(5.995)	(4.716)	(0.264)	(0.320)	(0.302)
Round 4	4.255	-17.295**	11.350	0.368	-0.788*	-0.285
	(5.409)	(8.718)	(6.910)	(0.387)	(0.466)	(0.440)
Constant	95.732*	134.893*	1.347	-0.224	-1.402	2.432
	(49.449)	(80.356)	(63.991)	(3.560)	(4.212)	(4.176)
Observations	4648	4650	4638	4562	4607	4677
R^2	0.361	0.621	0.729	0.539	0.442	0.478

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
Counterfactual DID	-0.029	-0.086	0.038	-0.031	0.034	0.012
	(0.051)	(0.079)	(0.100)	(0.104)	(0.042)	(0.013)
Round 2	-0.150	-0.478***	0.084	-0.141	0.022	0.007
	(0.107)	(0.164)	(0.213)	(0.234)	(0.076)	(0.029)
Round 3	-0.179	-0.952***	0.211	0.061	0.085	0.020
	(0.204)	(0.314)	(0.416)	(0.451)	(0.143)	(0.052)
Round 4	-0.328	-1.313***	0.240	-0.046	0.103	0.037
	(0.296)	(0.455)	(0.600)	(0.661)	(0.206)	(0.077)
Constant	-1.148	-6.467	5.008	-2.739	-0.024	0.346
	(2.779)	(4.226)	(5.445)	(6.139)	(1.975)	(0.840)
Observations	4670	4609	4071	4680	4479	4415
R^2	0.462	0.463	0.571	0.427	0.402	0.296

Standard errors in parentheses, clustered at individual level; net transfers are in ten-thousand Yuan.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: A glance at the post-policy dynamics of the elderly's outcomes

	Heart Rate	Systolic Pressure	Diastolic Pressure	Preference for Independent Living	Life Quality	Sleep Quality
DID for Round 3	0.412	-1.796	-1.996*	-0.016	0.207***	0.088
	(0.808)	(1.394)	(1.190)	(0.059)	(0.075)	(0.077)
DID for Round 4	-0.225	-3.758**	-2.882**	0.005	0.108	0.065
	(0.871)	(1.457)	(1.294)	(0.063)	(0.073)	(0.082)
Round 2	1.479	6.301**	-9.646***	0.140	-0.340**	-0.118
	(1.926)	(3.115)	(2.450)	(0.136)	(0.165)	(0.157)
Round 3	3.081	-19.040***	16.180***	0.329	-0.670**	-0.225
	(3.757)	(5.961)	(4.710)	(0.264)	(0.321)	(0.301)
Round 4	4.466	-14.999*	13.565**	0.369	-0.864*	-0.328
	(5.533)	(8.694)	(6.881)	(0.387)	(0.468)	(0.439)
Constant	96.047*	144.507*	8.501	-0.239	-1.683	2.258
	(49.802)	(80.178)	(63.816)	(3.559)	(4.217)	(4.172)
Observations	4648	4650	4638	4562	4607	4677
R^2	0.361	0.622	0.729	0.539	0.444	0.479

	Health (Interviewer Rated)	Health (Self Rated)	Deciding Family Spending	Deciding for Self	Net Transfers from Children	Net Transfers from Grandchildren
DID for Round 3	0.108**	0.159*	-0.065	0.011	0.014	-0.022**
	(0.054)	(0.082)	(0.102)	(0.112)	(0.034)	(0.010)
DID for Round 4	0.073	0.040	-0.037	-0.060	0.052	-0.008
	(0.054)	(0.082)	(0.104)	(0.118)	(0.043)	(0.038)
Round 2	-0.157	-0.483***	0.090	-0.137	0.019	0.008
	(0.108)	(0.164)	(0.213)	(0.233)	(0.076)	(0.029)
Round 3	-0.232	-1.030***	0.250	0.057	0.083	0.032
	(0.205)	(0.313)	(0.414)	(0.449)	(0.146)	(0.052)
Round 4	-0.375	-1.359***	0.277	-0.024	0.088	0.045
	(0.299)	(0.457)	(0.597)	(0.661)	(0.206)	(0.076)
Constant	-1.348	-6.569	5.156	-2.578	-0.163	0.363
	(2.800)	(4.245)	(5.453)	(6.137)	(1.960)	(0.862)
Observations	4670	4609	4071	4680	4479	4415
R^2	0.463	0.463	0.571	0.427	0.402	0.296

Standard errors in parentheses, clustered at individual level; net transfers are in ten-thousand Yuan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Number of observations by sex and age in each year

Age (in years)	(0,3]		(3,6]		(6,12]		(12,16]		Total	
Gender	M	F	M	F	M	F	M	F	M	F
2010	831	716	752	598	1,479	1,293	906	905	3,968	3,512
2012	897	816	831	774	1,490	1,290	914	839	4,132	3,719
2014	884	809	847	753	1,489	1,311	817	742	4,037	3,615
2016	803	742	762	733	1,348	1,120	643	549	3,556	3,144

Table 14: Number of observations by sex and lineage of co-residing grandparents in each year

Co-residing with	No GP		Only Paternal		Only Maternal		Both Sides	
Gender	M	F	M	F	M	F	M	F
2010	1,550	1,356	1,133	1,009	124	112	7	9
2012	1,490	1,279	1,689	1,545	141	146	6	7
2014	1,368	1,200	1,556	1,453	136	138	10	17
2016	1,044	928	1,219	1,062	130	119	14	6

Table 15: Number of observations by the community type and lineage of co-residing grandparents in each year

Co-residing with	No GP		Only Paternal		Only Maternal		Both Sides	
Community	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
2010	1,639	1,267	1,389	753	111	125	14	2
2012	1,554	1,169	2,192	1,029	148	138	11	2
2014	1,361	1,174	1,855	1,064	120	148	13	13
2016	965	979	1,391	877	94	154	7	13

Table 16: Summary statistics of the outcome variables

gender	variable	N	mean	sd	min	25th	median	75th	max
male	weight (kg)	15,185	25.924	14.705	1.90	15.00	22.50	35.00	111.50
	height (cm)	14,823	116.909	32.862	30.00	90.00	120.00	143.00	215.00
	weight-for-age	10,152	-.104	1.597	-5.90	-1.02	-.06	.90	5.00
	height-for-age	13,524	-.679	2.032	-6.00	-1.90	-.43	.68	6.00
female	weight (kg)	13,487	24.683	13.538	2.25	14.50	21.00	35.00	94.50
	height (cm)	13,179	115.934	32.113	21.00	90.00	120.00	145.00	180.00
	weight-for-age	9,016	-.225	1.475	-5.96	-1.04	-.18	.69	4.95
	height-for-age	12,156	-.733	1.952	-6.00	-1.81	-.49	.51	5.96

gender	variable	N	mean	sd	min	25th	median	75th	max
male	expenditures [1]	15,189	0.175	0.357	0.000	0.000	0.043	0.200	7.490
	health status [2]	15,378	5.577	1.114	1	5	6	6	7
	excellence [3]	5,099	3.085	0.867	1	3	3	4	5
	capability [4]	5,086	2.811	1.150	1	2	3	4	5
female	expenditures [1]	13,516	0.186	0.420	0.000	0.000	0.048	0.205	16.000
	health status [2]	13,725	5.580	1.111	1	5	6	6	7
	excellence [3]	4,625	3.219	0.833	1	3	3	4	5
	capability [4]	4,598	3.043	1.116	1	2	3	4	5

[1] total educational expenditures are in ten-thousand Yuan.
[2] health status: an integer measure scaled from 1 to 7.
[3] self-rated excellence as a student: an integer measure scaled from 1 to 5.
[4] self-rated capability as a student cadre: an integer measure scaled from 1 to 5.

Table 17: Determining factors identified in the literature of Chinese intergenerational coresidence

Author	Factor	Affecting children	Controllable
Chen (2005)	childcare needs; widowhood; health status	yes	partially
Meng and Luo (2008)	(urban China) housing availability	no	yes
Zimmer and Korinek (2010)	physical and material needs, and marital status of the elderly	no	partially
Sereny (2011)	age, ethnicity, socioeconomic status and family care resources (on elders' preference)	no	partially
Rosenzweig and Zhang (2014)	(urban China) parents' and grandparents' income	yes	yes
Zhang et al. (2014)	filial piety; past receipt of support; needs of the elderly; home ownership	yes	partially
Cong and Silverstein (2015)	(rural China) past intergenerational transfers; emotional closeness	yes	no
Yu and Yan (2016)	marital status and income (on reality); education (on preference)	yes	yes
Meng et al. (2017)	(urban China) age (on preference); marital status	no	yes
Fan et al. (2018)	the relative income of the elderly and their children; health status	yes	partially
Li and Wu (2018a)	(urban China) the city-level housing price	no	yes
Yi et al. (2018)	house price	no	yes
Wang et al. (2019)	social norms, self-interest and altruism	potentially	partially

Note[1]: "on preference" stands for "having impacts on living preference".
Note[2]: "on reality" stands for "having impacts on actual arrangement".

Table 18: Determining factors identified in the literature of world intergenerational coresidence

Author	Factor	Affecting children	Controllable
Crimmins and Ingegneri (1990); Whittington and Elizabeth Peters (1996)	parents' and grandparents' income	yes	yes
Kamo and Zhou (1994)	cultural values	no	yes
Ermisch and Di Salvo (1997); Ermisch (1999); Paciorek (2015)	housing cost	no	yes
Autaç (1998)	urbanization and economic development; modernity and secularism	no	yes
Choi (1999)	income; health status	yes	partially
Giang and Pfau (2007)	age; gender; marital status; urbanity; home ownership	no	yes
Ruggles and Heggeness (2008)	industrialization; migration; economic growth	no	yes
Lee and Painter (2013); Engelhardt et al. (2016)	employment status	no	yes
Bolina and Tavares (2016)	gender; income	yes	yes

Table 19: Factors correlated with the coresidence decision

	GP 1	GP 2	paternal 1	paternal 2	maternal 1	maternal 2
girl	0.006	0.007	0.004	0.005	0.002	0.002
	(0.010)	(0.011)	(0.011)	(0.011)	(0.005)	(0.005)
child's age	-0.001***	-0.001***	-0.001**	-0.001**	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
child's health	-0.030***	-0.030***	-0.028***	-0.029***	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)
mom	-0.147***	-0.139***	-0.165***	-0.166***	0.022**	0.030**
	(0.026)	(0.028)	(0.026)	(0.028)	(0.011)	(0.013)
mom's age	-0.026**	-0.029**	-0.021	-0.022*	-0.003	-0.005
	(0.013)	(0.013)	(0.013)	(0.014)	(0.006)	(0.006)
mom's siblings	-0.008	-0.008	0.005	0.005	-0.014***	-0.014***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.003)	(0.003)
dad's siblings	-0.027***	-0.026***	-0.027***	-0.027***	0.001	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)
mom's education	-0.009	-0.012	-0.023***	-0.024***	0.012***	0.009**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)
dad's education	0.007	0.007	0.005	0.007	0.003	0.001
	(0.009)	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)
paternal GPs'	0.002*	0.003*	0.002	0.002	0.001	0.001
max age	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
maternal GPs'	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
max age	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
urban	-0.054***	-0.054***	-0.061***	-0.060***	0.009	0.007
	(0.021)	(0.021)	(0.021)	(0.021)	(0.008)	(0.008)
mom's income		0.010**		0.005		0.006**
		(0.004)		(0.004)		(0.003)
dad's income		-0.001		-0.005***		0.003***
		(0.002)		(0.002)		(0.001)
Observations	14896	14570	14885	14559	14892	14566
R^2	0.152	0.150	0.141	0.139	0.022	0.026

Standard errors in parentheses, clustered at the community level; income is in ten-thousand Yuan.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Co-residing impacts of grandparents using OLS

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
girl	-1.941***	0.439	-0.250***	-0.077	-0.001	0.004	0.108***	0.275***
	(0.273)	(0.428)	(0.073)	(0.065)	(0.033)	(0.011)	(0.039)	(0.054)
paternal	-0.515*	-0.639	-0.088	-0.168**	-0.108***	-0.009	0.029	0.093*
	(0.293)	(0.429)	(0.073)	(0.070)	(0.041)	(0.012)	(0.040)	(0.056)
paternal	0.912***	-0.481	0.062	0.155	0.005	0.012	0.014	-0.028
× girl	(0.341)	(0.577)	(0.092)	(0.094)	(0.045)	(0.016)	(0.061)	(0.078)
maternal	-0.469	-0.358	-0.180	-0.034	-0.118	0.118*	-0.163	0.175
	(0.715)	(0.789)	(0.150)	(0.166)	(0.088)	(0.065)	(0.113)	(0.141)
maternal	1.110	-0.429	0.356*	0.022	-0.037	-0.143**	0.504***	-0.099
× girl	(0.789)	(1.328)	(0.205)	(0.244)	(0.103)	(0.070)	(0.160)	(0.224)
educational	0.032	0.529*	0.021	0.077**	0.112***	0.019***	0.036	0.032
devotion	(0.129)	(0.274)	(0.032)	(0.037)	(0.022)	(0.006)	(0.024)	(0.034)
active com-	0.118	0.146	0.064*	0.058	0.210***	-0.001	-0.008	0.071**
munication	(0.139)	(0.272)	(0.035)	(0.042)	(0.025)	(0.007)	(0.024)	(0.035)
educational	0.079	0.770***	0.058***	0.096***	0.034**	0.008**	0.086***	0.061***
expectation	(0.080)	(0.129)	(0.022)	(0.020)	(0.015)	(0.003)	(0.015)	(0.020)

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Table 20 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
mom	0.004	3.024***	0.121	0.455***	0.142*	-0.000	0.047	0.033
	(0.410)	(0.919)	(0.123)	(0.151)	(0.076)	(0.019)	(0.086)	(0.121)
dad	0.448	-0.652	0.242**	-0.010	0.096	0.055***	0.001	0.013
	(0.353)	(0.744)	(0.096)	(0.108)	(0.066)	(0.015)	(0.075)	(0.099)
mom's	0.208*	1.306***	0.095***	0.237***	0.071***	0.043***	0.011	-0.044*
education	(0.114)	(0.191)	(0.030)	(0.032)	(0.018)	(0.005)	(0.019)	(0.024)
dad's	0.054	0.733***	0.056*	0.073**	0.049**	0.026***	0.012	0.025
education	(0.112)	(0.199)	(0.030)	(0.029)	(0.021)	(0.006)	(0.018)	(0.025)
paternal GPs'	0.009	0.449***	0.026	0.061**	0.015	0.013***	0.019	0.005
education	(0.115)	(0.157)	(0.026)	(0.026)	(0.015)	(0.005)	(0.016)	(0.022)
maternal GPs'	0.189*	0.762***	0.063**	0.105***	0.032**	0.018***	0.007	0.027
education	(0.105)	(0.190)	(0.025)	(0.030)	(0.015)	(0.006)	(0.017)	(0.022)
paternal GPs'	-0.034**	0.008	-0.011**	-0.005	-0.002	0.001	0.001	-0.001
max age	(0.017)	(0.028)	(0.005)	(0.004)	(0.002)	(0.001)	(0.002)	(0.003)
maternal GPs'	-0.007	0.036	-0.001	0.001	-0.005**	0.001	-0.001	0.000
max age	(0.016)	(0.030)	(0.004)	(0.004)	(0.002)	(0.001)	(0.002)	(0.003)

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Table 20 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
urban	0.287	1.546***	0.076	0.288***	0.028	0.040***	-0.036	-0.084*
	(0.246)	(0.475)	(0.065)	(0.081)	(0.050)	(0.012)	(0.035)	(0.047)
Constant	-4.611*	38.015***	-0.030	-2.721***	3.241***	-1.016***	-3.737	-4.088
	(2.404)	(5.327)	(0.792)	(0.912)	(0.444)	(0.152)	(6.880)	(8.907)
Observations	8852	8852	5786	8336	9039	9039	3544	3528
R^2	0.772	0.850	0.071	0.121	0.149	0.171	0.038	0.034

Standard errors in parentheses, clustered at the community level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To save space, some variable descriptions are abridged and listed here:

[1] educational spending: total educational expenditures are in ten-thousand Yuan;

[2] self-rated excellence: self-rated performance as a student;

[3] self-rated capability: self-rated capability of being a student cadre;

[4] educational devotion: parent's devotion to kids' schoolwork;

[5] active communication: parent's eagerness to communicate with kids;

[6] educational expectation: parent's expectation on kids' academic attainment;

[7] paternal GPs' education: the highest educational attainment of the paternal grandparents couple;

[8] maternal GPs' education: the highest educational attainment of the maternal grandparents couple.

Table 21: Co-residing impacts of grandparents with fixed effects at household level

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
girl	-0.570*	-0.011	-0.163*	0.063	-0.014	0.008	0.143	0.304***
	(0.313)	(0.614)	(0.094)	(0.094)	(0.036)	(0.010)	(0.091)	(0.114)
paternal	0.846*	-1.293	0.149	-0.180	-0.106	-0.009	0.172	0.116
	(0.486)	(0.840)	(0.143)	(0.143)	(0.092)	(0.025)	(0.133)	(0.149)
paternal	-0.475	-0.318	-0.083	-0.016	-0.008	0.002	0.057	-0.047
× girl	(0.373)	(0.747)	(0.111)	(0.120)	(0.048)	(0.014)	(0.129)	(0.150)
maternal	-0.226	-1.491	-0.516*	-0.016	-0.253	-0.081	0.261	1.767***
	(1.182)	(1.912)	(0.298)	(0.332)	(0.251)	(0.086)	(0.528)	(0.409)
maternal	-0.005	1.352	-0.081	-0.324	-0.021	-0.089	0.559*	-1.623*
× girl	(0.682)	(1.517)	(0.248)	(0.376)	(0.129)	(0.055)	(0.335)	(0.838)
educational	0.174	0.085	0.021	0.028	0.049	0.006	0.001	-0.001
devotion	(0.138)	(0.311)	(0.035)	(0.045)	(0.030)	(0.007)	(0.035)	(0.047)
active com-	-0.155	0.114	0.010	0.007	0.192***	-0.011	-0.026	-0.012
munication	(0.130)	(0.319)	(0.046)	(0.047)	(0.028)	(0.008)	(0.040)	(0.053)
educational	0.030	0.280*	0.043*	0.045*	0.005	0.001	0.029	0.008
expectation	(0.084)	(0.157)	(0.025)	(0.026)	(0.019)	(0.004)	(0.022)	(0.033)

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Table 21 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
mom	0.245	1.432	0.181	0.448*	0.006	0.065**	0.153	-0.130
	(0.504)	(1.456)	(0.179)	(0.239)	(0.143)	(0.026)	(0.195)	(0.233)
dad	0.233	-0.349	0.182	-0.200	0.179*	0.010	-0.145	0.255
	(0.410)	(0.981)	(0.124)	(0.171)	(0.108)	(0.020)	(0.133)	(0.177)
mom's education	0.329	0.193	-0.036	0.069	-0.066	0.017	0.086	-0.195**
	(0.382)	(0.493)	(0.096)	(0.092)	(0.057)	(0.016)	(0.067)	(0.099)
dad's education	-0.111	-0.350	0.032	-0.110	0.046	0.018	-0.010	-0.072
	(0.294)	(0.533)	(0.081)	(0.088)	(0.050)	(0.012)	(0.085)	(0.112)
paternal GPs' education	-0.567*	1.268*	-0.137	0.005	0.051	-0.001	0.206***	0.081
	(0.342)	(0.664)	(0.087)	(0.088)	(0.050)	(0.014)	(0.061)	(0.098)
maternal GPs' education	0.227	0.791	0.091	0.130	0.106**	0.008	0.059	0.039
	(0.339)	(0.498)	(0.079)	(0.082)	(0.048)	(0.015)	(0.072)	(0.098)
paternal GPs' max age	-0.148	0.261**	-0.031	0.022	-0.002	0.006	0.021	-0.035
	(0.097)	(0.126)	(0.029)	(0.021)	(0.013)	(0.005)	(0.024)	(0.028)
maternal GPs' max age	-0.039	0.005	0.004	0.008	-0.024*	-0.002	-0.043*	0.050
	(0.110)	(0.139)	(0.019)	(0.020)	(0.013)	(0.002)	(0.026)	(0.034)

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Table 21 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
urban	0.765	-0.986	0.201	-0.148	0.119	-0.061**	-0.096	-0.294
	(0.504)	(0.991)	(0.158)	(0.138)	(0.157)	(0.026)	(0.165)	(0.220)
Constant	9.353	56.129***	2.071	0.965	4.920***	-0.991***	-4.896	-19.518
	(7.255)	(11.923)	(2.326)	(2.157)	(1.305)	(0.312)	(9.731)	(13.545)
Observations	8852	8852	5786	8336	9039	9039	3544	3528
R^2	0.759	0.813	0.022	0.055	0.076	0.124	0.040	0.039

Standard errors in parentheses, clustered at the community level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To save space, some variable descriptions are abridged and listed here:

[1] educational spending: total educational expenditures are in ten-thousand Yuan;

[2] self-rated excellence: self-rated performance as a student;

[3] self-rated capability: self-rated capability of being a student cadre;

[4] educational devotion: parent's devotion to kids' schoolwork;

[5] active communication: parent's eagerness to communicate with kids;

[6] educational expectation: parent's expectation on kids' academic attainment;

[7] paternal GPs' education: the highest educational attainment of the paternal grandparents couple;

[8] maternal GPs' education: the highest educational attainment of the maternal grandparents couple.

Table 22: Co-residing impacts of grandparents using Lewbel's heteroskedasticity-based instruments

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
girl	-1.698***	0.521	-0.202***	-0.038	-0.006	0.003	0.112***	0.281***
	(0.255)	(0.446)	(0.075)	(0.067)	(0.032)	(0.011)	(0.039)	(0.055)
paternal	-0.227	-0.621	-0.042	-0.126*	-0.115***	-0.011	0.031	0.103*
	(0.292)	(0.435)	(0.075)	(0.071)	(0.040)	(0.012)	(0.041)	(0.058)
paternal	0.436	-0.624	-0.018	0.082	0.013	0.016	0.000	-0.043
× girl	(0.340)	(0.621)	(0.095)	(0.098)	(0.045)	(0.017)	(0.061)	(0.081)
maternal	-0.391	-0.305	-0.157	-0.002	-0.122	0.125*	-0.180	0.172
	(0.719)	(0.793)	(0.151)	(0.167)	(0.088)	(0.066)	(0.113)	(0.141)
maternal	0.991	-0.670	0.296	-0.049	-0.025	-0.155**	0.543***	-0.106
× girl	(0.792)	(1.327)	(0.209)	(0.246)	(0.104)	(0.072)	(0.161)	(0.224)
educational	0.033	0.530*	0.021	0.078**	0.112***	0.019***	0.036	0.032
devotion	(0.129)	(0.274)	(0.032)	(0.037)	(0.022)	(0.006)	(0.024)	(0.034)
active com-	0.116	0.144	0.063*	0.058	0.210***	-0.001	-0.008	0.071**
munication	(0.138)	(0.271)	(0.035)	(0.042)	(0.025)	(0.006)	(0.024)	(0.035)
educational	0.078	0.770***	0.058***	0.096***	0.035**	0.008**	0.086***	0.061***
expectation	(0.080)	(0.129)	(0.022)	(0.020)	(0.015)	(0.003)	(0.015)	(0.020)

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Table 22 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
mom	0.018	3.021***	0.123	0.458***	0.141*	-0.000	0.047	0.034
	(0.409)	(0.916)	(0.122)	(0.150)	(0.076)	(0.019)	(0.085)	(0.120)
dad	0.449	-0.650	0.241**	-0.010	0.096	0.055***	0.001	0.013
	(0.352)	(0.742)	(0.096)	(0.108)	(0.066)	(0.015)	(0.074)	(0.098)
mom's education	0.208*	1.306***	0.095***	0.237***	0.071***	0.043***	0.011	-0.043*
	(0.114)	(0.191)	(0.030)	(0.032)	(0.017)	(0.005)	(0.019)	(0.024)
dad's education	0.054	0.733***	0.056*	0.073**	0.049**	0.026***	0.012	0.025
	(0.112)	(0.199)	(0.030)	(0.029)	(0.020)	(0.006)	(0.018)	(0.025)
paternal GPs' education	0.007	0.447***	0.025	0.061**	0.015	0.013***	0.019	0.005
	(0.115)	(0.156)	(0.026)	(0.026)	(0.015)	(0.005)	(0.016)	(0.022)
maternal GPs' education	0.192*	0.763***	0.064**	0.106***	0.032**	0.018***	0.007	0.027
	(0.105)	(0.190)	(0.025)	(0.030)	(0.015)	(0.006)	(0.017)	(0.022)
paternal GPs' max age	-0.034**	0.008	-0.011**	-0.005	-0.002	0.001	0.001	-0.001
	(0.017)	(0.028)	(0.005)	(0.004)	(0.002)	(0.001)	(0.002)	(0.003)
maternal GPs' max age	-0.007	0.036	-0.001	0.001	-0.005**	0.001	-0.001	0.000
	(0.016)	(0.030)	(0.004)	(0.004)	(0.002)	(0.001)	(0.002)	(0.003)

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Table 22 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
urban	0.293	1.545***	0.077	0.289***	0.028	0.040***	-0.036	-0.084*
	(0.246)	(0.474)	(0.065)	(0.081)	(0.050)	(0.012)	(0.034)	(0.047)
Constant	-4.825**	38.067***	-0.066	-2.751***	3.247***	-1.014***	-3.756	-4.118
	(2.399)	(5.311)	(0.791)	(0.910)	(0.443)	(0.152)	(6.841)	(8.859)
Sanderson-Windmeijer multivariate F-test of weak identification†:								
patind	1102.380***	1117.230***	979.400***	1124.600***	1067.770***	1044.830***	659.670***	647.000***
matind	7677.960***	8054.110***	3549.760***	7052.970***	6083.640***	6822.800***	9493.610***	9343.280***
pat_girl	317.480***	317.960***	321.390***	355.560***	332.110***	315.270***	316.970***	320.850***
mat_girl	2730.800***	3030.460***	2378.420***	2297.620***	2933.730***	2788.820***	3900.710***	3856.140***
underidentification test using the Kleibergen-Paap rk LM-statistic:								
KP rk	449.977***	449.839***	403.830***	448.721***	457.416***	450.970***	390.490***	389.551***
overidentification test of all instruments using the Sargan-Hansen procedure (P-value):								
Hansen's J	0.537	0.497	0.730	0.811	0.107	0.795	0.621	0.730

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Table 22 – *Continued from previous page*

	weight (kg)	**height (cm)**	**weight-for-age**	**height-for-age**	**child's health**	**educational spending**	**self-rated excellence**	**self-rated capability**
Observations	8852	8852	5786	8336	9039	9039	3544	3528
R^2	0.772	0.850	0.071	0.121	0.149	0.171	0.038	0.034

Standard errors in parentheses, clustered at the community level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To save space, some variable descriptions are abridged and listed here:

[1] educational spending: total educational expenditures are in ten-thousand Yuan;

[2] self-rated excellence: self-rated performance as a student;

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[4] educational devotion: parent's devotion to kids' schoolwork;

[5] active communication: parent's eagerness to communicate with kids;

[6] educational expectation: parent's expectation on kids' academic attainment;

[7] paternal GPs' education: the highest educational attainment of the paternal grandparents couple;

[8] maternal GPs' education: the highest educational attainment of the maternal grandparents couple;

[9] patind: the coresidence indicator of paternal grandparent(s);

[10] matind: the coresidence indicator of maternal grandparent(s);

[11] pat_girl: the interaction term of the paternal-grandparent indicator and the child's gender, $patind \times girl$;

[12] mat_girl: the interaction term of the maternal-grandparent indicator and the child's gender, $matind \times girl$.

†With multiple endogenous regressors and a clustered sample, the Sanderson-Windmeijer F-statistics are correspondingly reported.

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