Parenting Style and Children's Time Preference: Evidence from a Randomized Control Trial in China

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Abstract

We conduct an evaluation of a randomized early childhood intervention on children's time preference. The Jamaican-based home visiting program is aimed at improving knowledge of child development and child-rearing practices. Analyzing the impact of a weekly home visiting program for over 500 households living in poor rural villages in China, we find a significantly positive impact on preschool children's patience measured two years after treatment. The intervention has a significant and lasting impact on parenting style but no persistent effect on other likely intermediating factors. Our findings are consistent with the literature in developmental psychology, which suggest child-rearing practices such as parenting style is closely correlated with children's time preference. We also find the impact of the early childhood intervention on children's patience is more prominent if the treated samples are girls, left-behind children cared by grandparents, children in families with high socioeconomic status and less harsh parenting styles, and children of high cognition.

Keywords: time preference, parenting style, early childhood intervention

JEL codes: J13, D15

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1. Introduction

This study aims to establish a causal link between early childhood experiences with children's time preference. Time preference is an important predicator of adulthood outcomes, including but not restricted to cognitive skills, social skills, school performance, health, labor supply, and lifetime income (Mischel et al., 1988, 1989; Castillo et al., 2011; Watts et al., 2018; Golsteyn, et al, 2014; Sutter et al., 2013). There has been a large body of literatures focusing on the crucial role of early childhood intervention in developing cognitive skills, noncognitive skills and social preferences of children (Cunha and Heckman, 2007; Attanasio et al., 2020; Heckman et al., 2020; Andreoni et al., 2019).

However, how does early childhood experiences especially parental bahaviors affect children's time preference has not received sufficient attentions by economists. There are several theoretical papers discussing parents' role in formation of economic preferences such as time preference of children (Maital and Maital, 1977; Becker and Mulligan, 1997; Doepke and Zilibotti, 2008). But there are only a few studies conducted empirical analysis between family socioeconomic status and economic preferences (Falk et al., 2021; Delaney and Doyle, 2012). They both find that children from families with high socioeconomic status are more patient, and the correlation can be mediated by parental time and parenting style investments (Falk et al., 2021). Neither of them captures a causal effect of parental investments, even parenting style is an endogenously chosen strategy to cope with the socio-economic environment (Doepke and Zilibotti, 2017) and is responsive to children's performance (Huh et al., 2006). Andreoni et al. (2019) estimated the causal impact of an early childhood education program on children's time preference but they failed to find a significant impact and their paper suffers from substantial attritions.

A large body of literatures in psychology has made much earlier progress in linking parenting practice with self-control or delay of gratification, both of which can be viewed as

early forms of time preference. Developmental psychologists find that young children's self-control are closely linked to caregivers' parenting behaviors. Baumrind (1971) categorizes parenting styles into three types—authoritarian, authoritative, and permissive—mainly differentiated by the degrees of control and warmth[5]. Figure 1 vividly distinguishes these three types of parenting style. In reality, children rarely confront a dilemma in which they must choose between a smaller immediate reward and a larger delayed reward (Karniol and Miller, 1981). Being patient is a conduct imposed externally. For example, children are forced to study hard or to save in a piggy bank; subsequently, the behavior is gradually internalized as a behavioral norm (Olson et al., 1990). Children's compliance, or the likelihood of them behaving patiently, is extremely sensitive to parents' disciplining style (Baumrind, 1971). Children are more compliant if parents show warmth and responsiveness. On the other hand, too little control makes children delinquent, while excessive control makes them defiant. As a result, an authoritative parenting style that combines moderate control with high responsiveness is most effective for instilling patience in children[6] (Mauro and Harris, 2000; Olson et al., 1990). An important caveat of the above pscychological studies, from the view of economics, is their conclusions are generalized from small samples sufferring from endogeniety concerns. Even though, they are enlightening to economic analysis.

To be brief, the challenges of establishing a causal relationship between parental investment and time preference lie in two aspectss. First is the lack of a comprehensive data that contains both children's time preference and parental investment. Second, even there are several papers that have comprehensive measures (Andreoni et al., 2019; Falk et al., 2021;

[5] While authoritarian parents impose strict control over children but are not responsive to children's needs, authoritative parents show a moderate level of control and a high level of warmth to children. Permissive parents are highly respectful of children but impose few or no boundaries.

[6] Mauro and Harris (2000) experimented on 30 preschool children and recorded how mothers taught them to avoid touching a brightly wrapped present while the mothers were away. For children who behaved more patiently, the words and disciplinary methods their mothers employed were most consistent with an authoritative parenting style. Olson et al. (1990) followed 79 two-year-olds and found that responsive parent-toddler interactions modestly predicted toddlers' ability to delay gratification.

Delaney and Doyle, 2012), the parenting practice is endogenously determined in their studies. Our study overcomes the above challenges by analyzing a unique dataset collected as part of the Early Childhood Intervention Program conducted in rural China. It is a randomized control trial offering a six-month home visits program to caregivers of 2 to 3-year-olds. The program was designed to encourage caregivers to show warmth and encouragement to children, which is exactly an important component of the authoritative parenting style. In addition to the advantages of randomized treatment, our data have several novel features that make it uniquely well-suited to evaluate the impact of parenting practice on children's patience. First, it collected measurements of children's time preference using incentivized experiments (Marshmallow Test)[7] that is appropriate to pre-school children. Second, children's patience was measured more than two years after treatment, reducing the likelihood that a temporary effect of the program was being captured. Finally, the survey included longitudinal measurements of parenting practice, which enabled us to test the causal impacts of the home visiting intervention on caregivers' parenting style as well as children's time preference.

We find that the home visiting program significantly increases children's likelihood of waiting for 15 minutes in the Marshmallow Test by 8.9 percentage points. The impact is greater among children who had not changed caregivers since the baseline, suggesting that the results are caused by persistent changes in caregivers' practices rather than being a longer-term consequence of short-term impacts on children's cognitive or noncognitive development.[8] In addition, we find that caregivers who participated in the baseline training are more authoritative than caregivers in the control group by 0.21 standard deviations. Conversely, the immediate and delayed impact of the intervention on children's cognitive skills, caregivers' time

7 Falk et al. (2021) use an incentivized Piggy Bank Experiment to measure children's time preference, while Delaney and Doyle (2012) only use the Strengths and Difficulties Questionnaire (SDQ) to proxy children's time preference at age 3.

8 Other randomized evaluations of similar caregiver-based interventions have found impacts on children's physical health (Doyle et al., 2015), cognitive skills (Attanasio et al., 2020; Sylvia et al., 2018; Andrew et al., 2019), socio-emotional skills (Sylvia et al., 2018), and delinquent behaviors (Kim et al., 2018).

preference, and monetary investment in children are statistically insignificant, alleviating concerns about the possibility of alternative pathways for the estimated effects. Our findings are consistent with developmental pscyhological literatures, that authoritative parents are more likely to raise patient children.

We contribute to existing work in at least three respects. First, our study is important in understanding the development of economic preferences and origins of inequality at an early age. Young children's patience is positively associated with later life outcomes, nevertheless formation of time preference is like a "black box" that only a few empirical literatures have linked parenting practices with it (Falk et al., 2021). By employing a comprehensive dataset as part of a randomized home visiting program at early childhood, our study is the first to date that examines the causal correlation between parenting style and pre-schoolers' time preference. The other side of randomized controlled trials is lack of external validity. We specially discuss the generalizability of our study by re-weighting our sample to represent the national rural population. The re-weighted estimate is still positive and becomes larger in magnitude, indicating that our results can map across relevant populations.

Second, our paper extends the literature on the impacts of early childhood interventions on development. Even though a large body of literatures focusing on short-term and long-term effect of early childhood interventions, evaluations are concentrated on cognitive skills, non-cognitive skills, physical health, etc. (Doyle et al., 2015; Attanasio et al., 2020; Sylvia et al., 2018; Andrew et al., 2019; Sylvia et al., 2018; Kim et al., 2018). Exceptions include the pioneering work by Cappelen et al. (2020) and Andreoni et al. (2019), which estimated the causal effects of randomized assignment to pre-school and home-parenting programs on children's fariness preference and time preference. A novelty of our study is we evaluate the longer-term intervention effect on one important dimension of economic preferences-time

preference. Our findings highlight the importance of conducting thorough evaluations of early childhood interventions.

Third, the population we study and our finding that the home visiting intervention has a larger positive effect on better off subgroups and left-behind children are policy relevant. Our samples are drawn from the least developed areas in China, all of which are more likely to suffer from impatience (Falk et al., 2021). On the one hand, our analysis is very inspiring because we find the home visiting intervention worked well with girls and children who were separated from parents. It suggests for a new policy tool that may narrow down the developmental inequality. On the other hand, the heterogeneity analysis suggests that better-off subgroups, such as children who are in high SES families, of high cognition and whose caregivers with preferred parenting style, benefit more from the intervention. That means the home visiting program alone is not enough in reaching people who need it most. It's preferred to combine various policy tools to cultivate patience at early age.

The rest of this paper is organized as follows. Section 2 introduces a conceptual framework to understand the formation of children's time preference. Further, experimental design and identification strategy are described in Sections 3 and 4. Moreover, Section 5 reports regression results, and finally, Section 6 concludes the paper.

2. A Conceptual Framework

2.1 Production Function of Time Preference

Similar to cognitive skills, time preference is conceptualized as an economic preference that can be learned and cultivated during childhood. A general production function for children's patience (P_{it}^{C}) is presented in Equation (1).

$$P_{it}^{C} = f\left(X_{it}, P_{it}^{P}, I_{it}^{m}, I_{it}^{p}, I_{it}^{t}\right) \quad (1)$$

First, X_{it} represents chidlren's individual characteristics that are correlated with patience. Age and cognitive skills are two important determinants. Earlier studies have found that children's time preference evolve significantly with children's age, that older children are generally more patient than younger children (Andreoni et al., 2019; Bettinger and Slonim, 2007; Sutter et al., 2015; Angerer et al., 2015). Cognitive skills also affect children's patience positively (Andreoni et al., 2017; Dohmen et al., 2010). Except for age and congnitive skills, time preference may be correlated with race (Andreoni et al., 2019; Castillo et al., 2011), gender (Dohmen et al., 2010) and other demographical characteristics.

Second, parents' patience P_{it}^{P} may have a direct impact on children through genetic inheritance or unintended social learning. Research on the intergenerational transmission of patience has not reached a consensus yet, with some studies finding a positive correlation between parents' time preference and children's time preference (Kosse and Pfeiffer, 2012; Brown et al., 2015; Gauly, 2017; Chowdhury et al., 2018), while others find no significant correlation (Andreoni et al., 2017; Andreoni et al., 2019; Bettinger and Slonim, 2006).

Finally, we capture several aspects of parental input, such as monetory investment I_{it}^{m}, parenting investment I_{it}^{p} and time investment I_{it}^{t}. The influence of family background is simplified as SES status in previous literatures (Delaney and Doyle, 2012), mainly because other parenting measures are absent. Falk et al. (2021) further identify parental investment in production of children's IQ and time preference as parenting style and parental time. Our study extends Falk et al.'s (2021) work by focusing on three aspects of parental input, mainly inspired by suggestions of developmental pscyhologists and benefits from the availability of ample parental investment measures.

Poverty can be directly correlated with time preference (Lawrance, 1991; Bernheim et al., 2015). Especially we use cookies as reward in the ecilitation task, family monetary

spending may decide children's propensity to wait. So we include households monetary investment on children, including books, toys and clothes in the production function. We also include parenting style and caregiver-child interactions as investment, as they capture the quality and quantity of child rearing practices.

In addition to the mechanisms we discussed, Doepke and Zilibotti (2008, 2017) suggested that patience may compose an innate part, that is shaped by the social, natural, and institutional environments (Callen, 2015; Galor and Özak, 2016) conditional on parental transmission. However, because the population in our study are pre-school children that most socilization are accomplished at home, we do not include the innate part in the production function.

2.2 Empirical Implications of the Home Visiting Program

The home visiting program is desinged to encourage more responsive parenting practice thereby improving children's cognitive skills (Grantham-McGregor and Walker, 2015). Concerning the production function of time preference in Equation (1), the intervention can influence children's time preference through the following channels: (1) it may increase patience by changing children's cognitive skills; (2) the intervention may play a role by changing caregivers' own time preference; (3) the intervention may improve parenting style or increase other parental investment.

Since the home visiting program was randomly assigned to households, the treatment is orthorgonal to personal and household characteristics. We only keep variables in X_{it} that may be affected by the intervention and allow the home vising program to affect children's time preference through children's cognitive skills, caregivers' time preference, and parental investment in Equation (2). The above mechanisms can be tested directly. However, in addition to the mentioned channels, the home visiting may affect children's time preference directly

through the weekly interactions with the trainers. Or it may affect the efficiency of parental investment by changing the production parameters, just as is discussed in Falk et al.(2021). Unfortuantely, we are not able to test these two channels directly.

$$P_{it}^{C} = f\left(X_{it}(T_i), P_{it}^{P}(T_i), I_{it}^{m}(T_i), I_{it}^{p}(T_i), I_{it}^{t}(T_i)\right) \qquad (2)$$

3. Research design

3.1 Experimental Design

The dataset we use is drawn from the rural population in one prefecture in Shaanxi Province in northwest China. The prefecture has one urban district and six counties, all of which were nationally designated poor counties in 2017. Prefectural GDP per capita in 2017 was 33,627 RMB (equivalent to 5,173 USD), only 58% of the national level. The sampled prefecture lies in a mountainous area and has a high poverty rate[9].

The randomization procedure stratified samples by county, survey cohort[10], and experimental groups of an earlier trial[11]. At baseline, the sample covered 586 children in 133 villages, with 64 and 69 villages randomly assigned to the treatment and control groups, respectively. In the treated villages, a home visiting program was offered randomly to 212 families, with all of which agreeing to participate. The remaining 76 families in the treated villages did not receive treatment to measure spillover effects. Given the absence of evidence of spillover effects (Appendix 1-Table A1), we include both the spillover group and those living in the control villages in the control group to increase the sample size when we estimate the program's treatment effects.

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[9] Approximately 26% of our sample received minimum living standard subsidies in the baseline survey.

[10] First, all the townships from four nationally-designated poor counties in the prefecture were included in the sampling frame. Subsequently, two villages were randomly selected in each town, yielding a sample of 133 villages. All the infants who were between 6 and 12 months old in April 2013 were enrolled in the program, and a second cohort of infants aged 6 to 12 months in October 2013 were added later.

[11] When children were 6 to 12 months old, they enrolled in a micronutrient package program aiming at reducing anemia. Two-thirds of them were randomly selected to receive the free micronutrient package. According to Luo et al. (2016), the nutrition program had a short-term effect on anemia after 6 months; however, it had no effect thereafter.

The home visiting intervention began in October 2014, when the children were 18 to 32 months old, and lasted for six months. One follow-up survey was conducted immediately in April 2015, with another follow-up survey conducted two years from the end of the intervention in June and July of 2017. The home visiting intervention comprised trained village officials making weekly home visits to the treated households and providing books and toys to teach caregivers how to interact with children in a way that would stimulate their cognitive functions. The curriculum was adopted from the Jamaican Early Childhood Development Intervention, designed to improve mothers' self-esteem and enjoyment in bringing up their child and their knowledge of child development and child-rearing practices (Grantham-McGregor and Walker, 2015). Encouraged maternal behaviors include the following: responsiveness to the child's mood, vocalizations, actions, and interests; mediating the environment for the child (drawing attention to, describing, labeling) and introducing new objects, sounds, activities, and concepts; giving positive feedback; celebrating the child's achievements; showing love. The curriculum comprised modules in four developmental areas: cognition, language, socio-emotional skills, and motor skills. Each weekly visit covered two of the areas, with the subsequent visit covering the other two areas. There was one task in each module; for example, "Taking care of younger siblings" is a task in the socio-emotional module (Appendix 2). The trainer first demonstrated the procedures required for the task. Subsequently, the participating caregiver imitated the procedures, including ways to challenge the child further if the child performed well. Although each module covered a different topic, a warm response was always encouraged. In nearly all the tasks, there were similar instructions like "The mother should hug her baby after the task" or "Regardless of whether the baby successfully finishes the task, the mother should give praise."

3.2 Measurement of Key Variables

3.2.1 Children's Time Preference

In the second follow-up wave by which time the sample children are on average 57 months old, we elicit their time preference by adopting the classic Marshmallow Test paradigm. The experiment was conducted one-on-one with a trained experimenter, mostly taken place in kindergarten or at home. Children were offered with a cookie in the front and could choose between eating the cookie at any time and being rewarded with the second cookie if they could resist the temptation for no less than 15 minutes[12]. The complete protocol for the experiment is shown in Appendix 3. Standardization of experimental research is of great signifgicance with pre-school children (Sutter et al., 2019). To make field experiments comparable to each other, the experimenters carefully recorded the experimental conditions, including the experimental venue, existence of disturbance, any interruptions to the experiment, how does the child like cookies, etc. In addition, we control for experimenter fixed effects in regressions to reduce the confounding effects of experimenters' personal charactersitics.

The Marshmallow Test is commonly used in the developmental psychology literatures (Mischel et al., 1972, 1988, 1989) and is also adopted in economic analysis (Kosse and Pfeiffer, 2012, 2013)). Another widely elicitation method is letting the kid making a choice between 1 reward today versus 2 rewards the next day. Given our sampling population were aged between 3 to 5 years old, a Marshmallow Test paradigm using food as incentives is more approporiate for two reasons. First, it put children in a real situation that they must overcome their frustration and inhibit their desire to eat the treat in front of them for a prolonged period of time (Shoda et al., 1990). Andreoni et al. (2019) had used a list of multiple price list to elicit children's patience, but they found some 3 year-olds have difficulties in understanding the concept of "tomorrow".

Second, trust toward the experimenter and risk preference may be correlated with children's choice in the intertemporal choice quations (Kidd et al., 2013). Employing a

[12] The experiment automatically ended if the child had waited for 15 minutes.

Marshmallow Test can effectively reduce the concerns of trust and risk, because the delay in Marshmallow Test is much shorter than other experiments, and during the experiment the promised awards are present. We also made all experimenters play a while with the children before the Marshmallow Test so that children were already familiar with experimenters when the experiment started.

Figure 1 displays the distribution of children's waiting time by treatment status. Approximately 48.5% of treated children waited for 15 minutes, while the proportion was 40.9% for children in the control group (p-value of difference is 0.0521). The proportion of children who can wait for 15 minutes in our sample is comparable to that in Mischel's original experiment with a group of slightly younger children[13], but is significantly lower than Kosse and Pfeiffer (2012)[14]. In the empirical analysis, we both use a dummy variable indicating whether the kid had waited for 15 minutes and a continuous waiting time to measure patience.

3.2.2 Children's Cognitive Skills

Different sets of cognition tests were adopted to assess children's cognitive skills as they aged. At baseline, all children were assessed using the Bayley Scales of Infant Development (BSID) Version I. It is a standardised test of infant cognitive and motor development (Bayley, 1969) adapted to the Chineses language and envireonment. The first follow-up survey still used Bayley test for children not older than 30 months and the Griffith Mental Development Scales (GMDSER 2-8) (Luiz et al., 2006) for older children. These two tests are comparable in assessing early childhood development (Cirelli et al., 2015). The second follow-up survey used the Weschler Preschool and Primary Scale of Intelligence (Wechsler,

[13] In Mischel's study (1972), subjects were aged from 3 years, 6 months, to 5 years, 8 months. Approximately one-third of them have waited for 15 minutes.

[14] In Kosse and Pfeiffer's (2012) study, 78% of children waited and received two bags of gummy bear. But the age range of children is unclear and the authors restricted the experiment to children who like gummy bears. Both can explain why their proportion of being patient is larger than ours.

2012). The assessment methods and their suitability with children's developmental stages are discussed in greater details in Sylvia et al. (2020) and Wang et al. (2021).

3.2.3 Caregivers' Investment

In line with Falk et al. (2021), we measured parenting practice in multiple dimensions: monetary investment, parenting style and time investment. First, only the second follow-up survey has information concerning monetaty investment in children. Thus we measure parental monetary investment by standardizing the actual spending on children's clothes, books, and toys. We also construct a comprehensive measure.

In the baseline and first follow-up survey, parenting style was assessed on a 4-point Likert scale for questions about how often caregivers used specific disciplinary techniques (such as spanking, yelling, taking away toys, limiting time, and explaining unreasonable behaviors). We take the mean of response to these five questions to construct a measure of harsh parenting. Assuming that harsh parenting is negatively correlated with authoritative parenting, we substract the harsh parenting score from 4 to create a positive measure of authoritative parenting in the first two waves.

In the second follow-up survey, we used a short version of the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson et al., 2001). The version we used has shown good validity and reliability with Chinese samples (Fu et al., 2013). We can either construct a comprehensive score representing how caregivers' parenting style is consistent with an authoritative parenting, and calculate scores in three subfactors: warmth, reasoning and democratic participation. Even we measure parenting style using different paradigms in the baseline and follow-ups, they are closely related. For example, the warmth subfactor is opposite to practice using spanking or yelling as discplinary method.

Parental time investment was assessed by the intensity of the interactions with the children in all three waves. We measure time investment both by constructing three binary

variables indicating whether the caregiver had read books, played with toys, or sang songs with the children the previous day and by constructing a comprehensive variable indicating if at least one activity happended the previous day.

3.2.4 Caregivers' Time Preference

Even the evidence on intergenerational transmission of time preference is mixed (Kosse and Pfeiffer, 2012; Brown et al., 2015; Gauly, 2017; Chowdhury et al., 2018), we elicited the caregiver's time preference using one hypothetical question. It asked what amount of money received after three months would make participants feel indifferent compared to receiving 10,000 RMB (approximately 1,500 USD) after one week[15]. By calculating the implied discount rate that equalized a future reward with a fixed reward at present, we obtain a measure of caregivers' impatience.

3.3 Balance Tests and Attrition

We focus on children whose mothers or grandmothers participated in the intervention, accounting for 91% of the baseline sample. We impose this selection criteria because fathers or other family members were typically temporary caregivers[16]. The end line attrition rate two and a half years after the baseline was 11.5%, which is low compared to other home visiting programs (10% after 18 months in Columbia, Attanasio et al., 2020; 34% after 18 months in Ireland, Doyle et al., 2015; 32% after 2.5 years in China, Heckman et al., 2020). We employ several strategies to address the potential bias caused by differential attrition, which was 14.4% and 6.3% in the control and treatment groups, respectively.

[15] The question is "Compared to receiving 10,000 RMB in one week, receiving___ RMB is worth waiting for three months?"

[16] Approximately 30% of households had changed the main caregivers between the baseline survey and the second follow-up survey if the baseline caregiver is mother or grandmother. While the probability of changing the main caregiver is above 85% if the baseline caregiver is father or other family members. That suggests the fathers and others are not good study samples because even they participated in the intervention their interactions with children were limited.

First, we show in Table 1 that the post-attrition sample is still balanced with respect to most baseline characteristics. The only exception is that the proportion of being cognitively delayed is significantly in the treatment group. Therefore, we control for baseline cognitive skills in the following analysis. Baseline statistics on parenting practices are reported in Panel C. Notably, at baseline, only 5% of caregivers had read to their children the previous day, while 39% reported singing songs, 33% played with toys, and 12% told stories. Harsh parenting is prevalent, with 23% and 16% of caregivers reported they oftern yelled at or spanked their children respectively. Our sample represents the population that caregivers know little about child rearing. The constructed indices for non-harsh parenting style and intensity of parent-child interactions are not significantly different between the control and treatment groups.

Second, we show in Appendix 1-Table A2 that attriters in the treatment and control groups are comparable in many aspects, except that attriters in the treatment group are more authoritative at baseline. If authoritative parenting is positively correlated with children's patience, this would lead us to underestimate, rather than overestimate, the treatment effect.

Third, we use a probit model to predict attrition with observables (Appendix 1- Table A3) and construct inverse probability weights (IPW), which are used in all the subsequent analyses. We also show that the main results are similar with and without the IPW (Appendix 1-Table A4), implying that the differential attrition does not bias our main findings.

At last, motivated by concerns that differential attrition was caused by unobservable reasons that create bias, we estimate a worst-case scenario by assigning good results to missing observations in the control group and bad results to those in the treatment group following Dupas et al. (2020). We estimated three scenarios. In all of them, we assign the worst case to the treatment group, assuming all the attriters in the treatment group are impatient (p=0). For the attriters in the control group, we assume their probability to be patient is 20%, 40%, and 60% respectively. Treated children are still more patient under these extreme assumptions,

although as a larger gap is assumed, the treatment effect decreases in magnitude and become less precisely estimated (Appendix 1-Table A5)

4. Identification Strategy

As households were assigned to treatment and control groups randomly, the difference in means of the outcome variables for the two groups provides a causal estimate of the intervention effect. We estimated a standard model for evaluating the impacts of a randomized experiment:

$$P_{ict} = \beta_0 + \beta_1 T_{ic} + X'_{ic}\beta_2 + E'\beta_3 + \lambda_c + H'\beta_5 + N'\beta_6 + \varepsilon_{ict} \quad (3)$$

where P_{ict} is the time preference of child i living in county c at time t, expressed as a dummy variable indicating whether the child has waited for 15 minutes in the Marshmallow Test. We also use continuous waiting time as an alternative measurement of time preference. Further, T_{ic} is the household level treatment dummy, indicating whether the household was assigned to participate in the home visiting program. Moreover, X represents a vector of control variables measured at baseline, including assignment of an earlier nutrition treatment, cognitive skills and distance to town. We also control for experiment conditions[17] (E), county dummies (λ_c), survey cohort dummies[18] (H), and enumerator group dummies[19] (N). Finally, ε_{ict} is the error term that represents unobservable and random factors that influence patience P_{ic}. Standard errors are clustered at the village level. The coefficient of interest β_1 represents the ITT (Intention-to-Treat) effect. The compliance of the intervention was heterogenous, that the number of actual home visits ranged from 0 to 28. To estimate the effect of per dose (home visit), we use the randomly assigned participation T_{ic} as instrumental variables of number of actual home visits and estimate a LATE in Section 5.3.

[17] Experimental conditions include experimental venue, existence of disturbance, any interruptions to the experiment, how does the child like cookies, etc.
[18] Prior to the parenting intervention, participants enrolled in the program in two cohorts.
[19] Over 80 enumerators from 14 groups were employed for data collection. Sometimes data for children and caregivers were collected by different enumerators from the same group. The group leader was responsible for data inspection for each enumerator in the group.

To test through what mechanisms the parenting intervention affects children's patience, we replace P_{ict} with different measures of parenting practices such as parenting style and parent-child interactions, children's cognitive skills, and other possible determinants of children's time preference, measured in the first and second follow-up surveys. When available, we control for baseline measures of the dependent variables. The other control variables are exactly the same as in Equation (3).

Because we estimate treatment effects on multiple outcomes, p-values adjusted for multiple hypotheses using the step-down procedure of Romano and Wolf (2005, 2016) which controls for familywise error rate (FWER) are reported[20].

5. Results

5.1 The ITT Effect of the Home Visiting Program on Children's Time Preference

We present the estimated treatment effect of the home visiting program on children's time preference in Table 2. If time preference is measured by a dummy variable indicating whether children had waited for 15 minutes in the Marshmallow Test, the intervention's effect is 0.0893, significant at the 1% significance level (see row one). This result suggests that participation in the home visiting program makes it 9 percentage points more likely that children will wait for the full 15 minutes in the Marshmallow Test.

As approximately 30% of sampled children were looked after by different persons in the baseline and follow-up study, we construct a same-caregiver sample in the second row. Children in this subsample spent a longer time with the treated caregiver and were expected to be more affected by the intervention. A larger intervention effect on the patience dummy is observed at 0.133. A larger intervention effect among the same-caregiver sample suggest that

[20] To compute adjusted p-values, we use rwolf2 command in Stata, which calculates Romano and Wolf's (2005a,b) step-down adjusted p-values robust to multiple hypothesis testing. It provides a more general syntax than that provided in the rwolf command, although the underlying algorithm is the same. For effects on parental investment in the first follow-up survey and the second follow-up survey, p-values are adjusted within each survey wave.

parenting practices are a likely mechanism and not other factors that are a consequence of the short-term impacts of the program.

In the next two rows, we treat the standardized waiting time in the Marshmallow Test as an alternative measurement of time preference. The intervention effect is significantly positive, with a coefficient of 0.157. Given the standard deviation of waiting time in the Marshmallow Test is 6.7 minutes, children who participated in the parenting program were more likely to wait for 1.05 minutes (6.7*0.157).

Compared to age and cognitive skills, which are two well recognized determinants of time preference, the treatment effect of our intervention is sizable. It's suggested that participating in the home visiting program is equivalent to one standard deviation increase in cognitive skills, or 3.5 months older. Our estimated treatment effect is not trivial either compared to randomized trials specially designed to increase children's patience. For example Alan and Ertac (2018) offered a classroom-based educational program to 3rd and 4th graders in elementary schools, and found the program can decrease the early choices (or impatient chocies) by 0.3 standard deviations.

Even making children more patient is not the direct goal of home visiting programs, we consistently find a positive intervention effect on cultivating patient children. Our study is among the few linking early childhood experiences with economic preferences. It can contribute to the understanding of medium-term and long-term impacts of this kind of early childhood interventions that aim to improve parenting practices.

5.2 The ITT Effect of the Home Visiting Program on Possible Mechanisms

One advantage of our dataset lies in detailed information about different outcomes of children and their caregivers, so that we can examine whether the intervention has a persistent effect on parenting style and other intermediating factors that may affect children's patience. As is discussed in Equation (2), we hypothesize that the home visiting program may affect

children's time preference through the following channels: increasing childrens' cognition, improving parental investment, including monetary input, parenting style and time input, and changing caregivers' time preference.

The kernel densities in Figure 2 reveal different patterns of the intervention effect on the distribution of parenting style and other possible mediators. The distribution of authoritative (non-harsh) parenting style moves to the right for the treatment group after participating in the home visiting program. Conversely, the distribution of cognition, monetary spending and discounted factor of treatment and control groups remain in similar positions before and after treatment, suggesting no significant impact of the home visiting program on other mediators.

Estimated ITT effects on children's cognition and other parental investments are reported in Table 3. The impact of the intervention on children's cognitive test scores is reported in Panel A. The intervention effects are small and insignificant in both the first and second follow-up surveys. Thus, we fail to find evidence of the positive impacts of the intervention on children's cognitive skills.[21] Although previous evaluations of randomized parenting interventions did find positive effects on cognitive skills in the short-term, such impacts may fade away over time (Kautz and Heckman, 2014).

Parenting style in the baseline and first follow-up are measured using the non-harsh parenting factor and in the second follow-up by the authoritative parenting score in Panel B. Participation in the parenting program has a significantly positive and persistent effect on authoritative parenting style, increasing non-harsh parenting by 0.241 standard deviations in the first follow-up survey and increasing the authoritative parenting score by 0.214 standard deviations in the second follow-up survey. In terms of dimensions of parenting style, the home

[21] Another study found positive short-term effects of the Chinese parenting program on child cognition (Sylvia et al., 2018). One possible reason for the difference in results is that our study used a smaller sample for which second follow-up survey data are available.

visiting program mainly improve caregivers' performance in showing warmth and reasoning to children.

The home visiting program also significantly increases caregivers' interactions with children, measured by whether the caregiver read books, played with toys, or sang songs with children during the previous day. The short-run intervention effect is substantial; treated caregivers are 23 percentage points more likely to involve any interactions above with the children. However, the impact falls to 8.8 percentage points by the time of the second follow-up survey. Actually, the caregiver-child interacctions in both treatment and control groups decreased a lot in the second follow-up. Decrease in reading is more prominent than singing songs and playing toys. As the program offered free toys and books during the intervention periods, the larger short-run effect could partly be capturing the impact of available materials. But as children grew older, the materials may become outdated with respect to children's development.

The lasting positive effect on parenting practices is consistent with previous studies. Several studies have found a significantly positive immediate effect of the parenting program (either in the form of home visits or workshops) on parents' knowledge of child care principles and their engagement in child-rearing (rural Jamaica, Powell et al. 2004; rural China, Jin et al., 2007; South Africa, Cooper et al., 2002, Cooper et al., 2009). A couple of studies also found longer-term effects. For example, Kim et al. (2018) found that the Positive Parenting Program in Germany significantly increased parents' positive engagement and decreased harsh discipline four years after the intervention. Further, Klein and Rye (2004) found significant benefits of a parenting intervention in Ethiopia on mother-child interactions three months, one year, and six years after the intervention.

Next, we examine whether the home visiting program leads caregivers to spend more resources on children in Panel D of Table 3. However, we find small and insignificant effects

of treatment on spending on children's clothes, books, and toys in the second follow-up survey, which suggests that changing monetary spending is not likely the channel of home visiting program to affect children's time preference.

As last, participation in the home visiting program could directly influence caregivers' time preference, and then their time preference transmits to their children. Again, we failed to find any significant differences in caregivers' time preference between the treatment and control groups (see Panel E of Table 3).

In summary, tests of the impact of the intervention on parenting practices and different alternative pathways that could influence children's patience find significant effects only on authoritative parenting style and interactions with children. The other potential channels are not significantly affected by the home visiting program. These findings suggest that parenting style is likely to be the key reason that the home visiting intervention increases children's patience.

5.3 Local Average Treatment Effect of the Home Visiting Program

Our earlier analysis estimates an Intention-to-treat effect of the home visiting program. Due to the existence of imperfect compliance, the intended number of home visits was 24 but actually ranged between 0 and 28 with a group mean at 12. We further estimate the LATE (Locally Average Treatment Effect) of the home visiting program on compliers. Sylvia et al. (2020) have concluded that the degree of compliance (or treatment intensity) is greatly determined by four factors, including child's gender, child's baseline cognitive skills, distance from the village and perception of FPC.

We use treatment assignment as instumental variables of the actual number of home visits and report 2SLS estimators in Table 4. Being assigned to the treatment group significantly increased the actual home visits by 11.4. The F test of excluded instruments is 225.35, much larger than the "rule of thumb" cutoff for weak instruments. The 2SLS estimator

on being patient is 0.00783, slightly smaller than the OLS estimator (0.00966). It means that one dose can significantly increase the propensity to wait for 15 minutes by 0.783 percentage points. We find similar patterns if we turn attentions to the impact of each home visit on possible mechanisms. The home visiting program significantly increase authoritative parenting and the interactiosn between caregivers and children, but show little impact on children's cognitive skills, monetary spending or caregivers' time preference.

5.4 Heterogeneity in Treatment Effect

Examination of how the impact of the home visiting program differs across subgroups of the population is crucial in understanding the origins of inequalities and also has policy implications. We split our sample by sex, cognitive skills at baseline, family socioeconomic status, type of caregiver (mother versus grandmother), and baseline parenting, and report the results in Table 5. Since we test multiple hypothesis at one time, p values are adjuested across each classification citeria. We have the following findings.

First, girls benefit more from the home visiting program than boys, with the intervention effect being 0.139 for girls and 0.0406 for boys. This gender difference is consistent with the study of Kim et al. (2018), who found that a parenting intervention only reduced externalizing behaviors for girls. One possible explanation is all the caregivers are females, and the treatment works better along the same-gender line (Duflo, 2003).

Second, the intervention effect is also heterogeneous with respect to household socioeconomic status, measured by whether the household received minimum living allowance at baseline (an indicator of poverty). The intervention shows a significantly positive effect of 0.116 for high SES families and a positive but insignificant effect (0.0396) for low SES families.

Third, we find those cognitively delayed children didn't benefit from the home visiting program in terms of time preference. The intervention effect on high cognition group, defined

by whether they were cognitively delayed at baseline, is both statistically and economically significant. However, the intervention effect on low cognition group is minimal and negative.

Fourth, one distinction between our study and others is the training was offered to both mothers and grandmothers, depending who was the main caregiver at baseline. That's because approximately 30% of our sample had one or both parents work in cities and had to stay with grandparents. This group of children are called left-behind children, which is a by-product of industrialization and rural-urban segregation. Left-behind children have become a severe social concern in China because they perform relatively worse in developing cognitive and noncognitive skills (Lee and Park, 2010; Meng and Yamauchi, 2017). The Chinese government has identified the support of left-behind children as an important policy priority[22]. We find that the intervention effect of the home visiting program is economically higher if grandmothers were the main caregiver at baseline, that the children's likelihood of being patient increases by 11.2 percentage points two years later. For mothers, the impact is only 5.73 percentage points. Even either estimator is precisely estimated, it is implied that grandmothers could be good targets in implementing early childhood intervention. That provides a new ankle to reduce inequalities and to improve cognitive and non-cognitive skills of left-behind children.

At last, we test the heterogeneity in treatment by baseline parenting practice. Column (9) re-estimate Equation (3) by restricting samples to those who had displayed high control (or harsh parenting) at baseline while Column (10) focuses on the low control group. The intervention effect is significantly higher in the low control group.

We consistently find the intervention effect of the home visiting program in cultivating patience is more substantial among better-off subgroups, for example the estimator is larger if families have high SES status, children are more developed in cognition and the baseline

[22] The State Council urged increased efforts to protect and take care of "left-behind" children in rural areas in a document issued on Feb 14, 2016.
http://english.www.gov.cn/policies/latest_releases/2016/02/14/content_281475289683304.htm

parenting is more consistent with authoritative style rather than harsh style. Our findings are opposite to other studies about cognition in China (Sylvia et al., 2020; Heckman et al., 2020). Economic preferences are different from cognitive skills that they are less visible and sometimes even adults may not realize its importance. So one possible explanation is that our sample comes from relatively poor rural areas where awareness of importance of being patient is considerably limited. An alternative explanation is different types of parental investment are complementary to each other, so the parenting style investment cannot work well if other types of investment are low.

We can draw several policy implications from the heterogeneity analysis. First, if researchers and policymakers want to make patience-augmented policies, it's necessary to make efforts to let caregivers realize the importance of being patient and cope with other types of pro-poor policies. Second, grandparents could be good targets of early childhood intervention program to decrease the developmental inequality between left-behind children and children living with parents.

5.5 Discussions of External Validity

Small-scale randomized control trials are fovered since they are carefully designed and can provide clearer causal relationships. However, such sudties are also criticized by lack of generalizability or external validity. Following the logics of pioneering work of List (2020) and Goldszmidt et al. (2020), we make the following attempts to show our study is not only applicable to certain settings among restricted samples, but it can be generalized to other samples.

First to our mind is the generilizability of sample structure. We sampled 3-5 years old rural children in one prefecture in western China, which may mis-represent the national sample. We show comparisons between our restricted sample with a national rural sample (2014 China Family Panel Studies) in Table A6. Our restricted sample is worse off compared to the national

sample, that our sample has a larger probability of having low bith weight, being ill last month, mother were less likely to breastfeed their babies, be at home and finished high school. We re-weight our sample to match the characteristics of the national population, and find the treatment effect of the home visiting program on being patient is still significantly positive (Table A4). The magnitude of the treatment effect is even larger. That implies that the treatment effect of home visiting program is not unique to the small sample but is not significantly from those who are not included in the Early Childhood Intervention program.

The second concern is whether the Marshmallow Test we used is sufficiently correlated with relevant situational conditions in real life. The Marshmallow Test paradigm confines children's choice to take the cookie or wait for the second cookie. This test simplified the decision making process in real life, but has similarities with intertemporal choices list used for adolescents and adults, because they both offer two options involved an earlier, smaller reward and a later, larger reward. Let's recall the process how we make decisions about human capital investment or other type of investment. Children have to choose between studying hard today and having a nice score in the exam, and watching TV today but performing poor in the exam. Over a longer horizon, the parents choose between sending children to college but being rewarded in the future, and using the tuition fee for present consumption but having limited transfer from children. Even the delay of payment in the Marshmallow Test is apparently shorter than the delay in the real life, as we discussed in Section 3.2.1, the length of delay is suitable for pre-school children.

6. Conclusion

We estimate for the first time the causal effect of a randomized home visiting intervention on children's time preferences. We find that children who participated in the intervention were more patient two years later compared to non-participants. The intervention effect is stronger among those who did not change their primary caregiver during the period

since treatment, suggesting that the intervention mainly affects children's time preference through sustained interaction with treated caregivers. We examine several possible mechanisms that may have contributed to the positive treatment effect. The program shows a significant and lasting impact on caregivers' parenting style, a short-term impact on caregiver-child interactions, and an insignificant impact on children's cognitive skills, monetary investments made by caregivers and caregivers' time preference. These results suggest that improved parenting style plays a key role in explaining the intervention effect. We also investigated the heterogeneous effect of the parenting program. We find that girls, left-behind children cared by grandparents, children in families with high socioeconomic status and less harsh parenting style, and children of high cognition benefit more from the program.

This study highlights the importance of the quality of parent-child interactions in early childhood in determining the time preference of children, which affects decision-making for the rest of their lives. It can help to answer a research question of general interest-when and how our economic preferences are formed. This study can also provide a new perspective to evaluate early childhood interventions.

Nevertheless, our study have several limitations. First, external validity may be a concern as the sample is drawn from one relatively poor prefecture in China. Even we have discussed the generalizability of our results with respect to the national rural sample, trials based on populations with considerably different characteristics are preferred to get a thorough understanding of the formation of time preference. Second, identifying the magnitude of the effect of parenting style on time preference is challenging because of changes in caregivers over time, attrition, and possible channels for program impact other than parenting style. Third, our estimates are based on measurements of patience at one point in time. More follow-up surveys would enable us to measure the persistent effects on patience more accurately and

discover whether the impacts on patience are indeed long-lasting and affect future learning and economic outcomes.

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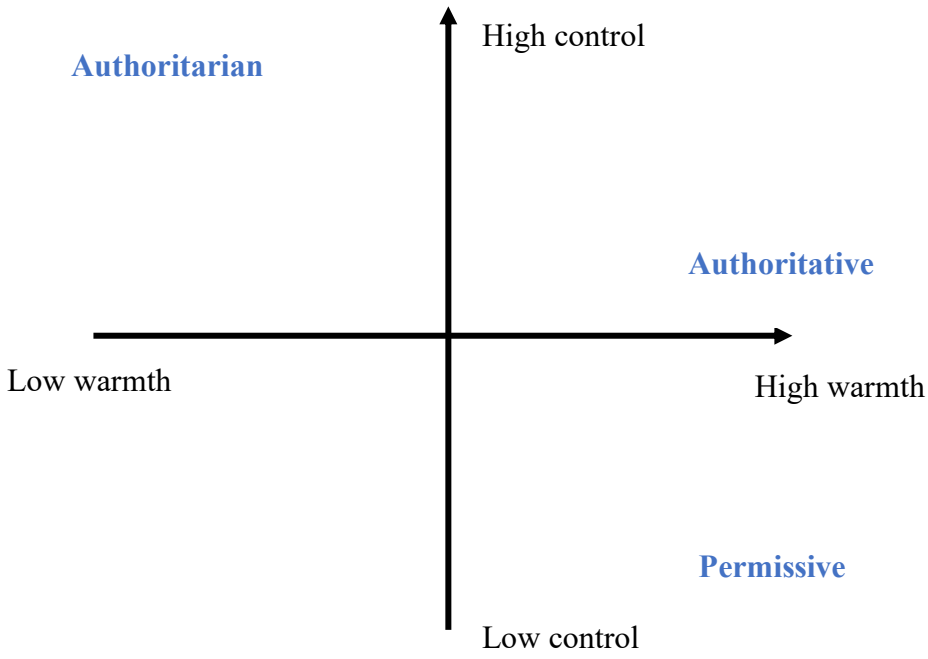

Figure 1: Classification of Parenting Style

Note: Baumrind (1971) categorized parenting style into three types, which are authoritarian style that combines high control and low warmth, authoritative style that combines moderate control and high warmth, and permissive style that combines high warmth and low control.

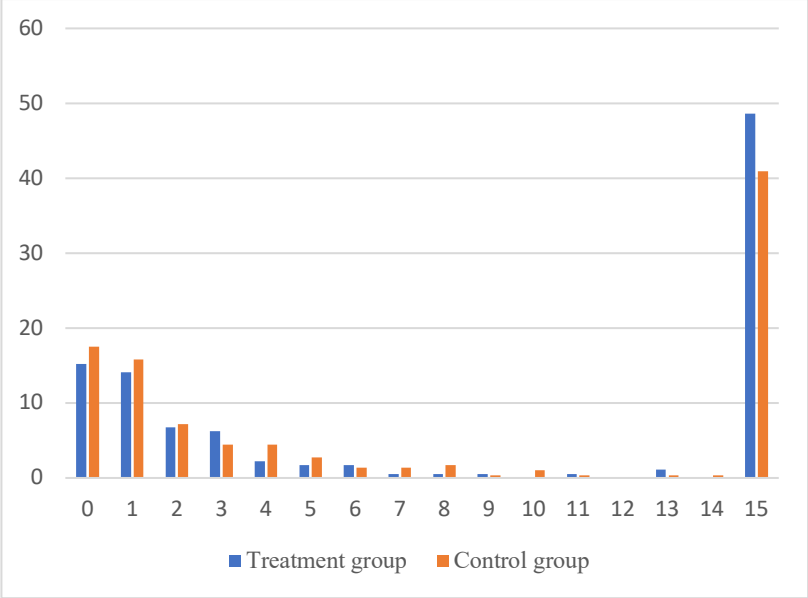

Figure 2: Distribution of Children's Waiting Time in the Marshmallow Test

Note: Waiting time is measured in minutes. Waiting time is recoded as zero if less than 1 minute. The experiment ends if children can wait for 15 minutes. The vertical axis is percent of each group.

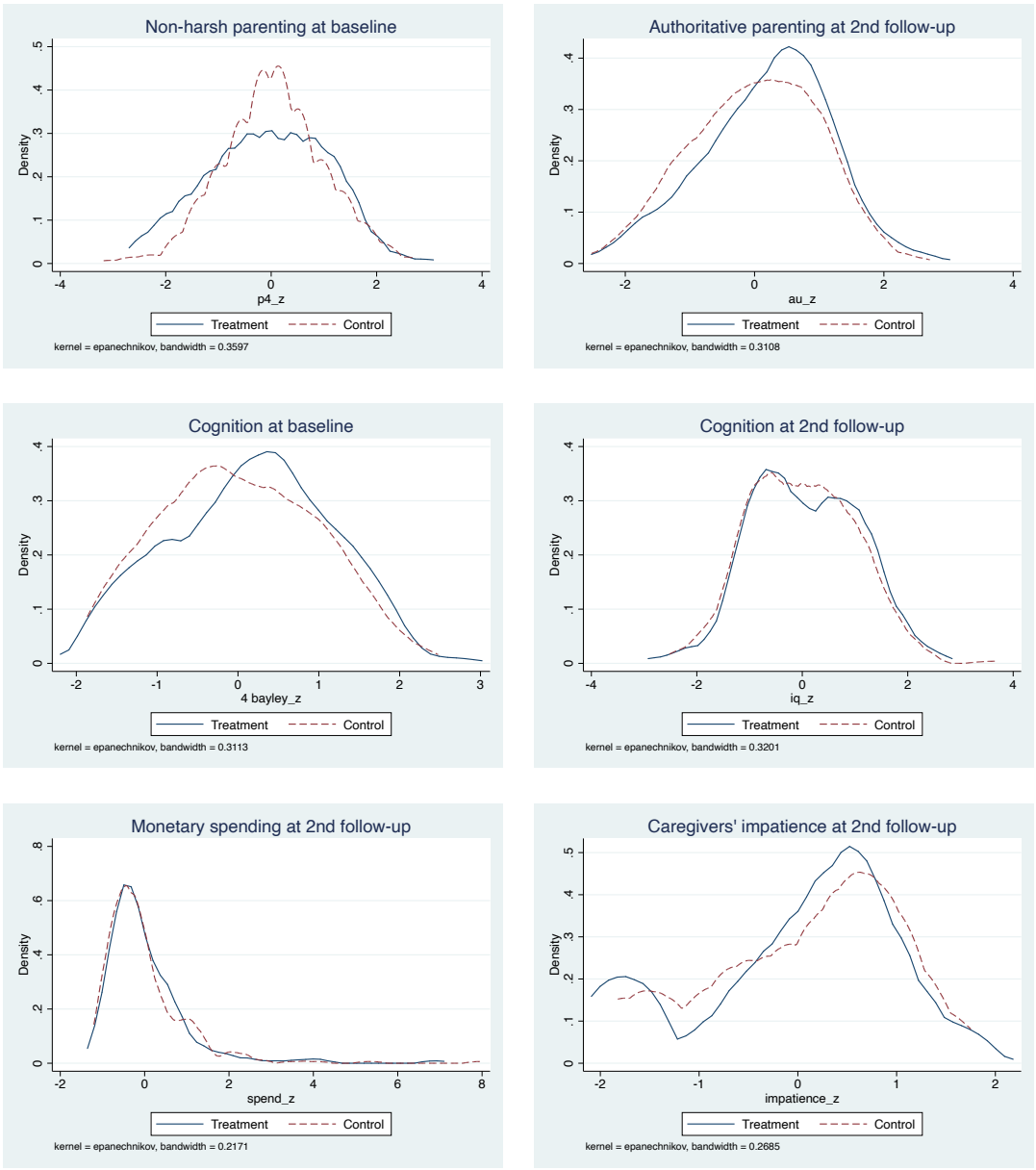

Figure 3: Kernel Densities of Possible Mediators at Baseline and the 2nd Follow-up

Note: Probability density functions of parenting style and children's cognitive skills are shown in the baseline and second follow-up surveys by treatment assignment. Probability density functions of monetary spending and caregivers' impatience are shown in the second follow-up survey by treatment assignment. The K-S test rejects the equality of authoritative parenting of treatment and control groups at second follow-up at the 10% significance level (p-value=0.083).

Table 1: Balance Check of Baseline Characteristics of Non-attriters

	Treatment N	Control N	Treatment Mean	Control Mean	Dif (T-C)
Child characteristics					
Age	291	177	24.657	24.526	.131
Male	291	177	.454	.514	-.06
Low birth weight	291	177	.041	.04	.002
First born	291	177	.615	.639	-.024
Ever breastfed	291	177	.852	.853	-.001
Days ill past months	290	176	4.391	4.812	-.421
Cognitive delay	291	177	.461	.367	.093**
Motor delay	291	177	.114	.09	.023
Social-emotional problem	291	177	.275	.271	.004
Nutrition program	291	177	.663	.672	-.009
Household characteristics					
Minimum living allowance	291	177	.285	.254	.031
Mother at home	291	177	.701	.678	.023
Mother education high school and above	291	177	.165	.164	.001
Parenting practice					
Use yelling to discipline	288	177	2.976	2.961	.015
Use spanking to discipline	288	177	2.726	2.848	-.122
Take away toys to discipline	288	177	2.087	2.164	-.077
Using time-out to discipline	288	177	1.792	1.78	.012
Explain unreasonable behaviour to discipline	288	177	3.202	3.102	.1
Non-harsh parenting style	288	177	2.724	2.67	.054
Played toys yesterday	289	177	.315	.356	-.041
Read books yesterday	288	177	.052	.034	.018
Told stories yesterday	289	177	.124	.113	.011
Sang songs yesterday	289	177	.395	.373	.022
Had interactions yesterday	291	177	.539	.52	.019

Note: *** p<0.01, ** p<0.05, * p<0.1

This table compares baseline characteristics of non-attriters in the control and treatment groups. The control group includes both pure control group that lived in non-treated villages and spillover group that lived in treated villages but wasn't assigned to be treated.

Table 2: The ITT effect of the Home Visiting Program on Children's Patience

	Point estimate	Standard error	P-value	Adjusted P-value
Panel A: DV=Patient				
Full sample	0.0893***	0.0479	0.065	0.0099
Same-caregiver sample	0.133***	0.0560	0.024	0.0099
Panel B: DV=wait_z				
Full sample	0.157**	0.0945	0.098	0.0297
Same-caregiver sample	0.254**	0.113	0.026	0.0198

Note: The dependent variable in Panel A is a dummy variable indicating whether the child waited for 15 minutes in the Marshmallow Test. The dependent variable in Panel B is the waiting time standardized by the distribution of the control group. In all regressions, we control for strata (county) fixed effects, cohort fixed effects, enumerator fixed effects, an early nutrition assignment status, and baseline cognitive delay. We additional control for experimental conditions, including experimental venue, existence of disturbance, any interruptions to the experiment, how does the child like cookies, etc.
All standard errors are clustered at the village level. Adjusted P-values are calculated using the Romano Wolf (2005, 2016) stepdown-procedure to control for the familywise error rate (FWER).
Significance levels based on adjusted P-values are as follows: *** p<0.01, ** p<0.05, * p<0.1

Table 3: The ITT Effect of the Home Visiting Program on Possible Mediators

	First follow-up					Second follow-up			
	Point estimate	Standard error	P-value	Adjusted P-value		Point estimate	Standard error	P-value	Adjusted P-value
Panel A: Children's cognitive skill					**Panel A: Children's cognitive skill**				
Z_score	0.00898	0.0872	0.918		Z_score	0.00596	0.0831	0.943	
Panel B: Parenting style					**Panel B: Parenting style**				
Spank	-0.224***	0.0879	0.012	0.0099	Warmth	0.204**	0.0982	0.040	0.0198
Yell	-0.241***	0.0945	0.012	0.0099	Reasoning	0.229**	0.0928	0.015	0.0198
Take away toys	-0.052	0.0917	0.568	0.7723	Democratic participation	0.123	0.101	0.228	0.1188
Limit time	-0.150	0.0941	0.114	0.1386					
Explain unreasonable behaviors	0.0416	0.0786	0.598	0.7723					
Non-harsh parenting	0.241**	0.0941	0.012		Authoritative parenting	0.214**	0.0954	0.027	
Panel C: Caregiver-child interaction					**Panel C: Caregiver-child interaction**				
Read	0.229***	0.0439	0.000	0.0099	Read	0.0413	0.03403	0.226	0.118
Sing song	0.123***	0.0470	0.010	0.0099	Sing song	0.106***	0.0345	0.003	0.0099
Play with toys	0.170***	0.0497	0.001	0.0099	Play with toys	0.0853***	0.0389	0.030	0.0099
Interaction	0.232***	0.0455	0.000		Interaction	0.0886**	0.0443	0.048	
					Panel D: Monetary spending				
					Spending on books	-0.0300	0.0689	0.664	0.822
					Spending on toys	0.0960	0.106	0.367	0.525
					Spending on clothes	-0.0115	0.0892	0.897	0.832
					Total spending	0.0254	0.0901	0.778	
					Panel E: Caregivers' impatience				
					Impatience	0.0184	0.1017	0.857	

Note: All outcomes are standardized by the distribution of the control group. In all regressions, we control for strata (county) fixed effects, cohort fixed effects, an early nutrition assignment status, and baseline cognitive delay. In regressions of 2nd follow-up, we control for enumerator fixed effects. In Panel A, B and C, we further control for baseline developmental outcomes.

All standard errors are clustered at the village level. Adjusted P-values are calculated using the Romano Wolf (2005, 2016) stepdown-procedure to control for the familywise error rate (FWER). Significance levels based on adjusted P-values are as follows: *** p<0.01, ** p<0.05, * p<0.1

Table 4: 2SLS Estimates of the Home Visiting Program

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Patient	Cognitive skills	Authoritative parenting	Play	Spend	Impatience
Visit_n	0.00783**	-0.000647	0.0154*	0.00687*	0.00151	0.00361
	(0.00399)	(0.00724)	(0.00835)	(0.00386)	(0.00786)	(0.00874)
Latent factor	N	Y	Y	Y	N	N
Observations	468	465	463	468	463	454
R-squared	0.202	0.151	0.121	0.104	0.098	0.151

Note: This table reports 2SLS estimators of visit_n on several dependent variables. Visit_n is the actual number of home visits each household received. All outcomes are standardized by the distribution of the control group. In all regressions, we control for strata (county) fixed effects, cohort fixed effects, enumerator fixed effects, an early nutrition assignment status and baseline cognitive delay. In Column (1), we additional control for experimental conditions, including experimental venue, existence of disturbance, any interruptions to the experiment, how does the child like cookies, etc. In Column (2) to (4), we additional control for baseline developmental outcomes. All standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Heterogeneity Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable	Patient	Patient	Patient	Patient	Patient	Patient	Patient	Patient	Patient	Patient
	Child's gender		Baseline SES		Baseline cognition		Baseline caregiver		Baseline parenting	
	Boys	Girls	Low	High	Low	High	Mother	Grandmother	High control	Low control
Treatment	0.0406	0.139***	0.0396	0.116**	-0.00475	0.148**	0.0573	0.112	0.0168	0.128*
	(0.0760)	(0.0692)	(0.111)	(0.0552)	(0.0776)	(0.0578)	(0.0558)	(0.104)	(0.0722)	(0.0662)
Control mean of dependent variable at endline	0.3863	0.4276	0.5060	0.3702	0.4477	0.3757	0.4040	0.4225	0.4265	0.3935
Observations	223	245	128	340	199	269	343	125	227	241
R-squared	0.214	0.252	0.231	0.212	0.180	0.307	0.205	0.306	0.201	0.301

Note: The heterogeneity analysis re-estimate Equation (3) by the child's gender, family SES status (whether receive the minimum living allowance), children's baseline cognition, baseline caregiver, and baseline caregiver's parenting. In all regressions, we control for strata (county) fixed effects, cohort fixed effects, enumerator fixed effects, an early nutrition assignment status, baseline cognitive delay and distance to town. We additional control for experimental conditions, including experimental venue, existence of disturbance, any interruptions to the experiment, how does the child like cookies, etc. Control mean of dependent variable at endline reports the average percent of being patient of the control group.

All standard errors are clustered at the village level. Adjusted P-values are calculated using the Romano Wolf (2005, 2016) stepdown-procedure to control for the familywise error rate (FWER). Significance levels based on adjusted P-values are as follows: *** p<0.01, ** p<0.05, * p<0.1

Appendix 1: Tables

Table A1: Test of Spill-over Effects within the Treated Villages

Dependent variable	(1) Patient	(2) Cognitive skills	(3) Authoritative parenting	(4) Interactions	(5) Impatience	(6) Spend
Treat_village	-0.104	-0.0903	0.157	0.0161	0.224*	0.0683
	(0.0754)	(0.169)	(0.153)	(0.0780)	(0.122)	(0.193)
Latent factor	N	Y	Y	Y	N	N
Constant	0.339**	-0.0584	-0.280	0.190	0.0715	-0.0127
	(0.159)	(0.217)	(0.213)	(0.132)	(0.213)	(0.237)
Observations	291	286	283	291	283	286
R-squared	0.245	0.206	0.105	0.160	0.179	0.112

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The pure control group is compared with the spillover group in the regression.

Control variables include age, gender, nutrition program participation, parents' education, baseline recieving minimum living allowance, baseline cognitive skills, county dummies, cohort dummies, enumerator dummies, and experiment controls.

All outcomes are standardized by the distribution of the control group.

Table A2: Balance Check of Baseline Characteristics of Attriters

	Treatment N	Control N	Treatment Mean	Control Mean	Dif (T-C)
Individual characteristics					
Age	49	12	24.53	24.166	.364
Male	49	12	.53	.584	-.052
Low birth weight	49	12	.041	0	.041
First born	49	12	.817	.666	.149
Ever breastfed	49	12	.837	1	-.164
Days ill past months	48	12	3.792	3.667	.125
Cognitive delay	49	12	.408	.334	.075
Motor delay	49	12	.183	.084	.101
Social-emotional problem	49	12	.286	.25	.036
Nutrition program	49	12	.715	.834	-.119
Household characteristics					
Minimum living allowance	49	12	.183	.167	.017
Mother at home	48	12	.584	.416	.167
Mother education high school and above	49	12	.164	.084	.08
Parenting practice					
Use yelling to discipline	48	12	3.083	2.25	.834***
Use spanking to discipline	48	12	2.833	2.167	.666**
Take away toys to discipline	48	12	2.208	2.167	.042
Using time-out to discipline	48	12	1.917	1.834	.084
Explain unreasonable behaviour to discipline	48	12	3.125	3.417	-.291
Non-harsh parenting style	48	12	2.617	3	-.384**
Played toys yesterday	48	12	.438	.25	.188
Read books yesterday	48	12	.062	.167	-.104
Told stories yesterday	48	12	.125	.167	-.042
Sang songs yesterday	48	12	.334	.416	-.084
Had interactions yesterday	49	12	.572	.5	.072

Note: *** p<0.01, ** p<0.05, * p<0.1

This table compares baseline characteristics of attriters in the control and treatment groups. The control group includes both pure control group that lived in non-treated villages and spillover group that lived in treated villages but wasn't assigned to be treated.

Table A3: Predicting the Status of Being Missing with Baseline Characteristics

	(1) Missing in 1st follow-up	(2) Missing in 2nd follow-up
Treatment	-0.227***	-0.0811**
	(0.0481)	(0.0345)
Nutrition program	0.0132	0.0405
	(0.0256)	(0.0364)
Cognitive delay	0.0131	-0.0374
	(0.0272)	(0.0273)
Motor delay	-0.0186	0.0644*
	(0.0386)	(0.0381)
Age in months	0.00211	0.0121*
	(0.00683)	(0.00635)
Male	0.0338	0.0342
	(0.0251)	(0.0270)
Mother high school	0.122**	-0.0247
	(0.0496)	(0.0311)
Mother edu missing	0.126	0.000804
	(0.160)	(0.127)
Father high school	-0.00531	-0.00230
	(0.0299)	(0.0357)
Father edu missing	--	0.161
		(0.101)
Mom at home	0.00622	-0.0583**
	(0.0290)	(0.0246)
Dibao	-0.0267	-0.0702**
	(0.0296)	(0.0293)
Has village information	0.0223	-0.187**
	(0.0683)	(0.0889)
Village*number of hhs	-0.000115	-9.17e-05
	(0.000113)	(0.000100)
Village*distance to town	0.00201	0.00240
	(0.00219)	(0.00241)
Village*outmigration rate	-0.0499	0.153*
	(0.0655)	(0.0834)
Cohort	Y	Y
County	Y	Y
Constant	-1.647	-2.528
	(1.457)	(1.181)
Observations	510	528

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
All the control variables are baseline variables.
Reported is marginal effect change from the base level.

Table A4: Robustness Check

	(1)	(2)
	Without IPW Patient	Re-weight Patient
Treatment	0.0831*	0.162*
	(0.0477)	(0.0910)
Constant	0.3417**	0.695***
	(0.133)	(0.217)
Observations	468	468
R-squared	0.1873	0.755

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Column (1) estimates Equation (3) without IPW. Column (2) estimates Equation (3) after re-weighting with the national sample.

Table A5: Lower Bound Treatment Effects

	(1) Patience Control: 20% Treatment:0%	(2) Patience Control: 40% Treatment:0%	(3) Patience Control:60% Treatment:0%
Treatment	0.0798*	0.0515	0.0260
	(0.0496)	(0.0491)	(0.0488)
Observations	529	529	529

Note: Estimates are based on the same regression equations as in Equation (3) but without enumerator effects and experiment controls.
Columns (1)–(3) randomly assign the patience dummy to missing samples. Missing observations in the treatment group are all assumed to be impatient (patient=0). Further, missing observations in the control group are assumed to have a probability of 20%, 40%, and 60% to be patient.
The reported coefficients and standard errors are based on the mean of 100 repeats.

Table A6: Summary Statistics between Sample in This Paper and National Sample

	Sample in this paper			2014 CFPS		
	N	Mean	SD	N	Mean	SD
Male	468	0.476	0.500	1,102	0.538	0.499
Distance to town (kilometre)	441	3.843	1.4625	739	3.352	1.863
Low birth weight	468	0.0406	0.197	846	0.0236	0.152
Ever breastfed	468	0.852	0.355	864	0.911	0.285
Ever ill past months	468	0.731	0.444	1,102	0.476	0.499
Mother at home	468	0.692	0.462	1,102	0.766	0.423
Mother education high school and above	463	0.145	0.352	1,099	0.770	0.421

Note: CFPS (China Family Panel Studies) is a national representative survey. We compare individual, household and community level characteristics between our restricted sample and the national rural sample born in the same cohorts.

Appendix 2: One example of the home visiting intervention curriculum

Social-Emotional Module: Taking care of younger siblings

Materials: two dolls (one boy and one girl), one cup, one small bowl, one spoon
Goal: To help the baby establish an intimate relationship with family and instill a sense of responsibility toward others
Procedures

1. The trainer shows how to play the game "Taking care of the younger brother and sister" following the steps below:

(1) The mother puts two dolls on the table and tells the baby, "Baby, this little boy is the younger brother, and the little girl is the younger sister. Now the younger brother and younger sister are sick. Are you willing to take care of them today?"
(2) Further, the mother says, "It is noon now; can you use the spoon to feed food to the younger brother and sister?" If the baby does not understand, the mother can hold a bowl in one hand and a spoon in the other, pretending to feed the dolls. Subsequently, the mother tells the baby, "You can feed them like this." **If the baby can successfully do it, the mother should praise the baby**.
(3) After feeding, the mother says, "The younger brother and sister are sick. They should take the medicine after the meal. Can you bring the cup over to help them take the medicine?" The mother first demonstrates how to feed medicine to the younger brother or sister and subsequently lets the baby feed medicine to the other person.
(4) When the baby has finished feeding the medicine, the mother can tell the baby to lay the brother and sister down to rest.
(5) After the whole process, the **mother should hug the baby and say, "You have grown up and can take care of others. Awesome!"**

2. The mother follows the steps demonstrated by the trainer and plays the game of "taking care of the younger siblings" with the baby.
3. If the baby can skillfully play the above game, the mother can conduct expansion activities:

(1) The mother can let the baby try to feed the mother.
(2) The mother can also let the baby take care of the siblings by themselves.

Appendix 3: Experiment manual for children's time preference

Experimental procedures

(1) Find a room and place a chair before a table (or bed). Let the child sit there.
(2) Show them one cookie, and tell them "I will leave for 15 minutes. You can eat the cookie. However, if you don't eat and wait until I come back, you can have two cookies. Once you eat the cookie, please knock on the door." The enumerators should make ensure that each child understands the rule. Further, show the child you have more cookies.
(3) If the kid knocks on the door before 15 minutes, record their waiting time. If the child waits for 15 minutes, give them another cookie and praise them.

Questionnaire

1. Where is the room?
A. Bedroom at home
B. Study room at home
C. One room in education center
D. Other_____

2. Is there any entertainment in the room? (multiple choices allowed)
A. Toys
B. Books
C. TV
D. Other_____

3. Is the environment quiet?
A. Very quiet
B. Quiet
C. Just so-so
D. Noisy
E. Very noisy

4. Has the test been interrupted?
A. No
B. Yes, because the child went to the toilet but returned immediately
C. Yes, because the child needed to take medicine but returned immediately
D. Yes, because the child went to the toilet/took medicine/went to play but did not return

5. How long has the child waited?____mins

6. (Enumerator answer) How did the child like the cookie?
A. Like it very much
B. Like
C. Just so-so
D. Dislike
E. Hate the cookie

Appendix 4: Parenting styles and dimensions questionnaire

Please rate your behaviour with

1=never; 2=once in a while; 3=about half of the time; 4=very often; 5=always

Note: Questions that begin with a star are components of authoritarian parenting style, and the remaining questions are components of authoritative parenting style.

1. Responsive to the child's feelings or needs
2. *Uses physical punishment as a way of disciplining our child
3. Considers the child's desires before asking them to do something
4. *When the child asks why they must conform, states either of the following: because I said so or I am your parent, and I want you to
5. Explains to the child how we feel about their good and bad behavior
6. *Spanks when the child is disobedient
7. Encourages the child to talk about their troubles
8. Encourages the child to freely express themselves even when disagreeing with parents
9. *Punishes by taking privileges away from the child with little, if any, explanation
10. Emphasizes the reasons for rules
11. Provides comfort and understanding when the child is upset
12. *Yells or shouts when the child misbehaves
13. Gives praise when the child is good
14. *Explodes in anger toward the child
15. Considers the child's preferences in making plans for the family
16. *Grabs the child when being disobedient
17. Shows respect for the child's opinions by encouraging them to express
18. Allows the child to give input into family rules

19. *Scolds and criticizes to make the child improve
20. Gives the child reasons why rules should be obeyed
21. *Uses threats as punishment with little or no justification
22. Has warm and intimate times together with the child
23. *Punishes by putting the child off somewhere alone with little, if any, explanation
24. Helps the child understand the impact of their behavior by encouraging them to talk about the consequences of their own actions
25. *Scolds and criticizes when the child's behavior does not meet our expectations
26. Explains the consequences of the child's behavior
27. *Slaps the child when they misbehave.