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Educational differences in parental time devoted to childcare in China

Fenglian Du [a], Xiao-yuan Dong [c,*], Yinyu Zhang [b]

[a] School of Economics and Management & Research Centre for Chines Time Use Survey at Inner Mongolia University, University West Street 235#, Hohhot 010021, Inner Mongolia, China
[b] Research Center for Chinese Time Use Survey at Inner Mongolia University & Hulunbuir University, Hulunbuir, China
[c] Department of Economics at the University of Winnipeg, 515 Portage Avenue, Winnipeg R3B 2E9, Manitoba, Canada

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ABSTRACT

The intergenerational transmission of education in China has drawn extensive public and academic attention. This paper explores the differences in the amount of time Chinese parents spend on childcare stratified by education level and investigates the factors driving these differences. The analysis shows that more educated parents devote more time to childcare than less-educated parents. The educational differences in parental childcare time are particularly pronounced among working parents, parents with school-age children, and parents in the provinces where educational institutions are relatively scarce. Much of the extra childcare time is directed to educational care and travel with children. Compared to households in which the mother has less than a junior high school education, households with university-educated mothers spend 74 min more per day on childcare, with 58% of the extra time devoted to children's learning and education.

1. Introduction

Parents devote time and financial resources to raising their children. The time parents spend with their children is the most important input for children's cognitive and social skill development (Fiorini & Keane, 2014; Heckman, 2006), and early childhood development has lifelong consequences (Carneiro & Heckman, 2003; Heckman & Masterov, 2007). Parental time investment in children is also a possible channel for the intergenerational transmission of parental (dis)advantages. A large body of time use studies in developed countries has documented that more-educated parents spend more time in childcare than do less-educated parents (Altintas, 2016; Guryan, Hurst, & Kearney, 2008; Craig, 2006). While much of the research on parental time with children has been done for developed countries, the literature on this topic for developing countries remains sparse. To fill in this knowledge gap, this paper examines differences in the amount of time Chinese parents spend on childcare stratified by education level.[1]

China provides a unique context for exploring the relationship between parental education and childcare time. The parenting practice of Chinese families is highly influenced by Confucian cultural tradition in which education is regarded as a ladder to higher earnings and social status. Chinese parents generally have high expectations for their children's academic achievements as it is illustrated by the saying "hoping for a son to become a dragon and a daughter to become a phoenix" (Hau & Ho, 2010). China's

* Corresponding author.
E-mail addresses: fldu@imu.edu.cn (F. Du), x.dong@uwinnipeg.ca (X.-y. Dong), xue19890327@126.com (Y. Zhang).

[1] We will refer the concepts of "parental childcare time" and "parental time with children" interchangeably hereafter.

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transition to a market-oriented economy has greatly enhanced the value of human capital, increasing the demand for higher education (Fleisher & Wang, 2005; Li, Meng, Shi, & Wu, 2012). While the supply of higher education has rapidly expanded over the past two decades,[2] there remains a large gap between the number of young Chinese desiring a college education and the number of college enrollments available, especially at elite colleges (Li, Loyalka, Rozelle, Wu, & Xie, 2015). College admission in China is determined primarily by students' scores on the National College Entrance Exam. Because academic achievements are cumulative, students start preparing for college entrance examinations as early as in primary school. Because high-quality educational resources are scarce, high schools in China are classified into premier schools and regular schools. Admission to premier schools is also determined by the scores received on junior and senior high school entrance exams. On average, students at premier high schools have a higher probability of being admitted to colleges than those at regular high schools (Liu & Wan, 2019; Park, Shi, Hsieh, & An, 2015). The competition for admissions to premier high schools and elite colleges has put tremendous pressure on Chinese parents to make time and financial commitments to children's learning and school success (Zou, Neil Anderson, & Tsey, 2013; Xu & Yeung, 2013).

Studies have shown that parental involvement in children's education has a positive effect on children's school performance (Siebert, Wei, Wong, & Zhou, 2018; Young, 2020; Zong, Zhang, & Yao, 2018). This has raised concerns about equality of educational opportunities for children from families with low socioeconomic status. Empirical research has found that there are large academic achievement gaps between children of more-educated and less-educated parents (Knight, Li, & Deng, 2009; Knight, Sicular, & Yue, 2011). Magnani and Zhu (2015) and Dong, Luo, Zhang, Liu, and Bai (2019) found that there is a strong positive correlation between the years of schooling experienced by parents and their children. Liu and Wan (2019) and Yang and He (2015) showed that parental education is a significant determinant of children's scores on college entrance examinations and of their probability of being admitted to colleges. Thus, studying educational differences in parental time with children will shed light on a possible channel for the intergenerational transmission of human capital in China.

In China, as in most other countries, childcare is typically the mother's responsibility. However, Chinese women also participate in the work force in high numbers and the vast majority of Chinese women work fulltime. As a result, Chinese women experience a great work-family conflict (Cook & Dong, 2011). A few time use studies have explored gender roles in intra-household allocation and their implications for domestic gender inequalities in China. Dong and An (2015) found that Chinese mothers gave up leisure time so they could allocate more time to paid work and more time to the care of their families. The "time squeeze" was particularly acute for low-paid working mothers, who had to allocate a substantial amount of time to paid work to support the family (Qi & Dong, 2018). Education was found to play a pivotal role in achieving a more balanced distribution of unpaid work (housework and care work combined) between women and men. Bruin and Liu (2020) showed that more-educated urban husbands took on a larger share of unpaid work than their less-educated counterparts. Zhai, Gao, and Wang (2019) found that wives with an education level equal to or higher than that of their husbands spent less time on unpaid work than wives with an education level lower than that of their husbands. Using a measure that limits childcare to routine care activities for preschool children, Zhao (2018) documented the trends in parental time with children for the period from 2004 to 2011. She found that during this period, fathers' time spent on childcare increased, while mothers' childcare time slightly decreased. This paper supplements the existing Chinese time use literature that concentrates on domestic gender inequalities by studying parental time use from a new angle.

In this study, we document the patterns of educational differences in total childcare time and the types of childcare activities in which parents engage in two-parent families with at least one child under 18 years of age. We also investigate the factors driving these differences. We examine how parents with different education levels allocate time among paid work, housework, childcare, leisure, and self-care to understand how childcare time choice is compared to other unpaid uses of time in response to economic factors and how education affects parents' tradeoffs between paid work and unpaid activities and between meeting children's needs and their own needs for leisure and relaxation. We also examine the extent to which China's competitive education system may play a role in explaining the educational differences in parental time with children.

Our analysis has obtained robust evidence that in China, as in many developed countries, more-educated parents spend more time caring for children than less-educated parents. The most important component of the extra parental time with children is time spent on activities related to children's education. We found that highly educated, high earning parents value time caring for children more than other unpaid uses of time, so they are more inclined to trade time spent on domestic chores or leisure for time caring for children than low-educated, low-earning parents. Compared to parents with more education and higher earnings, low-educated, low-earning parents face a more acute time squeeze from paid work, which reduces their time available for all unpaid activities, including childcare. We also found that the positive education gradient in childcare time is more pronounced in the provinces where the supply of educational institutions is relatively scarce and academic competition tends to be more intense.

The paper proceeds as follows. Section 2 provides a brief account of the theoretical background for the study of parental time with children and formulates research hypotheses. Section 3 describes the data, measures, and empirical methods used. Section 4 presents the empirical results. Section 5 concludes.

2. Theoretical background and research hypotheses

From an economic perspective, the relationship between parental education and time with children is not straightforward. In light of human capital theory, more educated individuals are potentially high-wage earners and have a high opportunity cost of time. Hence,

[2] From 2000 to 2020, the college enrolment rate in China increased from 7.6% to 58.4% according to World Development Indicators published by World Bank at http://databank.worldbank.org/data/reports.aspx?source==worlddevelopment-indicators (accessed on July 17, 2021).

more educated parents will have higher labor force participation rates and fewer children and consequently allocate more time to paid work and less time to childcare. Bargaining theories also predict a negative relationship between parental education and childcare time based on the argument that education enhances the bargaining power of a marital partner for less housework and fewer caregiving responsibilities (Lundberg & Pollack, 1996; Zhai et al., 2019).

Contrary to the conjecture of a negative relationship between parental education and time with children, numerous studies in developed countries have found that more educated parents spend more time on childcare than do their less educated counterparts.[3] Education affects not only the amount of time parents spend with children but also the types of childcare activities in which parents engage. College-educated parents were found to spend proportionally more time reading to children, playing with them, and supervising their homework than non-college educated parents (Craig, 2006; Ramey & Ramey, 2009; Sayer, Bianchi, & Robinson, 2004). Research has also revealed that although mothers still shoulder the lion's share of childcare, the gender gap in childcare time has narrowed over the years and the involvement of fathers relative to that of mothers in childcare is higher for the more educated than the less educated (Chalasani, 2007; Yeung, Sandberg, Davis-Kean, & Hofferth, 2001).

The literature has put forth several explanations for why more educated parents tend to spend more time on childcare. Guryan et al. (2008) argued that parents' childcare time choice is distinct from other unpaid uses of time such as housework and leisure in response to economic factors. Parents' time allocation follows a similar logic of the traditional income/leisure choice model in which the effect of a wage change is ambiguous, depending on the relative strength of substitution and income effects. A higher wage will increase the time devoted to housework, childcare and leisure and decrease the time spent on paid work if the income effect dominates and it will decrease the time on the unpaid activities and increase the time on paid work if the substitution effect dominates. However, three unpaid activities differ in degrees of substitutability and values for parents. Housework is more substitutable compared to childcare and leisure. A mother can purchase substitutes for her time spent on housework, but she cannot pay someone to perform leisure activities, such as watching a movie or going to a concert. While a mother can hire a nanny to perform routine tasks such as feeding, washing, or keeping an eye on children, there are no good substitutes for her one-on-one time with her child (supervising homework or playing) and it is also difficult to monitor paid care providers to ensure that high-quality care services are delivered. Given these differences, a higher wage will have a larger substitution effect on time spent on housework compared to time spent on childcare or leisure. Regarding the values of different unpaid activities for parents, subjective wellbeing studies have shown that parents on average consider spending time with children more enjoyable than on leisure or housework, and doing housework is the least enjoyable among the three activities (Krueger, Kahneman, Schkade, Schwarz, & Stone, 2019; Juster, 1985). The revelation that parents derive more satisfaction from the time spent with children than the time spent on leisure is consistent with the perception that parents are altruistic toward their offspring (Becker, 1991). Thus, among the three unpaid activities, the income effect of a wage change is the largest for childcare and the smallest for housework, while the income effect on leisure time lies in between.

Based on the argument above, Guryan et al. (2008) postulated that a higher wage will increase the time spent on childcare and decrease the time spent on housework and leisure because the income effect tends to dominate in the childcare choice and the substitution effect tends to dominate in the choices of housework and leisure time. Taking educational attainment to be an indicator of earning potential, this conjecture can be applied to predict the variations in parental time use by education level. Empirical research has obtained evidence supporting the claim that childcare is distinct from either housework or leisure activities. Kimmel and Connelly (2007) showed that a wage change has a positive effect on the time a mother allocates to paid work and childcare and a negative effect on the time she allocates to housework and leisure in the United States. Guryan et al. (2008) found a positive education gradient for paid work and childcare time and a negative education gradient for housework and leisure time among American working women. This study also found a positive education gradient for childcare time and a negative education gradient for leisure time among American men.

Ramey and Ramey (2009) introduced a rat race model to explain why the amount of time that American parents, particularly college-educated parents, spent in childcare dramatically increased in recent decades. They attributed the increase in childcare time to an increase in the perceived return to attending a good college and an increase in competition for spots at top-tier colleges. The model focuses on care activities that help children gain admissions to good colleges and assumes that college-educated parents have a comparative advantage in investing in college preparation over non-college educated parents. The model shows that as the growth of the college aged population outpaces the expansion of spots at top-tier colleges, college preparation requirements will increase. To ensure that their children gain admission to good colleges all parents must spend more time on college preparation, and the increase in college preparation time is greater for college-educated parents relative to non-college-educated parents. Ramey and Ramey (2009) argued that the competition for inelastically supplied spots at top-tier colleges is like a rat race as it may drive college-educated parents to wastefully overinvest in college preparatory activities from a social standpoint.

Sociologists have applied gender role and ideology theories to explain why more-educated fathers are more likely to be involved in childcare and housework than their less-educated counterparts. Gender role and ideology theories contend that the relative contribution of parents to childcare and housework is determined not only by economic considerations but also by the gender attitudes and beliefs that mothers and fathers hold (England & Folbre, 2003; Bianchi, 2000). More-educated parents are receptive to the ideals of domestic gender equity, whereas less-educated parents tend to adhere to the traditional "male breadwinner and female caregiver" gender roles. So fathers with higher levels of education are more willing to spend time caring for children and doing housework than

[3] A selective list of studies include Altintas (2016), Chalasani (2007) and Bianchi, Cohen, Raley, and Nomaguchi (2004) for the United States, Guryan et al. (2008) for the United States and 13 other developed countries, Gauthier, Smeeding, and Furstenberg Jr. (2004) for Canada, Germany, Italy and Norway, and Craig (2006) for Australia.

fathers with lower education (Sullivan, 2010).

In the remainder of the paper, we will investigate how the alternative explanations for educational differences in parental childcare time play out in the context of China. We first describe the patterns of educational differences in total childcare time and its subcategories (routine care, educational care, recreational care, and travel) among parents. We compare the differences between employed and non-employed parents at both individual and household levels. The household level analysis takes into account the influence of the marriage norm of "assortative mating" that men and women tend to select partners with similar education levels. If there were a positive education gradient for childcare time, educational homogamy would exacerbate inequality in parental investment in children by doubling parental (dis)advantage (Altintas, 2016).

We next investigate the reasons why childcare time varies across parents of differing education. We first test the hypothesis proposed by Guryan et al. (2008) that childcare time does not behave like either leisure or housework: other things being equal, more-educated parents spend more time on childcare and less time on housework and leisure than do less-educated parents. This conjecture implies that highly educated parents would feel the conflict between paid employment and caregiving most acutely (Craig, 2006). However, the time poverty literature has found that in developing countries where social welfare and protection programs are not well developed, working mothers from disadvantaged groups often have great difficulty balancing paid work and childcare because they have to spend long hours in paid employment to support the family due to low wages (Bardasi & Wodon, 2010). In China, less-educated workers are concentrated in the informal sector where wages are low and the minimum-wage and working hours regulations are not effectively enforced (Du & Xue, 2012; Ye, Gindling, & Li, 2015). We will compare the time use patterns between parents who earned less than the minimum wage and other working parents to understand how the "time squeeze" from paid work affects parental childcare time.

We further investigate what role China's competitive educational environment plays in explaining the educational differences in parental time with children. We will test the hypothesis derived from the rat race model that competition for scarce college spots induces more-educated parents to invest more time in children's education relative to less-educated parents. This hypothesis has three implications for our analysis: (1) The educational difference in parental childcare time is primarily driven by time spent on educational care; (2) The educational difference in childcare time is more pronounced among households with school-age children than households with preschool children, given that academic competition is more intense among school-age children than preschool children; (3) The educational differences in childcare time are greater in the provinces where the supply of colleges and senior high schools is relatively scarce and academic competition is more intense. We will test these predictions.

3. Data and empirical method

3.1. Data

This paper is the first to study parental childcare time in China using data collected through time diary instruments. Most existing studies relied on conventional households surveys, such as China Family Panel Studies (CFPS) and China Health and Nutrition Survey (CHNS).[4] In conventional household surveys, data on time allocations are typically obtained through such questions as how much time the respondent spent on a list of selected activities during a reference period. The conventional survey method usually does not count all the activities, although it may double count the activities that take place simultaneously. Diary-based time use surveys overcome these shortcomings and provide more accurate information on how people spend their time in a given day.

The data used for our analysis come from the 2017 China Time Use Survey (CTUS), which was conducted jointly by the Inner Mongolian University and the Southwestern University of Finance and Economics. The CTUS interviewed 12,471 households that were randomly selected from a large sample of >40,000 households covered by China Household Finance Survey (CHFS). The CHFS is designed to collect information on household finance and it was launched in 2011 and has been conducted every two years by the Research Institute of Economics and Management at the Southwestern University of Finance and Economics. The CHFS covers all provinces in mainland China except for Tibet and Xinjiang Uygur Autonomous Regions.[5]

The CTUS survey required each household in the sample to complete a time diary for each household member aged 3 years or older recording the activities they performed at 10-min intervals between 4:00 am on the day preceding the interview and 4:00 am on the day of the interview. Each respondent filed one diary on a randomly assigned day of the week. The CTUS collected information on primary activities and secondary activities conducted simultaneously, the location at which the primary activity took place, the individuals with whom the person was present when the primary activity started, and modes of transportation used if travel was involved in the activity. The survey also gathered information on the socioeconomic characteristics of respondents and the demographic composition, income, and expenditures of households.

For the analysis of this paper, we draw from the CTUS a subsample of parents aged between 21 and 54 years in two-parent families with at least one child under 18 years of age.[6] Our analysis focuses on primary activities because only a small number of respondents

[4] Bruin and Liu (2020) and Zhai et al. (2019) utilized data from CFDS and Short, Zhai, Xu, and Yang (2001) and Zhao (2018) used data from CHNS.

[5] The CHFS provides high quality information for research on Chinese household finance. A selective publications that used data from CHFS include Ma, Wu, and Gan (2019) and Yang and Gan (2020).

[6] Of all families with children in the CTUS, 88% are two-parent families; 6% are families with one parent present, and 6% are families with both parents absent. The parents and children from the same household were matched by household identifier and household member relationship code.

reported secondary childcare activities. Excluding diaries with <5 daily episodes of activity recorded and observations with missing information, we have a sample of 2516 mothers and 2516 fathers for analysis.

3.2. Empirical method

We examine the determination of parents' time allocation with two reduced form equations. The first one is estimated, separately, for mothers and for fathers, and the second one is for households as a unit.

The regression model at the individual level is specified as

$$T_{ji} = \beta_0 + \beta_1 educ_i + \beta_2 Z_i + u_{ji} \quad (1)$$

where j represents a specific activity; i is the index for parents; T_{ji} is time in hours per day spent by parent i on activity j; $educ_i$ is a vector of dummy variables related to levels of parental educational attainment; Z_i is a vector of covariate control variables measuring individual and household characteristics; u_{jt} is the error term. β_0, β_1 and β_2 are unknown regression parameters. β_1 is the parameter of interest, which measures the conditional difference in time spent in activity j between parents with a higher education level and parents with the lowest education level.

The dependent variable of eq. (1) involves five primary time use activities (paid work, housework, childcare, leisure, and self-care) and four specific childcare activities (routine care, educational care, recreational care, and travel with children). Paid work includes waged employment and self-employment. Housework includes meal preparation and clean up, laundry, housekeeping, pet care, shopping, care for adults, and travel associated with these activities. Leisure includes physical exercise, fitness activities, entertainment, social interaction, religious activities, and travel associated with these activities. Self-care includes sleeping, personal hygiene, eating, drinking, and associated travel. Total childcare time is the sum of time spent on four specific childcare activities. Routine care refers to care activities necessary for children's daily lives, including feeding, bathing, dressing, putting children to sleep, watching children playing or sleeping, and maintaining a safe environment for children. Educational care refers to activities such as reading to children, teaching children, supervising homework, and meeting with teachers. Recreational care includes playing with children and watching TV with children. Travel with children includes transporting children to daycare, school, playground, to participate in extracurricular activities, to visit a doctor, and any travel related to other childcare activities.

The explanatory variables of primary interest, *educ,* are dummy variables related to levels of parental educational attainment. We create five levels of educational attainment: parents who have (1) a primary school education or lower, (2) a junior high school education, (3) a senior high school education, (4) some college education, or (5) a 4-year university education or higher. Parents with a primary school education or lower are chosen as the base group for comparison. Other explanatory variables entered into the model as covariate control variables in Z include the age of each parent, the age of the youngest child, and number of girls and boys in the age groups of 0–2, 3–5, and 6–17, and number of women and men in the age groups of 18–49, 50–64, and 65+ in the household. We also control for non-earned income measured in yuan[7] per month in log form. For the regressions for mothers (fathers), the variable of non-earned income includes father's (mother's) earnings, family investment incomes, and welfare payments. A series of dummy variables are entered to measure whether the person lived in an ethnic minority autonomous region, whether the diary day was a weekday or a weekend day, whether the person lived in the rural sector or the urban sector, and province fixed effects.

To evaluate the extent to which the time squeeze from paid work is responsible for the "time deficit" in childcare among low-educated parents, we add a dummy variable for those who worked fulltime (at least 8 h a day) but had a monthly earnings below the average minimum wage threshold of the province (termed "low-paid workers") to the regressions for five primary time use activities.[8]

We also estimate eq. (1) for five primary time use activities by replacing education variables with dummy variables for predicted earnings quintiles. To obtain predicted earnings, we run a regression of log monthly earnings on four dummy variables for educational attainment, experience and its squared term, a dummy variable for the rural sector, and province fixed effects, separately, for mothers and fathers of dual-earner families.[9] We then rank the working mothers (and working fathers) by their predicted earnings and place them into earnings quintiles. The estimates of earnings regressions are presented in Table A2 in Appendix. A description of the explanatory variables is provided in Table A1 in Appendix.

The regression model at the household level is written as

$$H_{ri} = \alpha_0 + \alpha_1 meduc_i + \alpha_2 Z_i + \varepsilon_{ri} \quad (2)$$

where H_{ri} is time in hours per day spent by household i on childcare activity r or annual expenses on children's education in yuan by household i; $meduc_i$ is a vector of dummy variables for levels of maternal education attainment; Z_i is a vector of covariate control

[7] One US dollar = 6.46 yuan as of September 7, 2021.

[8] China's minimum wage standards include two thresholds: a monthly threshold for full-time workers and an hourly threshold for part-time workers. Minimum wage standards are determined by the government of each province, and, within each province, minimum wages vary across cities (Qi & Dong, 2018). The CTUS did not provide information on how many days a parent worked in a month so we were unable to convert monthly earnings into hourly earnings. Some parents had low monthly earnings because they spent less time on paid work. The low-paid worker variable differentiates these parents from those who worked long hours without choice because of low wages.

[9] We did not correct for potential selection bias because of the lack of information on excludable variables.

Table 1
Summary statistics of parents.

	Mothers				Fathers			
	LFPR (%)	Age	No. of children	Obs.	LFPR (%)	Age	No. of children	Obs.
Full sample	72.7	37.5	1.4	2516	90.8	39.5	1.4	2516
Primary school or lower	69.0	40.5	1.6	591	84.8	42.7	1.6	394
Junior high school	68.6	37.7	1.5	904	90.4	39.9	1.5	986
Senior high school	68.2	35.8	1.3	431	90.2	38.8	1.4	510
Junior college	81.2	35.4	1.2	282	94.1	37.6	1.2	307
University or higher	90.6	35.0	1.1	308	97.5	37.4	1.2	319

Notes: LFPR and Obs. stand for labor force participation rate and number of observations, respectively.
Source: China Time Use Survey 2017.

Table 2
Hours per day spent on primary time use activities by educational attainment.

	Overall time use activities					Subcategories of childcare			
	Paid work	Housework	Childcare	Leisure	Self-care	Routine care	Educational care	Recreational Care	Travel time
Mothers									
All mothers	5.90	2.11	1.35	3.12	11.52	0.75	0.19	0.35	0.06
Primary school or lower	6.01	2.57	0.75	3.36	11.31	0.44	0.07	0.21	0.03
Junior high school	5.75	2.34	1.22	3.27	11.42	0.71	0.21	0.24	0.07
Senior high school	5.76	1.90	1.68	3.13	11.54	0.95	0.19	0.45	0.09
Junior college	5.93	1.71	1.65	2.85	11.87	0.86	0.22	0.53	0.05
University or higher	6.31	1.21	2.13	2.49	11.86	1.08	0.32	0.65	0.07
Fathers									
All fathers	8.20	0.60	0.46	3.48	11.28	0.20	0.07	0.17	0.03
Primary school or lower	8.21	0.72	0.21	3.52	11.34	0.13	0.02	0.05	0.01
Junior high school	8.42	0.52	0.29	3.56	11.21	0.12	0.05	0.12	0.02
Senior high school	8.27	0.62	0.53	3.41	11.17	0.25	0.09	0.16	0.03
Junior college	7.66	0.71	0.72	3.54	11.37	0.25	0.09	0.33	0.05
University or higher	7.88	0.53	0.89	3.21	11.50	0.39	0.12	0.35	0.03

Source: 2017 Chinese Time Use Survey.

variables measuring individual and household characteristics; ε_{ri} is the error term. α_0, α_1, and α_2 are unknown regression parameters.

The dependent variables of eq. (2) include household time spent on childcare and four specific activities and household expenses on children's education. Household time spent in activity r is calculated by summing up the amounts of time that the mother and the father of household i spend in that activity. Household expenses on children's education is the sum of tuitions; fees for cram school, extracurricular activities, and online courses; and living expenses for daycare and boarding school in yuan paid by household i for children between the ages of 3 and 17 during the year before the survey was conducted.

For the household-level regressions, we only enter mothers' education categories instead of both parents' to minimize multicollinearity problems, given that the education levels of spouses are highly correlated. We focus on mothers' education instead of fathers' due to the consideration that the bulk of childcare is carried out by mothers. The father's education is controlled through the variable of the mother's non-earned incomes, which include the father's earnings (a positive correlate of his educational attainment) in addition to household investment incomes and welfare payments. The household-level regression model includes the same set of covariate variables as the individual-level regression model.

We evaluate the impact of China's competitive education systems on parental childcare time by comparing the educational differences in household childcare time between regions differentiated by relative scarcity of educational institutions. The relative scarcity of educational institutions is measured by whether the number of colleges per 1000 senior high-school graduates or the number of senior high schools per 1000 junior high school graduates in the province is lower or higher than the respective national average. While Chinese high school graduates can go to colleges in other provinces, to gain admission they usually need to score higher in the national college entrance examination than local students. Hence, students in the provinces with fewer colleges relative to high school graduates would face more competition for college admissions. In China, primary school education and junior high school education are compulsory for all children. The admission to senior high school is determined by entrance examination scores. The provinces with more limited resources are more likely to concentrate scarce resources on premier schools. Hence, there would be greater rivalry among junior high school students for admissions to senior high schools in general and to premier schools in particular in the provinces where the number of senior high schools per 1000 junior high school graduates below the national average than in the

Table 3
Hours per day spent on childcare and annual expenses on children's education by households.

	All childcare	Subcategories				Educational expenses 1000 yuan/year
		Routine care	Educational care	Recreational care	Travel time	
Full sample	1.80	0.94	0.25	0.52	0.08	6.28
By mother's educational attainment						
Primary school or lower	0.98	0.56	0.10	0.28	0.03	4.03
Junior high school	1.56	0.88	0.26	0.33	0.09	5.34
Senior high school	2.17	1.10	0.28	0.69	0.12	6.68
Junior college	2.32	1.11	0.31	0.82	0.08	7.72
University or higher	3.09	1.51	0.42	1.05	0.12	11.23
By children's age						
Age 0–2	5.53	3.80	0.16	1.50	0.07	3.50
Age 3–5	2.87	1.46	0.25	1.05	0.11	7.55
Age 6–11	1.32	0.57	0.36	0.29	0.10	7.24
Age 12–17	0.67	0.32	0.15	0.13	0.07	8.96

Source: 2017 Chinese Time Use Survey.

Table 4
Monthly earnings and daily paid work hours of employed parents.

	Mothers			Fathers		
	Monthly earnings	Daily work hours	% Low-paid workers*	Monthly earnings	Daily work hours	% Low-paid workers
Full sample	1551	7.6	13.4	2697	8.7	8.3
Primary school or lower	445	7.8	27.6	940	9.0	21.3
Junior high school	711	7.8	24.9	1499	8.9	13.8
Senior high school	1413	7.9	8.5	2527	8.8	5.9
Junior college	2819	7.2	6.7	4065	7.9	5.1
University or higher	5170	6.9	1.6	7523	8.0	1.0

Source: 2017 Chinese Time Use Survey.
Notes: *Low-paid workers refer to those who spent at least 8 h per day on paid work but had monthly earnings below the minimum wage threshold. Data on minimum wage thresholds are published by Ministry of Human Resources and Social Security of the People's Republic of China at http://www.mohrss.gov.cn/ldgxs/LDGXqiyegongzi/LDGXzuidigongzibiaozhun/201803/t20180329_290981.html (accesses on January 17, 2023).

provinces above the national average.

All regression equations are estimated as a Tobit model because of the prevalence of zero values reported in most of the dependent variables.[10] The standard errors of the estimates are corrected for heteroscedasticity and intra-province clustering. We recognize that the estimates of parental education may be subject to simultaneous bias due to the omission of unobserved variables that may affect both parental education and time with children. We are unable to address this concern because of the difficulty finding valid instrumental variables. Hence, the conditional educational differences in parental time with children presented in the next section measure the partial correlations, not causal relations, between parental education and parental time use.

4. Results

4.1. Descriptive statistics

Descriptive statistics of parents' characteristics are presented in Table 1. In the sample, 72.7% of the mothers and 90.8% of the fathers participate in the labor force, and each couple on average has 1.4 children.[11] Dividing the sample by education level, 23.5% of the mothers and 15.6% of the fathers have a primary school education or lower, while 12.2% of the mothers and 12.7% of the fathers have a university education or higher. As we would expect, university-educated parents have higher labor force participation rates and fewer children than parents with lower education levels.

Table 2 reports the average daily hours spent on primary time use activities and specific childcare activities by parental education

[10] While the CTUS provided survey weights for the original 12,471 households, these weights are not applicable for our analysis. Hence, the empirical analysis was not adjusted by survey weights.

[11] For parents with more than one child, the survey only reports total childcare time and not time spent caring for each child. To address this data limitation, we control numbers of children in different age groups in the regression models.

Table 5
Conditional differences in daily hours spent on childcare and its subcategories by education, by gender.

	Mothers					Fathers				
	Childcare	Routine care	Educational care	Recreational care	Travel	Childcare	Routine care	Educational care	Recreational care	Travel
Base group = primary school education or lower										
Panel A: Full sample										
Junior high school	0.255**	0.100	0.271***	−0.023	0.081**	0.031	−0.126	0.070	0.209**	0.007
	(0.099)	(0.086)	(0.066)	(0.103)	(0.036)	(0.094)	(0.110)	(0.076)	(0.101)	(0.045)
Senior high school	0.297***	0.145	0.279***	0.087	0.139***	0.224*	0.154	0.234***	0.154*	0.069
	(0.112)	(0.099)	(0.078)	(0.122)	(0.048)	(0.117)	(0.119)	(0.088)	(0.087)	(0.044)
Junior college	0.255*	0.078	0.317***	0.096	0.064	0.445***	0.188	0.250***	0.294***	0.128**
	(0.147)	(0.093)	(0.099)	(0.161)	(0.051)	(0.113)	(0.134)	(0.097)	(0.112)	(0.060)
University or	0.417***	0.100	0.431***	0.106	0.093**	0.430***	0.213	0.332***	0.324**	0.098*
higher	(0.132)	(0.131)	(0.101)	(0.129)	(0.043)	(0.140)	(0.145)	(0.103)	(0.132)	(0.056)
Observations	2516	2516	2516	2516	2516	2516	2516	2516	2516	2516
Panel B: Parents of dual-earner families										
Junior high	0.183	0.090	0.193***	0.053	0.043	0.188	0.020	0.064	0.085	0.014
School	(0.116)	(0.112)	(0.066)	(0.092)	(0.030)	(0.120)	(0.026)	(0.102)	(0.112)	(0.056)
Senior high	0.362***	0.208	0.253***	0.179	0.093**	0.355**	0.023	0.210**	0.030	0.108*
School	(0.135)	(0.140)	(0.078)	(0.132)	(0.043)	(0.138)	(0.031)	(0.100)	(0.088)	(0.059)
Junior college	0.515***	0.242*	0.354***	0.322**	0.056	0.660***	0.045	0.286**	0.184	0.175**
	(0.184)	(0.126)	(0.100)	(0.126)	(0.046)	(0.150)	(0.035)	(0.117)	(0.131)	(0.069)
University or	0.839***	0.345***	0.517***	0.452***	0.112***	0.611***	0.079**	0.305***	0.202	0.097
higher	(0.151)	(0.131)	(0.109)	(0.120)	(0.040)	(0.152)	(0.037)	(0.114)	(0.123)	(0.061)
Observations	1716	1716	1716	1716	1716	1716	1716	1716	1716	1716
Panel C: Non-employed parents										
Junior high	0.326	0.045	0.409***	−0.199	0.150*	−0.340	−0.681***	0.074	0.067	−0.003
School	(0.272)	(0.220)	(0.129)	(0.213)	(0.077)	(0.265)	(0.264)	(0.119)	(0.069)	(0.011)
Senior high	0.213	0.027	0.397***	−0.063	0.293***	0.235	0.128	0.081	0.081	0.020
School	(0.274)	(0.231)	(0.134)	(0.211)	(0.073)	(0.410)	(0.299)	(0.099)	(0.123)	(0.022)
Junior college	0.110	0.140	0.384**	−0.344	0.170	0.352	0.218	0.018	−0.057	0.007
	(0.299)	(0.237)	(0.186)	(0.291)	(0.129)	(0.530)	(0.352)	(0.140)	(0.127)	(0.018)
Observations	686	686	686	686	686	231	231	231	231	231

Source: China Time Use Survey 2017.
Notes: Standard errors in brackets are clustered at the provincial level. All equations control for mother's and father's age, unearned income in log form, age of the youngest child, gender and age composition of the household, whether the person lived in an ethnic minority autonomous region, whether the time diary was taken on a workday or a weekend day, and whether the person lived in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

Table 6
Conditional differences in households' daily hours spent on childcare and annual expenses on children's education by mother's education.

	Childcare	Subcategories of childcare				Education expenses 1000 yuan
		Routine care	Educational care	Recreational care	Travel time	
Base group = primary school or lower						
Panel A: Full sample						
Junior high school	0.369***	0.177*	0.314***	0.008	0.109***	1.026***
	(0.117)	(0.095)	(0.069)	(0.110)	(0.028)	(0.338)
Senior high school	0.456***	0.188	0.355***	0.241*	0.189***	1.454***
	(0.126)	(0.125)	(0.079)	(0.135)	(0.042)	(0.501)
Junior college	0.482***	0.133	0.405***	0.188	0.162***	2.186***
	(0.181)	(0.119)	(0.110)	(0.174)	(0.043)	(0.723)
University or higher	0.834***	0.356**	0.498***	0.283**	0.171***	4.054***
	(0.171)	(0.158)	(0.114)	(0.141)	(0.053)	(1.011)
Observations	2516	2516	2516	2516	2516	2516
Panel B: Dual-earner families						
Junior high school	0.300**	0.176	0.241***	0.067	0.072**	1.080***
	(0.130)	(0.118)	(0.071)	(0.112)	(0.035)	(0.397)
Senior high school	0.559***	0.313**	0.319***	0.329***	0.154***	1.804***
	(0.153)	(0.158)	(0.079)	(0.117)	(0.048)	(0.578)
Junior college	0.696***	0.291**	0.390***	0.364***	0.136***	2.877***
	(0.214)	(0.145)	(0.111)	(0.139)	(0.045)	(0.766)
University or higher	1.226***	0.572***	0.535***	0.569***	0.178***	4.469***
	(0.176)	(0.146)	(0.124)	(0.140)	(0.050)	(0.954)
Observations	1716	1716	1716	1716	1716	1716
Panel C: Families with at least one parent not employed						
Junior high school	0.440**	0.147	0.412***	−0.060	0.169***	0.912*
	(0.221)	(0.215)	(0.126)	(0.213)	(0.058)	(0.544)
Senior high school	0.284	−0.000	0.426***	0.167	0.259***	0.908
	(0.246)	(0.221)	(0.134)	(0.217)	(0.072)	(0.615)
Junior college	0.502	0.117	0.569***	0.011	0.262**	0.386
	(0.390)	(0.298)	(0.218)	(0.346)	(0.103)	(0.740)
University or higher	0.764*	0.561	0.521**	−0.063	0.152	3.680**
	(0.463)	(0.483)	(0.227)	(0.333)	(0.150)	(1.693)
Observations	800	800	800	800	800	800

Source: 2017 Chinese Time Use Survey.
Notes: Standard errors in brackets are clustered at the provincial level. All equations control for mother's and father's age, non-earned income in log form, age of the youngest child, gender and age composition of the family, whether the person lives in an ethnic minority autonomous region, whether the time diary was taken on a workday, and whether the person lives in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

levels. In line with the traditional gender division of labor, mothers spend less time on paid work and more time on unpaid housework and childcare than do fathers. For the sample as a whole, mothers spend a total of 1.35 h per day on childcare, while fathers spend 0.46 h per day. There are no consistent patterns of variation in paid work time by education levels for both sexes. Regarding unpaid activities, more-educated mothers spend less time on housework and leisure and devote more time to childcare and self-care than less-educated mothers. Mothers with a primary school education or lower (termed low-educated) spend 0.75 h per day on childcare, while mothers with a university education or higher (termed highly educated) devote 2.13 h per day to childcare. Compared to highly educated mothers, low-educated mothers spend a greater proportion of their childcare time on routine care (59% versus 51%) and a smaller proportion of childcare time on educational care (9% versus 15%). While there are no clear patterns of variation in fathers' time on housework and leisure, their time spent on total childcare and each specific care activity increases monotonically with education level.

Table 3 presents the average household time spent on childcare and average household expenditures on children's education. For the sample as a whole, each household spends 1.8 h per day on childcare and 6280 yuan per year on children's education (8.2% of the household's consumption spending). Households with more-educated mothers invest more time and money in children than do households with less-educated mothers. The second half of the table reports households' investments in children by children's age. As we would expect, the amount of time parents spend on overall childcare, routine care, and recreational care decreases with children's age, while the average household education expenses increase with children's age. The amount of time households spend on educational care is the highest for those with primary school children (age 6–11).

Table 4 presents the average monthly earnings, daily hours of paid work, and proportion of low-paid workers for employed parents. For all employed parents in the sample, mothers' monthly earnings are only 57.5% of fathers', while mothers' daily paid work hours are 87.4% of fathers'. Mothers are more likely than fathers to be low-paid workers (13.4% versus 8.3%). Dividing the sample by

Table 7
Conditional differences in daily hours spent on primary time use activities by education, by gender.

	Mothers					Fathers				
	Paid work	Housework	Childcare	Leisure	Self-care	Paid work	Housework	Childcare	Leisure	Self-care
Education attainment: base group = primary school education or lower										
Panel A: Full sample										
Junior high school	0.255**	0.100	0.271***	−0.023	0.081**	0.031	−0.126	0.070	0.209**	0.007
	(0.099)	(0.086)	(0.066)	(0.103)	(0.036)	(0.094)	(0.110)	(0.076)	(0.101)	(0.045)
Senior high school	0.297***	0.145	0.279***	0.087	0.139***	0.224*	0.154	0.234***	0.154*	0.069
	(0.112)	(0.099)	(0.078)	(0.122)	(0.048)	(0.117)	(0.119)	(0.088)	(0.087)	(0.044)
Junior college	0.255*	0.078	0.317***	0.096	0.064	0.445***	0.188	0.250***	0.294***	0.128**
	(0.147)	(0.093)	(0.099)	(0.161)	(0.051)	(0.113)	(0.134)	(0.097)	(0.112)	(0.060)
University or higher	0.417***	0.100	0.431***	0.106	0.093**	0.430***	0.213	0.332***	0.324**	0.098*
	(0.132)	(0.131)	(0.101)	(0.129)	(0.043)	(0.140)	(0.145)	(0.103)	(0.132)	(0.056)
Observations	2516	2516	2516	2516	2516	2516	2516	2516	2516	2516
Panel B: Non-employed parents										
Junior high school	–	0.209	0.326	−0.022	0.227	–	−0.109	−0.340	0.827	−0.842**
		(0.182)	(0.272)	(0.237)	(0.212)		(0.324)	(0.265)	(0.588)	(0.355)
Senior high school	–	0.069	0.213	−0.039	0.158	–	0.032	0.235	0.475	−0.562
		(0.221)	(0.274)	(0.303)	(0.292)		(0.324)	(0.410)	(0.537)	(0.626)
Junior college or higher	–	0.323	0.110	−0.320	0.336	–	−0.563	0.352	1.149	−1.203**
		(0.313)	(0.299)	(0.354)	(0.380)		(0.334)	(0.530)	(0.940)	(0.596)
Observations	–	686	686	686	686	–	231	231	231	231
Panel C: Parents of dual-earner families										
Junior high school	−0.149	0.065	0.183	0.135	−0.104	−0.429	0.076	0.188	0.264*	0.042
	(0.327)	(0.106)	(0.116)	(0.142)	(0.166)	(0.276)	(0.091)	(0.120)	(0.143)	(0.216)
Senior high school	−0.261	0.014	0.362***	0.213	0.063	−0.443	0.146*	0.355**	0.260*	0.015
	(0.425)	(0.111)	(0.135)	(0.163)	(0.213)	(0.418)	(0.081)	(0.138)	(0.156)	(0.288)
Junior college	−0.886**	−0.056	0.515***	0.305**	0.501**	−1.577***	0.327**	0.660***	0.531***	0.372
	(0.345)	(0.124)	(0.184)	(0.138)	(0.204)	(0.447)	(0.132)	(0.150)	(0.194)	(0.324)
University or higher	−1.086***	−0.273**	0.839***	0.198	0.551***	−1.494***	0.126	0.611***	0.397*	0.606*
	(0.407)	(0.132)	(0.151)	(0.184)	(0.213)	(0.498)	(0.093)	(0.152)	(0.207)	(0.331)
Observations	1716	1716	1716	1716	1716	1716	1716	1716	1716	1716
Panel D: Parents of dual-earner families										
Junior high school	−0.077	0.051	0.186	0.120	−0.123	−0.181	0.061	0.158	0.177	−0.022
	(0.284)	(0.108)	(0.118)	(0.147)	(0.156)	(0.242)	(0.094)	(0.122)	(0.124)	(0.220)
Senior high school	0.322	−0.097	0.304**	0.052	−0.094	0.013	0.103	0.310**	0.081	−0.102
	(0.411)	(0.114)	(0.136)	(0.170)	(0.215)	(0.398)	(0.082)	(0.141)	(0.153)	(0.288)
Junior college	0.272	−0.269**	0.383**	−0.021	0.182	−0.472	0.227	0.546***	0.059	0.081
	(0.339)	(0.128)	(0.179)	(0.142)	(0.210)	(0.478)	(0.131)	(0.148)	(0.192)	(0.334)
University or higher	0.486	−0.532***	0.619***	−0.232	0.124	−0.128	0.017	0.475***	−0.167	0.248
	(0.461)	(0.148)	(0.153)	(0.196)	(0.218)	(0.510)	(0.097)	(0.150)	(0.198)	(0.336)
Low-paid workers	4.223***	−0.783***	−0.577***	−1.237***	−1.148***	3.697***	−0.338***	−0.386***	−1.607***	−0.959***
	(0.198)	(0.098)	(0.080)	(0.134)	(0.098)	(0.242)	(0.065)	(0.075)	(0.111)	(0.125)
Observations	1716	1716	1716	1716	1716	1716	1716	1716	1716	1716

Source: 2017 Chinese Time Use Survey.

Notes: Standard errors in brackets are clustered at the provincial level. All equations control for mother's and father's age, unearned income in log form, age of the youngest child, gender and age composition of the family, whether the person lived in an ethnic minority autonomous region, whether the time diary was taken on a workday or a weekend day, and whether the person lived in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

education level, we note that for both sexes, monthly earnings increase with education levels, while daily work hours decrease with education levels. The earnings gaps between the low-educated and the highly educated are strikingly large; for example, the monthly earnings ratio of the low-educated to the highly educated is 9% for mothers and 13% for fathers. Despite the relatively low earnings, low-educated mothers and low-educated fathers spend nearly one hour more per day in paid work than do their highly educated counterparts. Low-educated parents are thus more likely than other parents to be low-paid workers.

4.2. Findings from regression analysis

4.2.1. Patterns of time spent on childcare by parental education

Table 5 reports the conditional differences across educational levels in daily hours spent on childcare and its subcomponents for the full sample, parents of dual-earner families, and non-employed parents.[12] A look at the estimates for the full sample in Panel A reveals that for both sexes, more educated parents spend more time on childcare; for example, highly educated mothers spend 0.42 h more per day than low-educated mothers, while the childcare time gap between the two types of fathers is 0.43 h per day.[13] Moreover, no significant variation in routine care time was found to be associated with education levels for both sexes.[14] However, mothers with more than a primary school education and fathers with more than a junior high school education were found to devote more time to educational care. Numerically, the difference in educational care between the highly educated and the low-educated is 0.43 h per day for mothers and 0.33 h per day for fathers. While there are no variations in mothers' time in recreational care by education levels, more-educated fathers were found to spend more time playing or watching TV with children. For both sexes, more-educated parents spend more time traveling with children than low-educated parents, with the exception of mothers with a junior college education and fathers without a college education. It is noteworthy that much of the travel time is directed to education related activities, such as transporting children to after-school tutoring classes and other extracurricular activities. The finding that a positive education gradient holds for educational care, not for routine care is consistent with the conjecture that more-educated parents have a comparative advantage in activities related to children's learning but have no obvious advantage in routine care activities. The positive educational gradient in recreational care among fathers would accord with the argument that more-educated men are more receptive to the ideals of domestic gender equity.

We next compare the patterns of educational differences by parents' employment status. Similar to the findings from the full sample, the estimates for parents of dual-earner families (see Panel B) show that education is positively associated with parental time on total childcare and educational care for both sexes. The educational gradient in total childcare time is more pronounced among working parents than working and nonworking parents as a whole. For example, highly educated working mothers spend 0.84 h more per day on childcare than their low-educated counterparts, twice as large as the difference of 0.42 h for working and nonworking mothers combined. As the result for the full sample, educational care is the largest component of the extra childcare time spent by educated parents among four childcare activities. For example, compared to their low-educated counterparts, highly educated mothers spend 0.35 h more on routine care, 0.52 h more on educational care, 0.45 h more on recreational care, and 0.11 h more on travel with children, while the difference between highly educated and low-educated fathers is 0.08 h on routine care and 0.31 h on educational care. The finding that highly educated working parents also spend more time on routine care - an activity in which they arguably do not have a skill advantage, is attributable to the fact that more-educated parents are more critical of substitutes for their own time spent with children and therefore they are more willing to perform hands-on childcare if time permits. As we learned from Table 4, highly educated working parents spent less time in paid work than did their less-educated counterparts, which would allow highly educated working parents to spend more time not only on educational care but also other care activities.

Turning to the estimates for non-employed parents in Panel C, we find that there are no significant variations in mothers' total childcare time by education levels.[15] For non-employed mothers, a positive education gradient holds for educational care and travel time, but not for routine care and recreational care. The effect of education on total childcare time appears to be dominated by the effect for routine care and recreational care, perhaps because the two activities account for >85% of total childcare time for non-employed mothers. With the exception of routine care time spent by fathers with a junior high school education, there are no variations in fathers' time by education levels on any activity. This may reflect that the sample of non-employed fathers is too small to generate precise estimates.

Table 6 presents the conditional differences in household daily hours spent on childcare and annual expenditures on children's education. For all households as a whole (see Panel A), a positive education gradient holds for total childcare, educational care, and travel with children. Quantitatively, households with highly educated mothers spend 0.83 h more per day on total childcare, 0.5 h more educating children, and 0.17 h more traveling for or with children than households with low-educated mothers. Households with highly educated mothers also devote more daily time to routine care (by 0.36 h) and recreational care (by 0.28 h) than households with low-educated mothers. Households with more-educated mothers not only devote more time to childcare but also spend more money on

[12] The estimates of the control variables in regression models are available upon request.

[13] To streamline the presentation, our discussion focuses on the estimates that are statistically significant and omit the level of statistical significance in the discussion.

[14] This result is partially corroborated by Zhao (2018) who found that mothers' time spent in childcare (only including routine care activities) does not vary with maternal education, while fathers' time in childcare is positively associated with paternal education.

[15] We merge parents with either a junior college education or a university education into one category because there are too few observations in each category among non-employed parents.

Table 8
Conditional differences in daily hours spent on primary time use activities by earnings quintiles, by gender.

	Mothers					Fathers				
	Paid work	Housework	Childcare	Leisure	Self-care	Paid work	Housework	Childcare	Leisure	Self-care
Base group: 1st quintile										
2nd quintile	0.708**	−0.293**	0.120	−0.016	−0.059	0.751***	−0.132	−0.055	−0.160	−0.204
	(0.297)	(0.128)	(0.140)	(0.156)	(0.117)	(0.248)	(0.073)	(0.130)	(0.147)	(0.211)
3rd quintile	1.432***	−0.565***	0.155	−0.207	−0.028	0.825**	−0.068	0.022	−0.095	−0.399*
	(0.434)	(0.157)	(0.131)	(0.200)	(0.194)	(0.338)	(0.084)	(0.148)	(0.215)	(0.211)
4th quintile	1.241***	−0.659***	0.378***	−0.258	0.150	1.267***	−0.078	0.137	−0.543**	−0.253
	(0.459)	(0.164)	(0.138)	(0.228)	(0.219)	(0.460)	(0.094)	(0.140)	(0.234)	(0.276)
5th quintile	1.884***	−0.978***	0.637***	−0.520**	0.080	0.874*	−0.127	0.338**	−0.545**	−0.180
	(0.481)	(0.162)	(0.170)	(0.231)	(0.204)	(0.505)	(0.116)	(0.157)	(0.212)	(0.364)
Low-paid workers	4.286***	−0.789***	−0.576***	−1.261***	−1.172***	3.790***	−0.355***	−0.397***	−1.649***	−0.998***
	(0.201)	(0.091)	(0.077)	(0.130)	(0.096)	(0.246)	(0.064)	(0.077)	(0.109)	(0.123)
Observations	1716	1716	1716	1716	1716	1716	1716	1716	1716	1716

Source: 2017 Chinese Time Use Survey.

Notes: Standard errors in brackets are clustered at the provincial level. Earnings quintiles are calculated based on the distribution of predicted monthly earnings for mothers and fathers. All equations control for mother's and father's age, unearned income in log form, age of the youngest child, gender and age composition of the family, whether the person lived in an ethnic minority autonomous region, whether the time diary was taken on a workday or a weekend day, and whether the person lived in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

Table 9
Conditional differences in households' time spent on childcare by mothers' education, by children's age.

	Childcare	Subcategories of childcare			
		Routine care	Educational care	Recreational Care	Travel time
Base group: primary school or lower					
Have a child aged 0–5					
Junior high school	0.261	0.203	0.310***	−0.058	0.095*
	(0.335)	(0.248)	(0.112)	(0.228)	(0.052)
Senior high school	0.321	0.037	0.405***	0.185	0.148**
	(0.318)	(0.285)	(0.141)	(0.277)	(0.069)
Junior college	0.257	0.001	0.374***	0.241	0.094*
	(0.396)	(0.300)	(0.141)	(0.312)	(0.055)
University or higher	0.500	0.108	0.325***	0.319	0.061
	(0.354)	(0.297)	(0.111)	(0.282)	(0.074)
Observations	968	968	968	968	968
Have a child aged 6–17					
Junior high school	0.304***	0.160	0.251***	0.001	0.106***
	(0.103)	(0.094)	(0.086)	(0.100)	(0.029)
Senior high school	0.341***	0.142	0.291***	0.251	0.179***
	(0.130)	(0.149)	(0.090)	(0.134)	(0.043)
Junior college	0.408**	0.159	0.376***	0.013	0.170***
	(0.188)	(0.128)	(0.137)	(0.172)	(0.052)
University or higher	1.036***	0.583***	0.615***	0.241	0.246***
	(0.225)	(0.195)	(0.136)	(0.192)	(0.067)
Observations	1904	1904	1904	1904	1904

Source: 2017 Chinese Time Use Survey.
Notes: Standard errors in brackets are clustered at the provincial level. All equations control for mother's and father's age, non-earned income in log form, age of the youngest child, gender and age composition of the family, whether the person lives in an ethnic minority autonomous region, whether the time diary was taken on a workday, and whether the person lives in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

children's education. The educational expenditures gap between households with highly educated and low-educated mothers amounts to 4054 yuan per year, about 100% higher than the average expenditure of households with low-educated mothers.

The estimates for dual-earner households in Panel B show again that households with more educated mothers spend more time in childcare. The positive education gradient in childcare time for dual-earner households appears to be steeper than the gradient for all households as a whole. For example, households with highly educated working mothers spend 1.2 h more per day caring for children than households with low-educated working mothers, 44.5% higher than the difference of 0.83 h for all households as a whole. For households in which the mother has a junior high school education, all the extra childcare time is directed to educational care and travel with children. For households in which the mother has an education level at senior high school or higher, the extra childcare time is distributed more or less evenly over four specific activities. Similar to the findings for all households, dual-earner households with more educated mothers invest more financial resources in children's education. The annual expenditure of households with highly educated mothers is 4469 yuan, 111% higher than the average expenditure of households with low-educated mothers.

The estimates for households in which at least one parent is non-employed are presented in Panel C of Table 6. The positive association between total childcare time and maternal education for non-dual earner households is not very robust. No variations in routine care and recreational care time were found to be associated with maternal education. However, a positive education gradient in educational care and travel with children holds among non-dual-earner households. As with dual-earner households, non-dual-earner households with highly educated mothers also spend about half an hour more a day in educational care than their counterparts with low-education mothers. The positive education gradient in expenditures on children's education appears to be less pronounced for non-dual-earner households than dual-earner households. This is attributable to the fact that with at least one parent not engaging in paid employment, non-dual-earner households have a lower demand for daycare than dual-earner households, which eliminates one source of variation in household expenditures by parental education.

4.2.2. Explaining educational differences in parental time with children

4.2.2.1. Does childcare time behave differently from other unpaid uses of time?. The estimates presented in Table 7 provide insights into how parents with different education levels allocate time to paid work, housework, childcare, leisure, and self-care. For the full sample (see Panel A), the estimates show that mothers with a college or a university education spend more time on paid work and childcare and less time on housework than low-educated mothers, and mothers with a university education also spend less time on leisure. Compared to low-educated mothers, highly educated mothers spend 1.21 h more per day on paid work, 0.42 h more on childcare, 0.65 h less on housework, and 0.37 h less on leisure. As their counterparts in developed countries, highly educated mothers in China try to balance paid work and childcare by curtailing the time spent on housework and leisure. In this regard, Chinese mothers' childcare time choice is substantively different from their choices of housework and leisure time. Unlike mothers' time allocation, fathers' time on

paid work and housework does not vary with their education levels, which means that fathers' time allocation is constrained by the "men breadwinner" gender role. However, fathers appear to view time spent on childcare and leisure as different from housework; the estimates show that fathers with a senior high school education or higher allocate more time to childcare than low-educated fathers, while more-educated fathers, with the exception of fathers with a university education, spend more time on leisure.

The estimates for the full sample do not take into account the impact of employment status on parents' unpaid uses of time. Comparing the time allocation of parents differentiated by employment status, we find strikingly different trends. From the estimates for non-employed parents (see Panel B), no variations in mothers' time on housework, childcare, leisure, and self-care were found to be associated with maternal education. As the time use of non-employed mothers, non-employed fathers' time on housework, childcare, and leisure was also found to be invariant by education levels.[16] The absence of a significant association between childcare time and maternal education among non-employed mothers can be explained by the fact that as we mentioned earlier, >85% of non-employed mothers' childcare time is spent on routine care – an activity in which skill differences between parents with different education levels are relatively small, and all non-employed parents have the same amount of time available for unpaid activities regardless of education levels.

Unlike non-employed parents, how much time employed parents are able to spend on childcare and other unpaid activities is limited by hours of paid work. The estimates (see Panel C) show that more-educated working parents are less time constrained than the less educated; for example, both working mothers and working fathers with a college education or higher spend about one hour less per day on paid work than their low-educated counterparts.[17] With more free time available, more-educated working parents would not have to make the kind of hard choices between caring for children and meeting their own needs for leisure and rest that the less educated have to make. Indeed, mothers with a junior college education devote more time to childcare, leisure, and self-care than low-educated mothers, and mothers with a university education also spend more time on childcare and self-care but less time performing housework. The estimates for working fathers reveal a positive education gradient for childcare and leisure time. Working fathers with a senior high school education or a college education also spend more time doing housework,[18] which accords with the conjecture that more-educated fathers are more willing to share the housework burdens with their spouses.

Why do more-educated parents spend less time on paid work? Taking education to be a proxy for wages, the negative education gradient in paid work time could be interpreted as the outcome of the working hours decision in which the income effect of a wage change dominates the substitution effect. However, this interpretation may conceal the struggle of less-educated working parents, who have to work long hours due to low wages. We address this concern by adding a dummy variable for low-paid workers to the regression models for parents of dual-earner families (see Panel D). The estimated coefficients on the variable for low-paid workers reveal a strikingly large working hours gap between low-paid and non-low-paid parents; for example, other things being equal, low-paid mothers and low-paid fathers spend, respectively, 4.2 h and 3.7 h more per day on paid work than their non-low paid counterparts. The excessively long hours of paid work impedes low-paid parents' ability to spend as much time on childcare and other unpaid activities as non-low-paid parents are able to. Compared to non-low-paid mothers, low-paid mothers spend 0.78 h less per day on housework, 0.58 h less on childcare, 1.24 h less on leisure, and 1.15 h less on self-care, and a similar pattern of differences was also found for fathers. With low-paid status being controlled for, the time spent on paid work by both mothers and fathers becomes invariant by education levels. This result indicates that the negative education gradient in paid work time presented in Panel C is primarily caused by the fact that low-educated parents are overrepresented among low-paid workers. The estimates also show that holding low-paid status constant, neither mothers' nor fathers' time on leisure and self-care vary with education levels. Nevertheless, controlling low-paid status does not change the trends that parental childcare time increases with parental education, but the childcare time gap between the highly educated and the low-educated decreases by 26% for mothers, from 0.84 h to 0.62 h, and by 22% for fathers, from 0.611 h to 0.475 h. Evidently, part of the educational difference in childcare time is caused by the time squeeze from paid work experienced by low-educated, low-paid parents. Moreover, holding low-paid status constant, college-educated mothers spend less time on housework than low-educated mothers. Thus, controlling low-paid status does not change the conclusion that more-educated mothers have a greater tendency to substitute time away from housework with more time for childcare than less-educated parents.

[16] The estimates also show that non-employed fathers with a junior high school education and fathers with a college education spend less time on self-care than the low-educated counterparts. Connecting this result to the estimates for leisure time, non-employed fathers in these education categories appear to be more inclined to trade sleeping time for leisure, compared to the low educated.

[17] This result is markedly different from the finding for the full sample that college-educated mothers devote more time to paid work than the low educated and fathers' paid work hours do not vary with paternal education. This difference can be explained by the fact that college-educated parents have higher labor force participation rates than the low educated (see Table 1), but the variations in labor force participation by education levels are much greater among mothers than among fathers because of the influence of traditional gender roles. Hence, despite the negative education gradient in paid work hours observed among employed parents, the average paid work time of employed and non-employed parents combined is higher for college-educated mothers relative to low-educated mothers and is more or less the same between the two groups of fathers. For example, from Tables 1 and 4, the labor force participation rate and daily hours of paid work are, respectively, 68.6% and 7.8 h for low-educated mothers, 90.6% and 6.4 h for university-educated mothers, 90.4% and 8.1 h for low-educated fathers, and 97.5% and 7.9 h for university-educated fathers. Based on these statistics, the average daily hours of paid work for employed and non-employed parents combined is 5.5 h for low-educated mothers, 6.4 h for university-educated mothers, 8.1 h for low-educated fathers, and 7.9 h for university-educated fathers.

[18] The finding that fathers with a college education spend more time on housework than fathers with a university education can be explained by the fact that university-educated fathers have higher monthly earnings than fathers with a college education (see Table 4), so the former are able to outsource more housework to the market than the latter.

Table 8 reports the conditional differences across predicted monthly earnings quintiles in daily hours spent on five primary time use activities for parents of dual-earner households. We again use the low-paid worker variable to differentiate those low-earning parents who have a strong preference for leisure and other unpaid activities from those who work long hours but remain poor because of low wages.[19] Consistent with the results for education, higher earning mothers (those in the 4th and 5th quintiles) and higher earning fathers (those in the 5th quintile) were found to spend more time with their children compared to their counterparts in the lowest earn quintile. The estimates also reveal a positive earnings gradient in paid work and a negative earnings gradient in housework for working mothers. Furthermore, mothers in the 5th quintile and fathers in the 4th and 5th quintiles spend less time on leisure than those in the lowest quintile. Higher earning fathers also spend more time on paid work than do their counterparts in the lowest quintile, although the variations by earnings quintiles are not monotonic. These results support the conjecture that parental childcare is more of a luxury good than home-produced services and leisure and therefore more-educated, higher-earning parents have a greater tendency to tradeoff time performing domestic chores or enjoying leisure for more time caring for children.

4.2.2.2. Does competition for children's academic achievements play a role?. We showed earlier (see Tables 5 and 6) that time on educational care is the largest component of the extra time more-educated parents spend on childcare and the positive education gradient is more robust for educational care time than for time spent on routine care or recreational care. These results highlight the importance of parents' aspirations for children's education for understanding the educational differences in childcare time among Chinese parents.

To further investigate the impact of academic competition, we compare parental childcare patterns between household with a preschool child and households with a school-age child (see Table 9). From the estimates for households with a preschool child, there are no significant variations in time spent on total childcare, routine care, and recreational care by maternal education levels. However, households with mothers in more-educated categories were found to spend more time on educational care and travel with children than households with low-educated mothers, with the exception of travel time by households with university-educated mothers.

Turning to households with school-age children in the second half of the table, we find that households with more-educated mothers devote more time to childcare; for example, households with university-educated mothers spend 1.04 h more per day on childcare than households with low-educated mothers. The positive education gradient in total childcare time appears to be primarily driven by the differences in time spent on educational care and travel with children. For example, households in which mothers have a university education spend 0.62 h more per day on educational care and 0.25 h more per day on travel with children than households with low-educated mothers, and the sum of the differences in two activities amounts to 83.7% of the difference in total childcare time. Comparing the estimates between households differentiated by children's age, the positive education gradients in educational care and travel with children are more robust and steeper for households with school-age children than for households with preschool children. This result supports the claim that competition for higher educational attainment is a factor driving more-educated parents to spend more time in childcare.

We further explore the connection between academic competition and educational differences in childcare time by comparing household childcare time patterns between provinces differentiated by the relative scarcity of colleges and senior high schools. From the estimates presented in Table 10, we note that by both measures, the positive education gradients in total childcare time and educational care time are more robust and more pronounced in the provinces where the supply of educational institutions is relatively more limited and academic competition tends to be more intense. These results indicate clear support for the conjecture that China's competitive education system plays a role in explaining the educational differences in parental childcare time.

5. Conclusion

This paper has documented the patterns of differences across education levels in parental childcare time in China. The analysis shows that in China, as in developed countries, more-educated parents spend more time caring for children than do less-educated parents. This finding holds for both mothers and fathers, despite the presence of large gender childcare gaps. The educational differences in parental childcare time are particularly pronounced among working parents, parents with school-age children, and parents in the provinces where the supply of educational institutions is relatively more limited. The analysis reveals an extra parental care of 74 min per day for children born to households with university-educated mothers over children born to households in which mothers have a primary school education or lower, with 58% of the extra time spent on activities related to children's education. These results suggest that children born to households with less-educated parents are disadvantaged in early learning and formal education, potentially opening the door to greater economic inequality and social stratification in the future.

We have investigated the factors driving the educational differences in parental childcare time. Our analysis has obtained evidence supporting the conjecture that parents' childcare time choice is different from their choices regarding other unpaid uses of time, such as housework and leisure, in response to the opportunity cost of one's time. Parents with higher education and higher earnings tend to value time caring for children more than other unpaid uses of time, so they have a greater inclination to trade time performing domestic chores or enjoying leisure for time caring for children. Compared to highly educated parents, low-education parents are

[19] In our sample, the average minimum wage threshold amounts to 57.7% of the median monthly earnings for mothers and 42.6% of the median monthly earnings for fathers. Among those whose monthly earnings were lower than the minimum wage threshold, 33.1% of working mothers and 23.3% of working fathers worked <8 h a day.

Table 10
Conditional differences in household daily hours spent on childcare by education, by relative scarcity of education institutions.

	Childcare	Routine care	Educational care	Recreational care	Travel	Childcare	Routine care	Educational care	Recreational care	Travel
By mother's education: base group = primary school education or lower										
	Number of colleges per 1000 high-school graduates lower than the national average					Number of colleges per 1000 high-school graduates higher than the national average				
Junior high school	0.372***	0.186**	0.343***	−0.091	0.014**	0.356*	0.178	0.226*	0.044	0.033***
	(0.133)	(0.094)	(0.075)	(0.155)	(0.007)	(0.193)	(0.189)	(0.130)	(0.109)	(0.011)
Senior high school	0.376***	0.185	0.350***	0.044	0.020	0.557**	0.160	0.311**	0.470**	0.055**
	(0.136)	(0.141)	(0.088)	(0.153)	(0.013)	(0.225)	(0.201)	(0.140)	(0.203)	(0.023)
Junior college	0.460*	−0.020	0.505***	0.212	−0.001	0.521*	0.327**	0.241	0.198	0.043***
	(0.247)	(0.162)	(0.147)	(0.269)	(0.009)	(0.267)	(0.164)	(0.157)	(0.231)	(0.012)
University or higher	0.868***	0.372***	0.588***	0.319	0.038	0.797**	0.417	0.340*	0.276	0.042**
	(0.181)	(0.132)	(0.142)	(0.221)	(0.025)	(0.313)	(0.302)	(0.181)	(0.186)	(0.019)
Observations	1420	1420	1420	1420	1420	1096	1096	1096	1096	1096
	Number of senior High schools per 1000 junior high school graduates lower than the national average					Number of senior High schools per 1000 junior high school graduates higher than the national average				
Junior high School	0.526***	0.239**	0.370***	−0.061	0.021**	0.223	0.131	0.238***	0.092	0.021**
	(0.171)	(0.116)	(0.118)	(0.172)	(0.008)	(0.160)	(0.154)	(0.072)	(0.132)	(0.010)
Senior high School	0.580***	0.220	0.392***	0.247	0.025**	0.379*	0.107	0.327***	0.376*	0.037
	(0.155)	(0.157)	(0.139)	(0.201)	(0.012)	(0.214)	(0.167)	(0.092)	(0.214)	(0.026)
Junior college	0.696**	0.002	0.563***	0.374	0.016**	0.340	0.276*	0.256*	0.122	0.021
	(0.295)	(0.150)	(0.171)	(0.287)	(0.008)	(0.238)	(0.159)	(0.138)	(0.220)	(0.016)
University or higher	0.998***	0.476***	0.600***	0.228	0.032	0.721**	0.311	0.380**	0.356**	0.038
	(0.200)	(0.168)	(0.155)	(0.215)	(0.021)	(0.286)	(0.269)	(0.164)	(0.178)	(0.025)
Observations	1272	1272	1272	1272	1272	1244	1244	1244	1244	1244

Sources: China Time Use Survey 2017; number of colleges is obtained from China Statistics Yearbook (2018), Table 21-15; number of senior high schools and graduates is from China Statistics Yearbook (2018), Table 21-16; and number of junior high school graduates is from China Education Statistics Yearbook (2017), pp.480–481.

Notes: Standard errors in brackets are clustered at the provincial level. All equations control for mother's and father's age, unearned income in log form, age of the youngest child, gender and age composition of the family, whether the person lives in an ethnic minority autonomous region, whether the time diary was taken on a workday, and whether the person lives in the rural sector, and province fixed effects. * p-value <0.1, ** p-value <0.05, and *** p-value <0.01.

experiencing a more acute time squeeze from paid work, which impedes their ability to spend as much time with their children as they would have liked to. The analysis also indicates that competition for children's academic achievements plays a role in driving more-educated parents to invest more time in children relative to less-educated parents. Education affects parents' childcare time choices not only through economic mechanisms but also by changing gender role attitudes; educated fathers' endorsement of the ideal of domestic gender equity acts paradoxically to increase class-based inequalities in parental time with children.

Two main limitations of this study need to be highlighted. First, due to the data limitation, we did not address the concern about potential endogeneity bias stemming from unobserved heterogeneity. Second, constrained by the lack of information on excludable variables, we did not control potential self-selection bias when deriving predicted monthly earnings. These issues need to be addressed in future work.

Despite the stated limitations, this paper provides evidence for an alarmingly large education gap in parental time with children and has uncovered an important mechanism for the intergenerational transmission of human capital in China. The findings reported in the present paper have important policy implications. In our sample, about 27% of the children lived in households in which the mother only has a primary school education or lower. As our analysis has shown, low-educated parents did not have the necessary human capital and resources to provide proper supervision for their children's school work. Low-educated working parents also faced a greater work-childcare tradeoff than more-educated working parents. The parental care deficits for children of less-educated parents could be mitigated through the provision of subsidized day care and preschool programs and free in-school homework supervision and tutoring. Policy measures, such as raising the minimum wage thresholds and effectively enforcing the labor protection regulations, would enable less-educated parents to devote more time to the care of their children. Increasing the supply of high quality education institutions and reducing regional disparities in access to higher education would help to lessen competition pressure on parents for children's academic achievements. To formulate an effective policy to reduce inequalities in parental time investment in children, more rigorous empirical analysis is needed to deepen our understanding of why more-educated parents tend to spend more time on childcare.

Declaration of Competing Interest

None.

Data availability

The authors do not have permission to share data.

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Appendix

Table A1
Description of explanatory variables.

Variables	Definitions
Education attainment	Dummy variables
Primary school or lower	Base group
Junior high school	=1 if the person has a junior high school education and = 0 otherwise
Senior high school	=1 if the person has a senior high school education and = 0 otherwise
Junior college	= 1 if the person has some college education and = 0 otherwise
University or higher	= 1 if the person has a 4-year university education or higher and = 0 otherwise
1st quintile	= 1 if the person is in the bottom 20% of the distribution of predicted monthly earnings and = 0 otherwise
2nd quintile	=1 if the person is in the second 20% of the distribution of predicted monthly earnings and = 0 otherwise
3rd quintile	=1 if the person is in the third 20% of the distribution of predicted monthly earnings and = 0 otherwise
4th quintile	=1 if the person is in the fourth 20% of the distribution of predicted monthly earnings and = 0 otherwise
5th quintile	=1 if the person is in top 20% of the distribution of predicted monthly earnings and = 0 otherwise
Low-paid worker	= 1 if the person's monthly earnings are less than the minimum wage and spend at least 8 h in paid work and = 0 otherwise
Age of parent	Parent's age in years
Age of youngest child	Youngest child's age in years
Log non-earned income	Sum of the other spouse's earnings, family's investment incomes, and welfare payments, measured in yuan per month, in log form.
Household composition	
Girls 0–2	Number of girls aged 0–2
Boys 0–2	Number of boys aged 0–2

(*continued on next page*)

Table A1 (*continued*)

Variables	Definitions
Girls 3–5	Number of girls aged 3–5
Boys 3–5	Number of boys aged 3–5
Girls 6–17	Number of girls aged 6–17
Boys 6–17	Number of boys aged 6–17
Women 18–49	Number of women aged 18–49
Men 18–49	Number of men aged 18–49
Women 50–64	Number of women aged 50–64
Men 50–64	Number of men aged 50–64
Women 65+	Number of women aged 65 and above
Men 65+	Number of men aged 65 and above
Rural sector	= 1 if the person lived in the rural sector and = 0 if the person lived in the urban sector
Weekday	= 1 if the diary day was a weekday and = 0 if the diary day was a weekend day
Ethnic	= 1 if the person lived in an ethnic minority autonomous region and = 0 otherwise

Table A2
OLS estimates of earnings equation by gender.

	(1)	(2)
	Mother	Father
Education attainment: base group = primary school education or lower		
Junior high school	0.688***	0.662**
	(0.228)	(0.276)
Senior high school	1.705***	1.151***
	(0.297)	(0.332)
Junior college	3.562***	3.067***
	(0.332)	(0.372)
University or higher	4.649***	3.907***
	(0.339)	(0.388)
Experience	0.217***	0.025
	(0.054)	(0.062)
Experience^2	−0.005***	−0.001
	(0.001)	(0.001)
Rural sector	−1.446***	−1.614***
	(0.202)	(0.219)
Province fixed effects	Yes	Yes
R^2	0.340	0.275
Observations	1716	1716

Source: China Time Use Survey 2017.

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