The effect of the "Selective Two-Child" policy on the first child*

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Abstract

The Quantity–Quality trade–off model predicts a negative relationship between the number of children and the quality of human capital investment per child. Given that a family has limited resources, having many children makes it more difficult for parents to make high-quality human capital investments for each child. This study explores the empirical relevance of the Quantity–Quality trade–off in China, by examining the effects of China's family planning policy change on the first child's human capital investment and parent-child relationship. Our identification strategy utilizes the "selective two-child" policy in China, which suddenly and unexpectedly relaxed the severity of family planning for many Chinese parents who were only children themselves. Our estimation results, based on four waves of panel data from the Chinese Family Panel Studies, are in line with the Quantity-Quality trade-off model. We find that the new family planning policy increased the probability of having a second child and significantly influenced the first child's educational outcomes and parent-child relationship.

Keywords: Quantity-Quality trade-off, family planning policy, human capital, China

JEL Classification: I20, J13

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1 Introduction

The Quantity–Quality trade-off model ("Q–Q trade-off" henceforth) suggests that there may be a negative relationship between the quantity of children and the quality of human capital investment per child (Becker and Lewis, 1973). If a family has limited resources, all else equal, having more children makes it more difficult to make high-quality human capital investments for each child. This influential theoretical prediction has been examined in a series of studies that explore its empirical relevance (Hanushek 1992; Black, Devereux, and Salvanes, 2005; Cáceres-Delpiano 2006; Rosenzweig and Zhang, 2009). Despite this effort, research evidence remains mixed. Hanushek (1992) and Black, Devereux, and Salvanes (2005) find a negative correlation between family size and children's education. By contrast, Angrist, Lavy, and Schlosser (2010) examined the causal link between family size and children's outcomes using multiple instrumental variables and found little evidence that family size significantly influences children's outcomes.

One challenge in establishing a causal relationship between the quality and quantity of children is that the effect may be highly heterogeneous across different empirical settings. For example, the Q–Q trade-off may be more relevant in developing countries, where public goods such as education may not be sufficiently available to all households, and many household resources are severely constrained. By contrast, in developed countries, the number of children in a household may have a more limited impact because the reduced amount of investment made by the household may be compensated for by a relatively high level of public education. The Q–Q trade-off is therefore likely to be more pronounced in developing countries than in developed countries (Jia, Zhou, and Yang, 2021). Moreover, developing countries tend to have higher fertility rates and more children per household than developed countries, which makes them a more appropriate setting to study the Q–Q trade-off.

Indeed, some of the notable empirical evidence supporting the Q–Q trade-off comes from developing countries. For example, in Peru, the number and quality (height) of children are negatively correlated when the mother has an unplanned pregnancy (Lordan and Frijters, 2013). In Bangladesh, family size has a negative impact on the education of the first two children (Park

and Chung, 2012). China, the largest developing country in the world, has also attracted interest from researchers investigating the Q–Q hypothesis. Li, Zhang, and Zhu (2008) is the first study to use a plausibly exogenous identifying variation (i.e., a twin instrumental variable strategy) to study the relationship between the number of children and the level of human capital investments in China. Liu (2014) also provides evidence that support the Q–Q trade-off in the Chinese setting, showing that an increase in the number of children in a household leads to a significant reduction in children's height. Other studies have also shown that family planning policies in China have improved the quality of China's human resource stock (Zhu, Whalley, and Zhao, 2014; Qin, Zhuang, and Yang, 2017), although some fail to find significant evidence that supports the Q–Q trade-off prediction (Rosenzweig and Zhang, 2009).

In this study, we revisit the effect of a family planning policy change in China on the first child's human-capital-related outcomes, using a nationally representative, household-level longitudinal study. More specifically, we use the introduction of the "selective two-child" policy in China, which was implemented in 2014 and allowed Chinese families to have a second child if one of the parents is an only child, to assess the impact of the policy on the first child's educational outcome and parent-child relationship. Our study is most closely related to Jia, Zhou, and Yang (2021), who also examined the effect of the "selective two-child" policy on the intra-household resource allocation and found that the policy significantly reduced the total and per capita expenditures on children's education. Similar to their study, we also find empirical evidence supporting the Q–Q trade-off hypothesis (i.e., the "selective two-child" policy led parents to lower their expectation of the first child's eventual educational attainment). It is noteworthy, however, that our findings come from different empirical strategies and data sets used and thus complement each other. Jia, Zhou, and Yang (2021) analyze the China Household Finance Survey (CHFS) using the propensity score matching (PSM) and difference-in-differences (DID). On the other hand, our analysis relies on the Chinese Family Panel Studies (CFPS) and employs pooled OLS and household fixed-effects regression analyses.

Our findings are as follows. First, the "selective two-child" policy significantly increased the likelihood of Chinese parents having a second child. Secondly, we find that the implementation of the "selective two-child" policy significantly influenced several education outcome measures of the

first child. This policy led parents to lower their expectation regarding the first child's educational attainment and reduced the likelihood of saving money for the first child's future education, suggesting that the prospect of adding another child and the resulting increase in total childcare expenditure could reduce the amount of parental investment on the first child's human capital. Lastly, the policy also led parents to have more conversation with the first child, both positive ("heart-to-heart conversations") and negative ("quarrels").

Research evidence in the Q–Q trade-off literature has largely focused on the effect of having an additional child on the existing child's objective educational outcome measures. Many previous studies used objective educational measures such as school performance and educational attainment (Li and Zhang, 2017; Weng et al. 2019), but less attention has been paid to alternative, subjective educational measures such as parental expectations about the child's educational attainment, likely due to data limitations. Rosenzweig and Zhang (2009) deal with the study of parental educational expectations, but only consider whether parents expect their child to go to university. Again, taking advantage of the detailed survey data, we examine whether the new family planning policy in China has influenced parental expectations (e.g., more detailed educational expectations, and whether parents save money for children's education) about the first child's educational attainment.

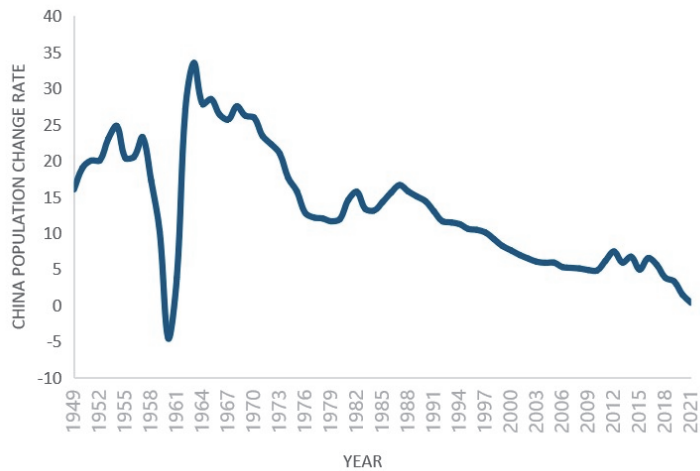
This study also extends the literature by investigating the effect of child planning policies on less conventional measures of health and development outcomes. Several studies have examined the consequences of the Q–Q tradeoff on the first child's birth weight and height (Rosenzweig and Zhang, 2009; Zhong 2017), but they paid less attention to the factors that could influence children's mental health, which can be more difficult to measure. In this study, we indirectly explore the effect of having a second child on the first child's mental health by utilizing subjective outcome measures that reflect the first child's relationship with parents.

The remainder of the paper is structured as follows. Section 2 describes the evolution of China's family planning policies. Section 3 presents our data and variables and Section 4 outlines the empirical strategy. Section 5 presents estimation results and Section 6 concludes.

2 Policy Background of China

China's family planning policy has undergone a long process of proposal, strict enforcement, and gradual opening up. Mao Zedong initially suggested that "a large population in China is a very good thing" at the founding of the country in 1949, believing that more people meant more power. However, the first population census in 1953 revealed that the population was significantly larger than expected, which prompted the promotion of birth control measures in 1954. China's population then boomed in the 1960s (Figure 1), as the country's economic development slowed and living and working conditions became increasingly difficult. In 1973, at the first national family planning conference, the policy of "late, sparse, and few" was proposed. The "late" policy meant that men would marry at the age of 25 and women at the age of 23, the "sparse" policy meant that the interval between births would be lengthened to about four years, and the "few" policy meant that only two children per family would be born. Although China's population growth rate declined after the policy was implemented in 1973 (Figure 1), economic development did not change much during the early 1970s (Figure 2).

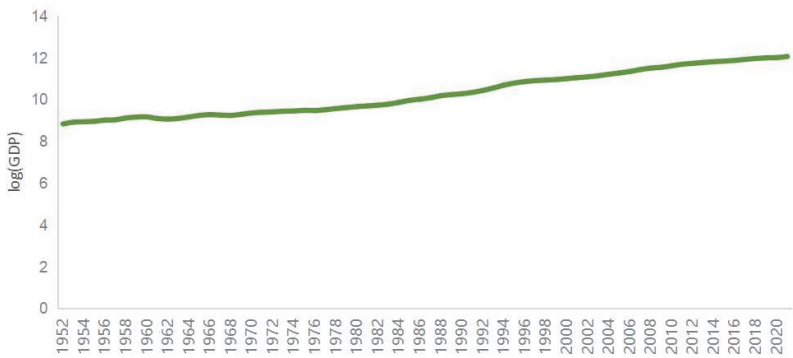
Figure 1. China's population growth rate



Source: Data from the National Bureau of Statistics of China.

As a result, in 1978, China began promoting and implementing its family planning policy, which became the most strictly enforced policy enshrined in the National Constitution. Fertility was strictly controlled by the country's well-known "one-child" policy, which advocated couples to have one child and at most two children. Over–births resulted in fines, and in more serious cases, job loss, with some conditional exemptions granted to rural populations and ethnic minorities. For example, families in 19 rural provinces were permitted to have a second child if the first child was a girl. The following two decades saw only limited adjustments to the policy.

Figure 2. China's (Log-transformed) National GDP Trend



Source: Data from the National Bureau of Statistics of China.

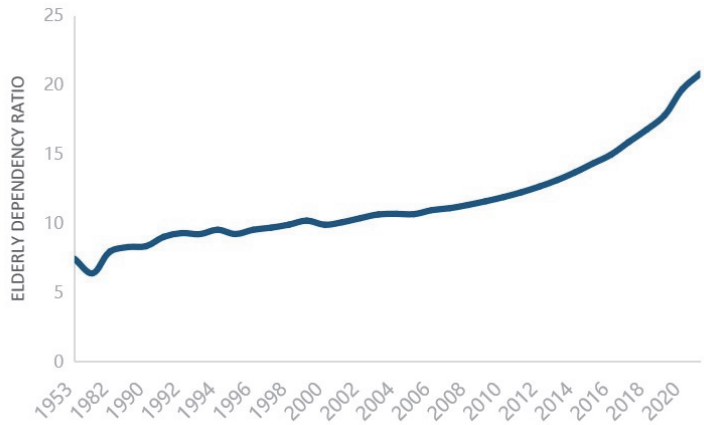
China's economy began to grow rapidly in 1998, and it became an aging society in 1999 (Figures 2 and 3), with labor costs increasing at an excessive rate. In 2002, the government introduced the "two only-child, two children" policy, which allowed parents to have two children if both parents were the only child in their own family.

However, as seen in Figure 1, although this "two only-child, two children" policy somewhat relaxed China's family planning policy, China's population growth continued to decline. To address the challenges that may hamper China's rapid economic growth, the Chinese government introduced a new policy of "selective two-child" in 2014, further relaxing the family planning restriction by allowing families to have two children if one of the parents is an only child.

Furthermore, in light of the rapidly aging population, the Fifth Plenary

Session of the 18th Party Central Committee explicitly proposed full implementation of the policy that one couple could have two children in October 2015. Then, in December 2015, the 18th session of the Standing Committee of the 12th National People's Congress considered and passed an Amendment to the Law of the People's Republic of China on Population and Family Planning that completely removed the one-child benefit and promoted the two-child subsidy. Subsequently, a new policy enacted in May 2021 further allowed all couples to have up to three children, in the hope that the "three-child" policy would alleviate the danger of China's aging population.

Figure 3. China's population dependency rate for the elderly



Source: Data from the National Bureau of Statistics of China.

3 Data

The analysis in our study is based on the CFPS survey data from 2010, 2012, 2014, and 2016. The CFPS baseline sample covers 25 provinces/municipalities/autonomous regions (excluding Hong Kong, Macau, Taiwan, Xinjiang Uyghur Autonomous Region, Tibet Autonomous Region, Qinghai, Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, and Hainan), which represents 95% of China's population. The 2010 baseline survey interviewed 14,960 households and 42,590 individuals, with a response rate of 79%, and CFPS continued to follow the sampled individuals

over time. CFPS is a nationally-representative, longitudinal social survey project initiated by Peking University that aims to meet the research needs of many social phenomena in contemporary China. It is the first large-scale, academically oriented social tracking survey project in China, focusing on the economic and non-economic well-being of the Chinese population. CFPS collects a large amount of information that covers various topics such as economic activity, educational outcomes, family dynamics and relationships, migration, and health (Xie and Lu, 2015). CFPS uses the University of Michigan Survey Research Center's computer-assisted personal interview technology, which tailors the interview to each household member to reduce measurement errors. The surveyors are internationally recognized experts in economics, statistics, sociology, and public policy, who work with an international advisory board, which resulted in a high-quality survey design and implementation (Fan, Yi, and Zhang, 2021).

CFPS consists of three levels of questionnaires. The first level is a community-level questionnaire which includes village- and community-level information on the demographics, infrastructure, policy implementation, economic situation, and social services. The second is a household-level questionnaire. The third level is at the individual level, where eligible individuals under 16 years of age (16 years old and above) are asked to respond to the questionnaire designed for a child (adult). For children under the age of 10, their guardians answered a portion of the questionnaire, while children between the ages of 10 and 15 were asked to complete the self-response part of the questionnaire themselves. The CFPS questionnaire covers a wide range of topics, as well as a comprehensive module of rural and urban interviews that collects information on the household structure and household members, mobility, event history (e.g., marriage, education, and employment history), cognitive ability, and child development. CFPS aims to provide the most comprehensive and high-quality survey data on contemporary China available to the academic community (Xie and Hu, 2014).

The analysis in this study relies upon the Family Relations Questionnaire, Adult Questionnaire, and Child Questionnaire of CFPS. We impose the following sample restrictions. First, we exclude the rural household sample from the analysis because the family planning policy implemented in 1978 already allowed eligible rural families to have a second child, making these rural families unaffected by the "selective two-child" policy. Secondly, we exclude from the analysis households in which the wife is over 50 years old,

who are less likely to conceive and give birth due to advanced age. Third, we also exclude households that already had a second child before 2014, whose fertility decision should be unaffected by the "selective two-child" policy. Lastly, households in which both parents are the only child in their own family are excluded because such households were allowed to have a second child since 2002, more than a decade before the "selective two-child" policy became effective (Jia, Zhou, and Yang, 2021).

Our final sample includes 2,372 households, which answered their survey questions about the first child but provided no information on the second child before 2014. To examine the impact of the "selective two-child" policy on the first child, we focus on two sets of outcome measures, 1) the first child's education outcomes, including parents' expectations about the child's educational attainment, and 2) the first child's relationship with parents.

Our empirical strategy follows Jia, Zhou, and Yang (2021), in that we consider families in which one spouse is the only child as the treatment group (treat=1) and families in which neither spouse is the only child as the control group (treat=0). The "selective two-child" policy was introduced in 2013 and was implemented nationwide in 2014. Accordingly, all the CFPS survey responses in 2010 and 2012 should be unaffected by the policy, while the survey responses in 2014 and 2016 should reflect the effects of the policy. Thus, we consider the responses from 2014 and 2016 as the "post" group (post = 1 if year = 2014 or 2016, and post = 0 otherwise).

We selected two sets of dependent variables in CFPS to construct the outcome measures related to the first child's education and mental health. Specifically, our education-related outcome measures include parents' expectation of the first child's education attainment, namely, (1) high school graduation or above, (2) college graduation or above, and (3) whether parents saved money for the first child's education in the previous year (1 if yes, 0 otherwise). These levels of parental expectations and saving behavior may not be identical to the actual level of educational attainment and spending observed many years later. However, to the extent that the first child could strongly respond to parents' expectation at an early age, these subjective expectations and early saving behaviors can be potentially related to the first child's eventual level of educational attainment.

On the other hand, our mental-health-related outcome measures include (4) the number of negative conversations ("quarrels") that parents had with the first child in the previous month, and (5) the number of positive

conversations ("heart–to–heart conversation") that parents had with the first child in the previous month. Existing research (Wang, Lin, and Zhou 2019) shows that there exists a strong correlation between parent–child communication and the child's overall mental health problems, such as emotional symptoms, behavioral problems, hyperactivity, and general difficulties.

Moreover, according to the Q–Q hypothesis, all else equal, parents are likely to invest less on each child's healthcare as the number of children increases. This prediction appears to be empirically relevant in the Chinese context, as Rosenzweig and Zhang (2009) showed that an increase in the number of children, net of a component of the birth weight-related birth endowment effect, significantly reduces the assessed health conditions of all children in the household. Based on the literature and economic theory, we use the following variables as covariates in our baseline panel regression analysis: children's age and sex, parents' age and highest level of education obtained, the number of family generations living together, and inflation-adjusted family income.

Descriptive statistics for the main variables are shown in Table 1. We note that some of the questions are unanswered and remain missing, especially those related to educational expectations and the first child's relationship with parents, and this high non-response rate is largely driven by the unique design of CFPS. In order to reduce the time and effort needed to fill out the CFPS questionnaire and increase the participation rate, some of the survey questions were given to a random subset of participants, although all CFPS participants were asked to complete a set of basic demographic questions. Moreover, since survey responses were not mandatory, it is plausible that some respondents intentionally refused to answer some of the survey questions. Below, we examine this issue more closely by exploring whether individuals' non-response patterns appear to be "missing-at-random" or can be predicted by observed individual characteristics.

Turning to our main outcome measures, we find that more than 95 (90) percent of the surveyed parents expect their first child to graduate from high school (college), although only one-thirds reported actually saving money for the first child's education in the past month. Moreover, the first child reportedly has an argument with their parents approximately 1.3 times a month, and has a "heart-to-heart" conversation 2.2 times a month.

Table 1. Descriptive Statistics

	N	Mean	SD
Treat	8,393	0.210	0.408
Post	8,393	0.497	0.500
Treat X Post	8,393	0.105	0.307
Demographic characteristics			
Log (Family income + 1)	8,393	10.730	1.099
Mother's age	8,393	36.080	8.190
Mother's education (1 if middle school or above)	8,393	0.460	0.498
Father's age	8,393	38.120	8.409
Father's education (1 if middle school or above)	8,393	0.477	0.500
First child gender (1 if male)	8,393	0.559	0.497
First child's age	8,393	11.140	8.424
Number of generations living together	8,393	2.433	0.675
First child's education			
Parental expectation (1 if high school degree or higher)	4,007	0.953	0.211
Parental expectation (1 if college degree or higher)	4,007	0.924	0.264
Parental saving for education in the past month (1 if yes)	3,927	0.330	0.470
First child's relationship with parents			
Number of negative conversations with parents	1,263	1.279	2.822
Number of positive conversations with parents	1,255	2.210	4.785

4 Empirical Model

To examine the impact of the "selective two-child" policy on the first child, we estimate the following regression model among the group of families which had a first child born before 2014 and satisfies the sample selection criteria described above:

$$Firstchild_i = a_0 + a_1 Treat_i + a_2 Treat_i \times Post_i + \beta X_i + \varepsilon_i \quad (1)$$

The dependent variable, $Firstchild_i$ indicates the outcome of interest of the first child in family i. $Treat_i$ is a dummy variable that indicates that households affected by the "selective two-child" policy, namely, the households in which only one parent is an only child (1 if yes, 0 otherwise). $Post_i$ is a binary indicator that is equal to 0 if the survey response comes from years before the policy implementation (2010, 2012) and 1 if after the

policy implementation (2014, 2016). $Treat_i \times Post_i$ is the interaction term. X_i a set of control variables that includes personal information about the first child (age, sex), information about the parents (age, highest education level) and information about the household (number of generations living together in the household, and inflation-adjusted household income). ε_i is the error term. We report robust standard errors in all of our regression analyses.

Our coefficient of interest is a_2 which represents the effect of the "selective two-child" policy on the first child of the affected households. The implementation of the "selective two-child" policy in 2014 can be seen as a quasi-natural experiment, as it was suddenly and publicly announced without any policy debates by influential experts and the media (Jia, Zhou, and Yang, 2021). We also note that a_2 should be viewed as the intention-to-treat (ITT) effects, since not eligible households ended up having a second child under the "selective two-child" policy.

Below we present estimation results from two separate regression specifications. First, we estimate the baseline specification shown in Equation (1) and present the resulting pooled OLS estimates. Secondly, we also estimate a fixed-effects regression specification by additionally controlling for family fixed effects θ_i which account for all time-invariant family characteristics. One downside of the fixed-effects approach in the current context is that some of the control variables we control for in Equation (1) reflect time-invariant characteristics (e.g., father and mother's educational attainment) and need to be removed from the fixed-effects regression. To make this variable selection consistent across alternative regression analyses, we decided to control for only two time-varying variables in our fixed-effects regression analyses, namely, (1) $Treat_i \times Post_i$ and (2) Log(Family Income + 1).

5 Estimation Results

5.1 Impact of the "selective two-child" policy on fertility

We begin our empirical analysis by estimating the impact of the "selective two-child policy" on the likelihood of having a second child. To this end, we

use the same regression specification shown in Equation (1), but use as the outcome variable a binary indicator of whether the household has a second child or not (1 if yes and 0 otherwise). Estimation results presented in Table 2 show that the households affected by the "selective two-child policy" significantly increased the probability of having a second child by 8.6 percentage points (134 percent). It appears that the policy has successfully achieved its goal of increasing childbirths among eligible Chinese parents.

Moreover, the coefficients on other covariates suggest that the positive effect of the policy may be disproportionately driven by households with certain demographic characteristics. Specifically, high-income households,

Table 2. Impact of the "Selective Two-child" Policy on the Likelihood of Having a Second Child

Outcome:	Family has a second child
Treat	-0.061
	(0.039)
Treat X Post	0.086**
	(0.042)
Log (Family income + 1)	0.009**
	(0.005)
Mother's age	0.000
	(0.001)
Mother's education (1 if middle school or above)	-0.016
	(0.011)
Father's age	-0.002
	(0.002)
Father's education (1 if middle school or above)	0.007**
	(0.003)
First child male	-0.005**
	(0.002)
First child's age	0.001***
	(0.001)
Number of generations living together	0.015**
	(0.006)
Constant	0.032
	(0.070)
Observations	8,393
Mean of Dep. Var.	0.064

Notes: Robust standard errors are in parentheses. ***: $p < 0.01$; **: $p < 0.5$; *: $p < 0.1$.

fathers with relatively high education attainment and families with a larger number of generations living together seem to have a higher probability of having a second child. However, we emphasize that, prior to the implementation of the "selective two-child" policy, the sample households were not allowed to have a second child regardless of the household income, education, and size.

5.2 Impact of the "selective two-child" policy on parents' educational expectations

Table 3 reports estimation results on the effect of the "selective two- child" policy on the parents' educational expectation of the first child. The first two columns correspond to the effect of the policy on the probability that parents expect the first child's education level to be high school graduation or above (Column 1) or college graduation or above (Column 2). As noted above, our focus here is on the coefficient on the interaction term between treatment families (Treat) and the years after the policy was implemented (Post). Panel (A) presents pooled OLS estimates and Panel (B) presents estimates from the family fixed-effects regression specification.

Consider Panel (A) first. After controlling for the characteristics of the first child, parents, and family characteristics, the "selective two-child" policy significantly reduced the probability that parental expectation of the first child's educational attainment is high school graduation or above by 4.3 percentage points (4.5%). Similarly, the policy led the probability parents expect the first child to obtain college education or above by 7.1 percentage points (7.7%). Echoing the findings from the first two columns, the last column shows that the share of parents saving money for their first child's education significantly fell by 6.6 percentage points (20%). Although our outcome measures consider parents' expectations of children's educational attainment, rather than the actual level of educational attainment observed, it is noteworthy that these findings are in line with the traditional Q–Q trade-off hypothesis, which states that, all else equal, having more children leads to lower human capital investments on each child (Becker and Lewis 1973). These findings are also consistent with many existing studies. Examples include Li and Zhang (2017), which find greater declines in household size and greater improvements in child education in prefectures with stricter enforcement of the "one-child" policy, and Qin, Zhuang, and Yang (2017),

Table 3. Impact of the "Selective Two-child" Policy on First Child's Education

Outcome:	Parental expectation = high school graduation or above	Parental expectation = college graduation or above	Saving for education
(A) OLS Estimates			
Treat	0.045***	0.058***	0.041
	(0.006)	(0.009)	(0.027)
Treat X Post	-0.043***	-0.071***	-0.066**
	(0.011)	(0.016)	(0.033)
Log (Family income + 1)	-0.007**	-0.012***	0.002
	(0.003)	(0.004)	(0.007)
Mother's age	-0.001	-0.002	-0.003
	(0.001)	(0.002)	(0.003)
Mother education	-0.011	-0.017*	-0.006
	(0.008)	(0.010)	(0.018)
Father's age	0.000	0.000	0.003
	(0.001)	(0.001)	(0.003)
Father education	0.028***	0.037***	0.041**
	(0.008)	(0.009)	(0.018)
First child male	0.006	0.011	-0.016
	(0.007)	(0.008)	(0.0153)
First child's age	0.000	-0.000	-0.002
	(0.001)	(0.001)	(0.002)
Number of generations	-0.002	-0.011*	0.000
living together	(0.005)	(0.007)	(0.012)
Constant	1.042***	1.103***	0.313***
	(0.042)	(0.059)	(0.105)
(B) Fixed Effect Estimates			
Treat X Post	-0.036***	-0.049**	-0.047
	(0.011)	(0.020)	(0.033)
Log(Family income + 1)	-0.008**	-0.020***	0.000
	(0.004)	(0.007)	(0.009)
Constant	1.048***	1.142***	0.332***
	(0.045)	(0.070)	(0.093)
Observations	4,007	4,007	3,927
Mean of Dep. Var.	0.953	0.924	0.330

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.5$, * $p < 0.1$.

which observed that children in families affected by the one-child policy had significantly higher educational attainment in adulthood.[1]

[1] The "one-child" policy has been compulsory since 1978, except for rural families in 19 provinces in China, which can have a second child if they are eligible. The rest of the families can only have one child.

Estimation results from the fixed-effects specification, presented in Panel (B) of Table 3, are qualitatively similar. We again observe that the effects of the policy on the parents' educational expectations are significantly negative. The effect on the saving pattern is no longer significant, but it remains negative.

5.3 Impact of the "selective two-child" policy on the first child's relationship with parents

Panel (A) of Table 4 presents pooled OLS estimation results on the effect of the "selective two-child" policy on the first child's relationship with parents. In columns (1) and (2), we estimate the effect on the parent-child relationship, measured by the number of negative and positive conversations parents had with the first child. As Reiss et al. (2000) suggested, in families with more than one child, differential parental treatment can lead to negative emotions and undesirable behaviors in children that are detrimental to their mental health. Estimation results are mixed, as the policy seems to have resulted in a significant increase in the number of both positive and negative conversations during the past month (0.7 for the negative conversation and 1.6 for the positive conversation).

Panel (B) of Table 4 presents the fixed-effects estimation results. We again observe that the policy significantly increased the number of negative parent-child conversations. The estimated effect of the policy on positive parent-child conversations is no longer statistically significant but remains positive.

Table 4. Impact of the "Selective Two-child" Policy on First Child's Relationship with Parents

Outcome:	Number of negative conversations	Number of positive conversations
(A) OLS Estimates		
Treat	-0.233	-1.351***
	(0.201)	(0.265)
Treat X Post	0.705**	1.630***
	(0.323)	(0.562)
Log (Family income + 1)	-0.009	0.254**
	(0.071)	(0.123)

Mother's age	-0.048	0.000
	(0.033)	(0.046)
Mother education	-0.172	0.017
	(0.162)	(0.309)
Father's age	0.045**	0.033
	(0.022)	(0.046)
Father education	-0.012	-0.156
	(0.162)	(0.317)
First child male	0.263*	-0.002
	(0.144)	(0.283)
First child's age	0.006	0.013
	(0.023)	(0.054)
Number of generations	-0.209	0.517**
living together	(0.135)	(0.218)
Constant	1.788*	-2.954
	(1.062)	(2.009)
(B) Fixed Effect Estimates		
Treat X Post	1.108**	0.923
	(0.488)	(0.719)
Log (Family income + 1)	0.081	0.189
	(0.162)	(0.187)
Constant	0.299	0.086
	(1.739)	(1.985)
Observations	1,263	1,255
Mean of Dep. Var.	1.279	2.210

Notes: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.5, * p < 0.1.

5.4 Missing Data Patterns

As shown in Table 1, the original CFPS survey data contain a large number of missing responses, which are likely caused by both the survey design (i.e., some of the survey questions were only given to a small subset of respondents) and respondents refusing to answer some of the questions given to them. Nevertheless, given the prevalence of missing responses in our data, it is important to better understand the patterns of missing data. Our main concern here is that the estimated effects of the two-child policy on the first child's education outcomes and parent-child relationship may be biased because the likelihood of missing data is endogenous and significantly correlated with certain household and parent characteristics. It is also

important to check whether the likelihood of missing data has systematically changed after the implementation of the "selective two-child" policy, which could also hamper a causal interpretation of our DID estimates.

For this purpose, we construct a binary outcome measure, which is set equal to 0 if a given survey question is answered and 1 if unanswered (i.e., the respondent either did not receive the question or did not answer it), and regress it on the same set of observable parent and child characteristics as before. Table 5 presents pooled OLS estimation results regarding the missing data patterns of the child's educational outcomes. We find that the likelihood

Table 5. Missing Data Patterns, First Child's Education Outcomes

Outcome Missing:	Educational expectation	Saving for education
(A) OLS Estimates		
Treat	-0.009	0.000
	(0.019)	(0.019)
Treat X Post	0.029	0.009
	(0.024)	(0.024)
Log (Family income + 1)	-0.008	-0.009*
	(0.005)	(0.005)
Mother's age	0.003	0.003
	(0.002)	(0.002)
Mother education	0.016	0.014
	(0.013)	(0.013)
Father's age	-0.002	-0.001
	(0.002)	(0.002)
Father education	0.011	0.013
	(0.013)	(0.013)
First child male	0.020*	0.023**
	(0.011)	(0.011)
First child's age	-0.004**	-0.004**
	(0.002)	(0.002)
Number of generations	-0.009	-0.008
living together	(0.009)	(0.009)
Constant	0.557***	0.553***
	(0.077)	(0.077)
Observations	8,393	8,393
Mean of Dep. Var.	0.477	0.467

Notes: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.5, * p < 0.1.

of missing data is not significantly correlated with most of the observable characteristics controlled for (except the first child's sex and age), which suggests that the pattern of missing data is close to random. However, there remains the possibility that the missing data patterns may be endogenous. A joint hypothesis test, with the null hypothesis that all coefficients in the regression specification except the intercept are zero, reveals that this null hypothesis can be rejected at a conventional significance level ($p < 0.0001$ for education expectation; $p = 0.0001$ for educational saving).

In Table 6, we repeat the pooled OLS regression analysis, this time using as the outcome measure whether a first child's parent-child relationship

Table 6. Missing Data Patterns, First Child's Relationship with Parents

Outcome Missing:	Number of negative conversations	Number of positive conversations
(A) OLS Estimates		
Treat	-0.006	-0.006
	(0.014)	(0.014)
Treat X Post	-0.009	-0.008
	(0.017)	(0.017)
Log (Family income + 1)	-0.001	-0.001
	(0.003)	(0.003)
Mother's age	0.002	0.002
	(0.002)	(0.002)
Mother education	0.002	0.004
	(0.009)	(0.009)
Father's age	-0.001	-0.001
	(0.001)	(0.001)
Father education	-0.005	-0.005
	(0.009)	(0.009)
First child male	0.008	0.008
	(0.008)	(0.008)
First child's age	-0.001	-0.001
	(0.001)	(0.001)
Number of generations	0.009	0.008
living together	(0.006)	(0.006)
Constant	0.139***	0.140***
	(0.054)	(0.054)
Observations	8,393	8,393
Mean of Dep. Var.	0.150	0.149

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.5$, * $p < 0.1$.

question is missing. Across all three regression specifications, we again find that most covariates are not significant predictors of missing data patterns. Moreover, when we ran the joint null F-test (with the null that all of the observed characteristics are not correlated with the likelihood that the given outcome variable is missing), we find that the missing data patterns for the negative and positive parent-child interactions seem to be close to random ($p = 0.595$ for negative parent-child conversation; $p = 0.639$ for positive parent-child conversation). In sum, it seems that the possibility that our main findings are driven by endogenous missing data patterns appears to be modest.

6 Conclusions

In this study, we explore the empirical relevance of the Q–Q trade-off hypothesis in the Chinese context, by examining how an increased number of children in a given household affects the first child's education outcomes and parent-child relationship. Our empirical setting is modern-day China, which relaxed its strict birth control policy in 2014 by introducing the "selective two-child" policy, which enabled households in which one of the parents is an only child to have a second child. The implementation of this policy provides an ideal quasi-experimental setting, as it led to a sudden and unexpected increase in the average number of children in Chinese households.

Our regression analysis, based on the nationally representative Chinese survey data (CFPS) between 2010 and 2016, provides strong evidence that supports the Q–Q trade-off hypothesis. Consistent with the hypothesis, we find that the households likely affected by the new policy significantly reduced the level of educational expectation on the first child, as well as lowering the probability of parental saving for the first child's education. By contrast, we find more mixed results when considering measures of the first child's relationship with parents. The two-child policy led the first child in the affected households to have an increased number of "close" conversations (both positive and negative) with their parents. Aside from these main findings, we also confirm that the "selective two-child" policy indeed had a desirable impact on China's family dynamics, by significantly increasing the likelihood of the affected parents having a second child.

Our findings have important implications for understanding the relationship between the number of children in a household, their relationship with parents, and their expected educational attainment. A particularly noteworthy implication is that, as the Chinese government continues to further relax its family planning policy, parents may invest less in their children's human capital, which could lead to a decline in per capita human capital investment and accumulation among future generations of the Chinese population. Many countries across the world, including China and South Korea, have recently experienced a rapidly declining fertility rate, making it increasingly important to understand the pattern of human capital accumulation and transmission across generations and how it could be affected by changes in government policies. Although the Q–Q trade-off hypothesis was first introduced several decades ago and has already been actively studied by researchers, it is still of great policy and research interest to better understand its empirical relevance and significance.

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