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Does gender matter for the intergenerational transmission of education? Evidence from rural China

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ABSTRACT

Many studies have examined whether children's gender influences their educational attainment. However, there are limited studies on both the impact of parents' education on children's education and the educational gender gap in rural China. This paper investigates the impact of parents' education on their children's education from a gender perspective in rural China using comprehensive rural household data. We find that the educational gender gap in rural China has been decreasing over the last several decades. Moreover, the educational gender gap decreases as parents' education increases. Parents' initial educational attainment plays an important role in narrowing the educational gender gap.

1. Introduction

Bridging the gender gap has been an important goal set by the United Nations (UN). The Sustainable Development Goals (SDGs) agreed upon by the UN in 2015 aim to fuel sustainable economies and benefit societies and humanity by, among other things, providing women and girls with equal access to education. It is worth emphasizing that an important part of Goal 5 in the SDGs is to achieve progress toward gender equality. Goal 5 states, "Achieve gender equality and empower all women and girls" (UN, 2016). Women and girls represent almost half of the world's population, and therefore, also almost half of its potential. Gender inequality is harmful and unjust for women, men, and societies at large, and it also adversely affects the educational attainment of the next generation. The United Nations Educational, Scientific and Cultural Organization (UNESCO) advocates for equality among genders, notably through education (United Nations Educational, Scientific and Cultural Organization (UNESCO, 2000). In particular, UNESCO's commitment to promoting Global Citizenship Education involves facilitating the acquisition of knowledge, skills, values, and attitudes that encourage individuals to challenge harmful stereotypes and prejudices, including those related to gender. In this way, it contributes to building societies that support gender equality. The objective of such education is to combat the discrimination that affects people regardless of their aspirations or potential. Such discrimination deprives individuals of mobility and choice, and it also denies societies valuable perspectives and much-needed workforces (United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017). Advancing educational gender equality is critical to all areas of a healthy society, from reducing poverty to promoting the health, safety, and well-being of girls and boys. Investing in education programs for girls can provide a $5 return for every dollar spent (United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019). Gender equality in educational attainment is not only a fundamental human right but also a necessary foundation for a peaceful, prosperous, and sustainable world.

Unfortunately, to date, gender inequality in educational attainment remains a major concern in many developing countries. As reported by Barro and Lee (2013), for the population aged 15 years and above, the average years of schooling for women is only 68.5 % of that of men in South Asia (4.25 versus 6.20 years); this percentage is 79.4 % in Sub-

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Saharan Africa (4.63 versus 5.83 years). Moreover, a gender gap in education exists in many other developing countries and regions (Barro and Lee, 2013). Undoubtedly, this has negative effects on their social and economic development (Guo and Yan, 2015; Li et al., 2014). Consequently, the increase in children's educational attainment and the narrowing of educational gender gap have profound significance. Educational opportunities can promote inclusive growth and reduce inequalities in societies through improving employment opportunities, higher earnings, and overall wealth. However, inequalities in educational attainment sometimes persist over generations, leading to widening inequalities in societies. To facilitate social inclusion and mobility and to improve socioeconomic outcomes for the present and future generations, governments worldwide should ensure all children have access to quality education. This is particularly important for children with disadvantaged backgrounds (often identified as being of low socioeconomic status), especially those with low-educated parents (Organisation for Economic Co-operation and Development [OECD], 2016).

China, as the largest developing country, has experienced serious gender inequality with respect to education. In China's long history, there is a tradition of "son preference," since sons could help on the family farm, provide support to their aging parents, and contribute more to their parents' well-being (Das et al., 2003). Gender has been an important influential factor for parents' decisions about their children's education in China for a long time. Many studies have shown that socioeconomic inequality originates from gender inequality between men and women (Breierova and Duflo, 2004; Chi and Li, 2008; Cutler et al., 2006; Ge and Zeng, 2011; Guo and Yan, 2015; Li et al., 2014; Zhang et al., 2008). In fact, China has made commitments to ensure gender equality in education since the founding of the People's Republic of China. The implementation of the nine-year compulsory education policy, which is not based on gender, has played a significant role in raising the educational attainment of girls, as has the implementation of the Compulsory Education Law of the People's Republic of China, the Educational Law of the People's Republic of China, and the National Medium and Long-term Educational Reform and Development Program (2010–2020) (Ministry of Education of the People's Republic of China, 2015; The Central People's Government of the People's Republic of China, 2006, 2010).

However, in recent years, a few in-the-field studies have shown that gender inequality in education remains a concern in China. Wang et al. (2013) reported that male students are dominant in college. They showed that male first-year college students were overrepresented in their sample, while the share of female students was only 41 %. Some other studies have reported that male students tend to drop out at the junior-high educational level (Mo et al., 2013; Wang et al., 2015; Yi et al., 2012). For example, one of those studies showed that only 5.4 % of female students dropped out, but 8.8 % of male students dropped out (Mo et al., 2013).

Although many studies, such as those mentioned above, have discussed gender differences in education, there have been some limitations in those studies. First, the data used in those studies suffer from a lack of representativeness. Wang et al. (2013) used just four universities in three provinces, and almost all other studies mentioned in the previous paragraph focused on the northwest region of China (Wang et al., 2015; Yi et al., 2012). Therefore, these studies appear to lack national representativeness. Second, these studies cannot evaluate the cohort effect since there is no variation in the age of sampled individuals (Mo et al., 2013; Wang et al., 2015). For example, the age range of sampled individuals in Wang et al. (2015) was approximately 12–15 years. Third, these studies are almost all descriptive and cannot deal with potential endogeneity problems due to data limitation (Wang et al., 2013, 2015; Yi et al., 2012). Moreover, children's education is one of the most important tasks that a family needs to undertake. It is not yet clear what role parents play in it, especially in terms of their own education. These are the gaps in the relevant literature from China.

The impact of parents' education on their children's education has in fact attracted attention, and there have been an increasing number of studies during the last ten years that have focused on the intergenerational transmission of education (Dong et al., 2019; Hertz et al., 2007; Holmlund et al., 2011; Maurin and McNally, 2008). The intergenerational transmission of education refers to the relationship between the years of schooling completed by parents and the years of schooling completed by their children. Regressing education of sons or daughters on its counterpart defined for fathers and mothers provides a measure of the intergenerational transmission of education. In the empirical analysis, the intergenerational transmission of education could be interpreted by the increase in the years of schooling completed by children compared to the increase in the years of schooling completed by their parents. Recent works have attempted to alleviate endogeneity problem caused by correlation in ability across generations. According to Holmlund et al. (2011), ability is the unobserved endowment caused by genetics. Parents and their children are linked by similar genetics, which affects the children's education. The intergenerational transmission effect of education may be overstated, since it includes the role of the intergenerational transmission of ability. In other words, the result that more educated parents develop more educated children may just be due to more able parents having more able children (Black and Devereux, 2010).

There are also several reports that have addressed the relationship between parents' educational background and children's academic achievement. One report by the OECD indicates that children without tertiary educated mothers are less likely to be enrolled in early childhood education programs and more likely to be enrolled in vocational than general upper secondary programs (Organization for Economic Co-operation and Development (OECD, 2018a). This affects their participation in higher education, where the share of entrants without a tertiary educated parent is small. Although educational attainment has been improving across countries, low educational attainment persists, particularly among those with low-educated parents. Parents' educational attainment plays some role in perpetuating similar educational attainment among their children (Organisation for Economic Co-operation and Development OECD, 2016). It could affect the educational attainment of children through several channels, such as assortative mating, educational investment, school choice, and so on. As shown in one report, school effects are driven by the selection of better students into schools, which is partly a parental choice (Organization for Economic Co-operation and Development (OECD, 2018b). In other words, children's academic achievement could be affected by parents' educational background to some extent.

Although previous studies have already demonstrated the relationship between parents and their children in terms of education, research on the intergenerational transmission of education within China itself is rare, especially from the perspective of gender. To our knowledge, there are only a few studies that address the intergenerational transmission of education in China. Sato and Li (2008) investigated the intergenerational effects of family class origin on family members' educational attainment. They found a drop caused by the class-based discrimination in the Maoist era, and a rebound in the post-reform era. By employing the Cultural Revolution (CR) as an instrumental variable for father's educational attainment, Yang and He (2015) found that a one-year increase in father's educational attainment improved their children's probability of entering college by about 8 %. Luo and Zhou (2010) found that a Quantity-Quality tradeoff existed in China, and they also verified the existence of birth order discrimination, but not gender discrimination.

As far as we know, there have not been any studies on the gender heterogeneous effect of parents' education on children's education in rural China. Previous studies have either focused on the educational gender gap or on the intergenerational transmission of education. As mentioned above, the UN aims to bridge the gender gap by empowering girls' access to education, among other measures (United Nations

Educational, Scientific and Cultural Organization (UNESCO, 2017). Such efforts could be made by the government, civil society, and so on. However, the role of parents' education in the gender gap is still less examined. Undoubtedly, family members, especially the parents of children, play an indispensable role in the progress toward gender inequality. Therefore, the overall goal of this study is to understand the role of parents' education on their children's education from a gender perspective. Under this goal, we have three specific objectives: First, to describe the gender pattern of children's education; second, to identify the role of parents' education in children's education with a gender perspective; and last but not least, to examine how the gender pattern of children's education evolves over time.

We collected a unique dataset to achieve the overall goal and the three specific objectives mentioned above. This dataset contains comprehensive information about sample households in rural China. Noteworthily, the dataset includes data on at least three generations of family members. We also collected personal information on their extended family members. The unique survey data allows us to alleviate the endogeneity problem by using the family fixed effects model. We will provide a more detailed description of the data we used throughout this study in Section 2.

This study examines the role of parents' education on their children's education from a gender perspective. The empirical outcomes show that the gender gap in children's education has been narrowing over the last several decades. More importantly, our study examines the role of parents' education in narrowing the educational gender gap, and it finds that improvement in parents' educational attainment is an important factor in narrowing this gap.

The rest of the paper is structured as follows. In Section 2, we describe the data and identification strategy used in our study. Section 3 presents our empirical results. Finally, Section 4 provides a summary of the study's findings and some discussion.

2. Data and identification strategy

2.1. Data

This study used data from the China Rural Development Survey (CRDS) conducted by the Center for Chinese Agricultural Policy of the Chinese Academy of Sciences in April 2016. A multi-stage stratified sampling procedure was used to select the sample. Five sample provinces (Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei) were randomly selected from each of China's major agro-ecological zones, not including Tibet, Hainan, Hong Kong, Macau, Taiwan, and four province-level municipalities (Beijing, Tianjin, Shanghai, and Chongqing). Five sample counties were then selected from each province by a two-step procedure. First, the enumeration team listed all counties in each province in descending order of per capita gross value of industrial output (GVIO). GVIO was used based on the conclusions of Rozelle (1996) who concluded that GVIO is a good predictor of standard of living and development potential and is often more reliable than net rural per capita income. Second, five sample counties were selected randomly from each list. After the county selection was completed, the team then chose the sample townships and villages following the same procedure outlined above. Finally, the survey team used village rosters and the survey team's own count of households that were living in the village but were not on the roster to randomly choose 20 households in each village. Compared to the last round of the survey conducted in 2012, our attrition rate was 9.39 %[1] . For those households that were not surveyed for various reasons, the enumeration team selected a replacement household following the same procedure used for the original selection of the households. Finally, a nationally representative sample of 2026 households from 100 villages was selected for the purpose of this study.

In these rural households, we investigated all family members, including the children who have gone to school in other cities or provinces and the offspring who have separated from the original family. In other words, we have investigated the original family and their extended family members. More importantly, this survey tracks at least three generations of each household for their family members, the household head and his/her spouse (2nd generation), their parents (1st generation), and their children (3rd generation). To our knowledge, there are no other studies that have collected similar detailed personal information of extended family members over time in rural China.

We collected information on the personal characteristics of all family members, such as gender, educational attainment, and birth year. In the survey, we coded individuals and relationships in the family, and this enabled us to conveniently match children and their parents. Since we surveyed the original family's head of household, who is usually a man in rural areas, the education information of the parents of daughters-in-law/sons-in-law is absent. Ultimately, we obtained a sample of 6119 individuals, containing complete information on the children and their parents.

2.2. Identification strategy

We adopted two methods to estimate the effect of parents' schooling on their children's schooling with a gender perspective: Ordinary Least Squares (OLS) and Family Fixed Effects (FFE).

(a) The OLS model

As the benchmark estimation, we first used the OLS model. For convenience, we defined $Educ_{children}$ as the schooling of the children. $Educ_{father}$, $Educ_{mother}$, and $Educ_{parents}$ represent the schooling of their father, mother, and the average of their parents, respectively. Z represents other factors that may influence the children's schooling years. *cohort* represents the individuals' birth cohort. We divided all individuals into five groups: before 1960, 1960 − 1969, 1970 − 1979, 1980 − 1989, and 1990 − 1999. Thus, *cohort* is a vector of dummy variables. The following three equations demonstrate the effect of educational intergenerational transmission from father, mother, and parents. For each child i in household h, we have:

$$Educ_{children_{ih}} = \alpha + \beta * male_{ih} + \delta * Educ_{father_{ih}} + \varphi * male_{ih} * Educ_{father_{ih}} + \lambda * cohort_{ih} + \rho * male_{ih} * cohort_{ih} + \gamma * Z_{ih} + \varepsilon_{ih} \quad (1)$$

$$Educ_{children_{ih}} = \alpha + \beta * male_{ih} + \delta * Educ_{mother_{ih}} + \varphi * male_{ih} * Educ_{mother_{ih}} + \lambda * cohort_{ih} + \rho * male_{ih} * cohort_{ih} + \gamma * Z_{ih} + \varepsilon_{ih} \quad (2)$$

$$Educ_{children_{ih}} = \alpha + \beta * male_{ih} + \delta * Educ_{parents_{ih}} + \varphi * male_{ih} * Educ_{parents_{ih}} + \lambda * cohort_{ih} + \rho * male_{ih} * cohort_{ih} + \gamma * Z_{ih} + \varepsilon_{ih} \quad (3)$$

Where α is the constant term. β stands for the effect of children's gender on their schooling. δ stands for the transmission effect of parents' schooling on their children's schooling. φ is the interaction effect of gender and father/mother/parents' schooling. λ stands for the effect of birth cohort. ρ stands for the interaction effect of gender and birth cohort. γ is the effect of other factors, and ε is the error term assumed to be white noise.

Models (1) and (2) follow existing studies; model (3) has been used less frequently in previous studies, but it has the advantage of

[1] The data we used are from a tracking investigation from 2005 − 2016, and the last round of that survey was conducted in 2012.

controlling for assortative mating, avoiding multicollinearity, and producing more precisely estimated coefficients (Holmlund et al., 2011; Oreopoulos et al., 2006).

(b) The FFE model

A key issue facing the OLS model is potential endogeneity. In our case, this arises when parents and their children are linked by similar genetics and family culture. This connection between the generations may bias the results in a way which tends to overstate the effect of parents' education on their children. In other words, if these children follow a similar path as their parents, which is statistically significant, then the OLS model may describe this only as being a feature of intergenerational transmission, rather than a combination of factors alongside similar genetics and family culture.

To address the potential endogeneity as much as possible, we used the FFE model to estimate the transmission effect of parents' schooling on their children's schooling from a gender per To address the potential endogeneity as much as possible, we used the FFE model to estimate the transmission effect of parents' schooling on their children's schooling from, while eliminat < span class = "error-correction" > <insert>e <insert> < /span > ing the other contributing factors that affect both parents and their children. We did so by taking advantage of our survey in which we gathered data on three generations within the same family. This allowed us to make different pairings of each parent with each child within the same family. The educational attainment of parents in the same family usually varies from one to another. To the best of our knowledge, there is no other study of this topic conducted specifically in China that employs the FFE to address the endogeneity problem, and this adds to the significance of our study in terms of its contribution to the literature. Despite these advantages, using the FFE model still involves some disadvantages. In particular, the model assumes that children within the same family have identical family culture and genetics. Clearly, this is not strictly the case.

In the FFE model, for each child i in household h, we have:

$$Educ_{children_{ih}} = \alpha + \beta^{*}male_{ih} + \delta^{*}Educ_{father_{ih}} + \varphi^{*}male_{ih}{}^{*}Educ_{father_{ih}} + \lambda^{*}cohort_{ih} + \rho^{*}male_{ih}{}^{*}cohort_{ih} + \gamma^{*}Z_{ih} + \nu_{h} + \varepsilon_{ih} \quad (4)$$

$$Educ_{children_{ih}} = \alpha + \beta^{*}male_{ih} + \delta^{*}Educ_{mother_{ih}} + \varphi^{*}male_{ih}{}^{*}Educ_{mother_{ih}} + \lambda^{*}cohort_{ih} + \rho^{*}male_{ih}{}^{*}cohort_{ih} + \gamma^{*}Z_{ih} + \nu_{h} + \varepsilon_{ih} \quad (5)$$

$$Educ_{children_{ih}} = \alpha + \beta^{*}male_{ih} + \delta^{*}Educ_{parents_{ih}} + \varphi^{*}male_{ih}{}^{*}Educ_{parents_{ih}} + \lambda^{*}cohort_{ih} + \rho^{*}male_{ih}{}^{*}cohort_{ih} + \gamma^{*}Z_{ih} + \nu_{h} + \varepsilon_{ih} \quad (6)$$

The definitions of α and β are the same as above. ε is the error term. As mentioned, a pooled regression such as OLS ignores the unobservable characteristics ν_h shared by parents and their children, such as genetics and family culture, which influence the education of both parents and their children. By using the FFE model, we can eliminate ν_h from the equation by differencing the equation above in the following way:

$$Educ_{children_{ih}} - \bar{Educ_{children_{h}}} = \beta^{*}(male_{ih} - \bar{male_{h}}) + \delta^{*}(Educ_{father_{ih}} - \bar{Educ_{father_{h}}}) + \varphi^{*}(male_{ih}{}^{*}Educ_{father_{ih}} - male_{h}{}^{*}\bar{Educ_{father_{h}}}) + \lambda^{*}(cohort_{ih} - \bar{cohort_{h}}) + \rho^{*}(male_{ih}{}^{*}cohort_{ih} - male_{h}{}^{*}\bar{cohort_{h}}) + \gamma^{*}(Z_{ih} - \bar{Z_{h}}) + (\nu_{h} - \nu_{h}) + (\varepsilon_{ih} - \bar{\varepsilon_{h}}) \quad (7)$$

$$Educ_{children_{ih}} - \bar{Educ_{children_{h}}} = \beta^{*}(male_{ih} - \bar{male_{h}}) + \delta^{*}(Educ_{mother_{ih}} - \bar{Educ_{mother_{h}}}) + \varphi^{*}(male_{ih}{}^{*}Educ_{mother_{ih}} - male_{h}{}^{*}\bar{Educ_{mother_{h}}}) + \lambda^{*}(cohort_{ih} - \bar{cohort_{h}}) + \rho^{*}(male_{ih}{}^{*}cohort_{ih} - male_{h}{}^{*}\bar{cohort_{h}}) + \gamma^{*}(Z_{ih} - \bar{Z_{h}}) + (\nu_{h} - \nu_{h}) + (\varepsilon_{ih} - \bar{\varepsilon_{h}}) \quad (8)$$

$$Educ_{children_{ih}} - \bar{Educ_{children_{h}}} = \beta^{*}(male_{ih} - \bar{male_{h}}) + \delta^{*}(Educ_{parents_{ih}} - \bar{Educ_{parents_{h}}}) + \varphi^{*}(male_{ih}{}^{*}Educ_{parents_{ih}} - male_{h}{}^{*}\bar{Educ_{parents_{h}}}) + \lambda^{*}(cohort_{ih} - \bar{cohort_{h}}) + \rho^{*}(male_{ih}{}^{*}cohort_{ih} - male_{h}{}^{*}\bar{cohort_{h}}) + \gamma^{*}(Z_{ih} - \bar{Z_{h}}) + (\nu_{h} - \nu_{h}) + (\varepsilon_{ih} - \bar{\varepsilon_{h}}) \quad (9)$$

Where "—" indicates the average of each variable in each family. In this way, we can eliminate the unobservable characteristics as much as possible and partially address the endogenous problem.

3. Empirical results

3.1. Evolution of children's schooling over time from a gender perspective

The schooling of both male and female children born between 1952 and 1993 gradually increased in rural China (Fig. 1). The average schooling of male children born in 1952 was 6.25 years, which is equivalent to graduating from primary school. The average schooling of female children born in the same year was 5.67 years, which is six months less than that of male children. As for individuals born in 1993, the average schooling of male children and female children was 10.68 years and 12 years, respectively. The schooling years of sampled individuals doubled from 1952 to 1993.

The increase in schooling of female children was more than that of male children. Before 1987, male children were consistently more exposed to education than female children, though the gap was narrowing. The schooling of female children born in 1987 surpassed that of male children born in the same year for the first time. After 1987, male children's schooling was always less than that of female children.

Although the schooling of female children showed a gradual increase, female children are more often victims in crises than male children, such as the Great Chinese Famine. The schooling of female children born between 1954 and 1958 was significantly less than that of male children, though schooling for both declined during this time. Individuals born between 1954 and 1958 were affected by the Great Chinese Famine during their primary school period. In those days, it was difficult to get enough to eat, and education was a luxury. Some previous studies have also found that famine exposure decreased educational attainment (Chen and Zhou, 2007;).

We found that male children's schooling increased with improvement in father's educational level. The average schooling of male children was about 7.61 years when their father was illiterate (Table 1, row 1, column 1). When their father had graduated from primary school, the schooling of male children increased to 8.47 years (row 2, column 1). When their father was a junior high school graduate, the average schooling of male children was about 9.78 years, which drastically increased to 12.10 years when father's educational level was high school or above (rows 3 and 4, column 1).

As for female children, their schooling also increased with improvement in father's educational level. The average schooling of female children was about 5.75 years when their father was illiterate (Table 1, row 1, column 2). When their father had graduated from primary school, female children's schooling increased to 7.85 years (row 2, column 2). When father's educational level was junior high school, female children's schooling was about 9.63 years, which sharply increased to 12.28 years when father's educational level was high school or above (rows 3 and 4, column 2).

There was gender discrepancy in children's schooling, though it declined with improvement in father's educational level. When the father was illiterate, male children tended to attain 1.86 more years of schooling than female children, and this was statistically significant ($p < 0.01$) (Table 1, row 1, columns 3 and 4). When the father was a primary school graduate, the gender discrepancy decreased to 0.62 years, and this too was statistically significant at the 1% level (row 2, columns 3 and 4). When the father was a junior high school graduate, the schooling of male children was 0.15 years more than that of female children, but this difference was not significant (row 3, columns 3 and

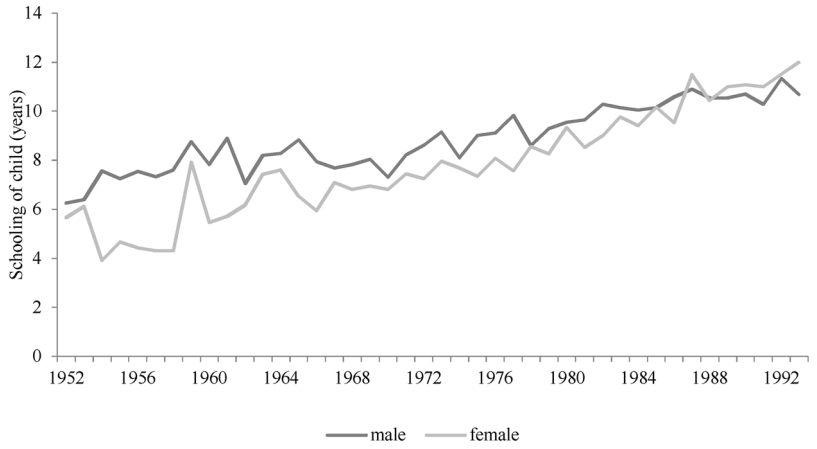

Fig. 1. The evolution of child's schooling years by gender.
Data source: Authors' survey.

Table 1
Child's schooling years by gender and parent's educational level.

Parent's educational level		Schooling years		Difference (1) - (2)	t-Test (p-value) H0: (1) = (2)
		Male child (1)	Female child (2)	(3)	(4)
Father's educational level					
(1)	Illiteracy	7.61	5.75	1.86	0.00***
(2)	Primary school	8.47	7.85	0.62	0.00***
(3)	Junior high School	9.78	9.63	0.15	0.29
(4)	High school and above	12.10	12.28	−0.18	0.45
Mother's educational level					
(5)	Illiteracy	8.07	6.61	1.46	0.00***
(6)	Primary school	9.13	8.82	0.31	0.02**
(7)	Junior high School	10.20	10.56	−0.36	0.09*
(8)	High school and above	13.61	13.46	0.15	0.51

Data source: Authors' survey.
Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4). However, when father's educational level was high school or above, the schooling of female children was more than that of male children, with a difference of 0.18 years, but this difference was insignificant (row 4, columns 3 and 4).

Children's schooling was also positively correlated with mother's educational level. If the mother was illiterate, the average schooling of male and female children was 8.07 years and 6.61 years, respectively (Table 1, row 5, columns 1 and 2). When mother's educational level was primary school, the average schooling of male and female children increased to 9.13 years and 8.82 years, respectively (row 6, columns 1 and 2). If the mother was a junior high school graduate, then the average schooling of male and female children was 10.20 years and 10.56 years, respectively (row 7, columns 1 and 2). However, the average schooling of male and female children increased to 13.61 years and 13.46 years, respectively, if mother's educational level was high school or above (row 8, columns 1 and 2).

We also found a difference in schooling between male and female children based on mother's educational level. When the mother was illiterate, male children's years of schooling was 1.46 years more than that of female children, and this was significant at the 1% level (Table 1, row 5, columns 3 and 4). If mother's educational level was primary school, then male children's schooling was more than that of female children, and this difference was also significant ($p < 0.05$) (row 6, columns 3 and 4). When mother's educational level was junior high school, female children's schooling increased and was significantly more than that of male children ($p < 0.1$) (row 7, columns 3 and 4). Male children's schooling was only slightly more than that of female children when mother's educational level was high school or above. However, this was not statistically significant (row 8, columns 3 and 4).

In addition, male children's schooling also increased with their birth cohort. The average schooling of male children born before 1960 was 7.20 years, equivalent to the first year of junior high school (Table 2, row 1, column 1). For male children born between 1960 and 1969, their schooling was 8.07 years, which is more than that of male children born before 1960 (row 2, column 1). Further, for male children born in the 1970s, their schooling increased to 8.67 years (row 3, column 1). The average schooling of male children born in the 1980s and 1990s was 10.29 years and 10.22 years, respectively (rows 4 and 5, column 1).

The change in female children's years of schooling is similar to that of male children. However, female children's years of schooling increased faster. The schooling of female children born before 1960 was 5.19 years, indicating that they did not graduate from primary school on average (Table 2, row 1, column 2). For those born in the 1960s, their average schooling increased to 6.76 years, which is 1.57 years more than that of female children born before 1960 (row 2, column 2). As for the schooling of female children born in the 1970s, it was 7.69 years, and that of female children born in the 1980s and 1990s, it was 9.98 years and 10.82 years, respectively (rows 3–5, column 2).

The level of schooling was also different among children of different genders and birth cohorts in rural China. The schooling of male children born before 1960 was 2.01 years more than that of female children, and this was significant at the 1% level (Table 2, row 1, columns 3 and 4). With the fast growth of the schooling of female children, the education gap between male and female children born in the 1960s declined to 1.31 years, which further decreased to 0.97 years for those born in the 1970s; this difference was also significant ($p < 0.01$) (row 2, columns 3

Table 2
Child's schooling years by gender and birth cohort.

	Children's birth cohort	Male child (1)	Female child (2)	Difference =(1) - (2) (3)	t-Test (p-value) H0: (1) = (2) (4)
(1)	Before 1960	7.20	5.19	2.01	0.00***
(2)	Cohort_1960s(1960 − 1969)	8.07	6.76	1.31	0.00***
(3)	Cohort_1970s(1970 − 1979)	8.67	7.69	0.97	0.00***
(4)	Cohort_1980s(1980 − 1989)	10.29	9.98	0.31	0.08*
(5)	Cohort_1990s(1990 − 1999)	10.22	10.82	−0.60	0.00***

Data source: Authors' survey.
Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

and 4; row 3, columns 3 and 4). The difference in the schooling of male and female children continued to decline for those born in the 1980s, and this was significant at the 10 % level (row 4, columns 3 and 4). However, the schooling of female children born in the 1990s was significantly more than that of their male peers (row 5, columns 3 and 4).

3.2. Results of the OLS estimation

According to the OLS estimation, father's educational attainment had a heterogeneous impact on female children's schooling (Table 3). On average, the schooling of male children was 2.09 years more than that of female children ($p < 0.01$) (row 1, column 2). Consistent with previous studies, a more educated father increased children's schooling. If father's educational attainment increased by a year, then children's schooling improved by 0.297 years ($p < 0.01$) (row 2, column 2), but the schooling of female children showed an improvement of 0.091 years more than that of male children ($p < 0.01$) (row 3, column 2).

Mother's educational attainment had similar effects on children's schooling as that of father's educational attainment. Specifically, when we considered mother's educational attainment, the schooling of male children was 1.987 years more than that of female children on average ($p < 0.01$) (Table 3, row 1, column 4). If mother's schooling increased by a year, then children's schooling improved by 0.278 years ($p < 0.01$) (row 4, column 4). The schooling of female children improved by 0.114 more years than that of male children, which is larger than the impact of father's schooling ($p < 0.01$) (row 5, column 4).

However, the impact of the average of parents' educational attainment on children's schooling was much stronger than that of father's or mother's alone. We found that a one-year increase in parents' education improved, on average, their children's schooling by about 0.440 years ($p < 0.01$) (Table 3, row 6, column 6). Female children also benefited more from improvement in their parents' schooling years by about 0.148 years ($p < 0.01$) (row 7, column 6).

In addition, birth cohorts were also correlated with children's schooling years. First, compared to the schooling of children born before 1960, the schooling of later cohorts was higher; the younger the children, the higher the schooling. For example, when we only controlled for father's educational attainment, compared to children born before 1960, the schooling of children born in the 1960s was 0.894 years more, and that of children born in the 1970s was 1.387 years more (Table 3, rows 8 and 9, column 1). The schooling of children born in the 1980s and 1990s were 3.069 years and 3.813 years, respectively, more than that of children born before 1960 (rows 10 and 11, column 1). When we only controlled for mother's schooling, the coefficients of birth cohorts were larger and more significant (rows 8–11, column 3).

Second, the schooling of female children increased faster than that of male children over time. The coefficients of the interaction item of male children and birth cohorts were negative, and the absolute values of these coefficients increased with birth cohorts. In particular, the schooling of female children born in the 1990s was 2.099 years more than that of male children born during the same period, when we only controlled for father's educational attainment (Table 3, row 15, column 2). In the other two models, the schooling of female children born in the 1990s was 2.077 years, or 1.814 years more than that of males[2] (row 15, columns 4 and 6).

3.3. Results of the FFE estimation

By controlling for the influence of genetics and family background, we were able to obtain the net effects of education across two generations (Table 4). These results are consistent with those of the OLS model. When we only considered the effects of father's educational attainment, the average schooling of male children was 2.422 years more than that of female children ($p < 0.01$) (row 1, column 2). If father's schooling increased by a year, then children's schooling increased by 0.176 years ($p < 0.01$) (row 2, column 2). Similar to the results of the OLS model, female children's schooling increased by 0.069 years more than that of male children ($p < 0.01$) (row 3, column 2).

When we only included mother's educational attainment in the model, the coefficient of the variable for male children declined to 2.353, indicating that male children's schooling was 2.353 years more than that of female children ($p < 0.01$) (Table 4, row 1, column 4). If mother's schooling increased by a year, then children's schooling increased by 0.192 years ($p < 0.01$) (row 4, column 4). The results of the FFE estimation showed that the coefficient of the interaction of male children and mother's schooling years was negative and significant for the outcome variable. This finding indicates that the impact of mother's schooling on female children was significantly different from that on male children, and that female children benefited more than male children ($p < 0.01$) (row 5, column 4).

The average educational attainment of parents seemingly had larger effects on their children's schooling. Male children's schooling was 2.442 years more than that of female children ($p < 0.01$) (Table 4, row 1, column 6). When parents' schooling increased by a year, their children's schooling improved by 0.282 years on average ($p < 0.01$) (row 6, column 6). The schooling of female children increased by 0.120 years more than that of male children if the average educational attainment of parents increased by a year ($p < 0.01$) (row 7, column 6).

In the FFE estimation, the relationship between parents' schooling and children's schooling is consistent with the results obtained from the OLS estimation, but the magnitudes of the coefficients are much larger. The schooling of children born in the 1960s was at least 1.6 years more than that of children born before 1960 ($p < 0.01$) (Table 4, row 8, columns 1, 3, and 5). As for children born in the 1970s, their schooling was at least 2.5 years more than those born before 1960 ($p < 0.01$) (row 9, columns 1, 3, and 5). The schooling of children born in the 1980s and 1990s was at least 4.5 and 5.6 years more than that of children born before 1960, respectively (row 10, columns 1, 3, and 5; row 11, columns 1, 3, and 5). In addition, female children benefited more in terms of achieving education over time. In all the models, the schooling of female children born in the 1990s showed a significantly higher increase than that of males born in the same period (row 15, columns 1–6).

3.4. Robustness check

To conduct the robustness check, we carried out the OLS and FFE estimations again using the subsample of households with both male and female children. Appendix Tables A1 and A2 present the subsample distribution and some summary statistics of the schooling years of different birth cohorts.

The results from the robustness checks using the subsample are consistent with what we have presented above using the full sample. The OLS model showed that the schooling of male children was more than that of female children, regardless of whether we considered father's and mother's educational attainment separately or together ($p < 0.01$) (Table 5, row 1, columns 2, 4, and 6). Furthermore, father's or mother's educational attainment, and both parents' educational attainment had positive effects on children's schooling ($p < 0.01$) (row 2, column 2; row 4, column 4; row 6, column 6). Female children also benefited more from improvement in father's educational attainment, mother's educational attainment, and the average of both parents' educational attainment, but the magnitude of the coefficient was slightly smaller than that in the results from the full sample ($p < 0.01$) (row 3, column 2; row 5, column 4; row 7, column 6).

The robustness check using the FFE estimation provided similar and consistent results: the schooling years of male children was more than that of female children ($p < 0.01$) (Table 6, row 1, columns 2, 4, and 6).

[2] In columns 2, 4, and 6 of Tables 3–6, we controlled the interaction terms of village and birth cohorts, which were collinear with birth cohorts.

Table 3
Relationship between parent's and child's schooling with a gender perspective: Estimation of the OLS model, full sample.

	Explanatory variables	Dependent variable: Schooling of child (years)					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Male (1 = yes)	2.395***	2.090***	2.307***	1.987***	2.339***	2.089***
		(0.591)	(0.655)	(0.621)	(0.705)	(0.600)	(0.674)
(2)	Schooling of father (years)	0.355***	0.297***				
		(0.027)	(0.024)				
(3)	Male*schooling of father	−0.106***	−0.091***				
		(0.027)	(0.028)				
(4)	Schooling of mother (years)			0.350***	0.278***		
				(0.032)	(0.026)		
(5)	Male*schooling of mother			−0.115***	−0.114***		
				(0.030)	(0.030)		
(6)	Schooling of parents (years)					0.519***	0.440***
						(0.033)	(0.028)
(7)	Male*schooling of parents					−0.161***	−0.148***
						(0.031)	(0.032)
(8)	Cohort_1960s	0.894**		1.237***		0.697	
		(0.425)		(0.434)		(0.423)	
(9)	Cohort_1970s	1.387***		1.882***		1.076**	
		(0.453)		(0.485)		(0.467)	
(10)	Cohort_1980s	3.069***		3.421***		2.363***	
		(0.480)		(0.509)		(0.490)	
(11)	Cohort_1990s	3.813***		3.986***		2.924***	
		(0.457)		(0.476)		(0.460)	
(12)	Male*Cohort_1960s	−0.586	−0.157	−0.769	−0.227	−0.491	−0.082
		(0.561)	(0.649)	(0.615)	(0.703)	(0.579)	(0.671)
(13)	Male*Cohort_1970s	−0.795	−0.612	−1.002	−0.719	−0.659	−0.497
		(0.619)	(0.688)	(0.672)	(0.749)	(0.643)	(0.714)
(14)	Male*Cohort_1980s	−1.338**	−1.150*	−1.368**	−1.099	−1.021	−0.870
		(0.621)	(0.692)	(0.684)	(0.750)	(0.645)	(0.715)
(15)	Male*Cohort_1990s	−2.114***	−2.099***	−2.255***	−2.077***	−1.823***	−1.814**
		(0.638)	(0.704)	(0.689)	(0.753)	(0.655)	(0.724)
(16)	Age when child is born, father	0.010	−0.003			−0.012	−0.024
		(0.011)	(0.010)			(0.018)	(0.018)
(17)	Age when child is born, mother			0.026**	0.008	0.049***	0.045**
				(0.012)	(0.011)	(0.018)	(0.020)
(18)	Minority (1 = yes)	0.465	0.263	0.094	0.187	0.044	0.217
		(0.292)	(0.456)	(0.283)	(0.475)	(0.243)	(0.456)
(19)	Village*Cohort	No	Yes	No	Yes	No	Yes
(20)	Constant	4.015***	4.817***	4.167***	4.623***	3.531***	4.197***
		(0.484)	(0.676)	(0.477)	(0.701)	(0.468)	(0.680)
(21)	Observations	6119	6119	6119	6119	6119	6119
(22)	R-squared	0.219	0.365	0.214	0.355	0.254	0.379

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The interaction terms of villages and birth cohorts are included in (2), (4) and (6).

Father's or mother's educational attainment, and the average of both parents' educational attainment had positive effects on children's schooling ($p < 0.01$) (row 2, column 2; row 4, column 4; row 6, column 6). Female children also benefited more from improvement in father's educational attainment, mother's educational attainment, and the average of both parents' educational attainment ($p < 0.01$) (row 3, column 2; row 5, column 4; row 7, column 6).

The results from both the OLS and FFE estimations showed that children's schooling increased over time, and that female children showed more improvement than male children. For example, from the results of the FFE estimation, we can see that the schooling of children born in the 1970s was at least 2.5 more years than that of children born before 1960 (Table 6, row 9, columns 1, 3 and 5). Moreover, for those born in the 1990s, their schooling years was at least 5.7 years more than those of children born before 1960 (row 11, columns 1, 3 and 5). The schooling gap between female and male children born in the 1990s narrowed by around 2.5 years compared to those born before 1960, with female children showing a faster improvement than their male peers (row 15, columns 1–6).

4. Conclusion and discussion

This study examined the role of parents' education on their children's education from a gender perspective. By using the OLS and FFE model, we verified the correlation between parents' schooling and their children's schooling. Our results indicate a remarkable reduction in the education gap between male and female children over time. Overall, children's years of schooling have been steadily increasing, along with the increase in their parents schooling, regardless of their gender. Additionally, we found that the gender gap in children's schooling years decreases as their parents' educational level increases. Another distinctive feature we observed is that later birth cohorts tend to have more years of schooling.

Regarding our primary research question of whether gender matter for the intergenerational transmission of education in rural China, our results indicate that the answer is yes. For those born before the 1980s, the total effect of gender on their educational attainment was more than two years. In other words, the average schooling of male children was two years more than that of female children. For those born after 1980, our results show that there is no statistically significant difference between male and female children's educational attainment. During this transition, parents' educational attainment might play a significant role in narrowing the educational gender gap of their children.

Our results show that the gender gap in children's education has been narrowing over the last several decades, which is consistent with the results of previous studies (Guo and Wu, 2010; Hannum and Xie,

Table 4
Relationship between parent's and child's schooling with a gender perspective: Estimation of the FFE model, full sample.

	Explanatory variables	Dependent variable: Schooling of child (years)					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Male (1 = yes)	2.621***	2.422***	2.544***	2.353***	2.646***	2.442***
		(0.505)	(0.639)	(0.493)	(0.627)	(0.496)	(0.631)
(2)	Schooling of father (years)	0.150***	0.176***				
		(0.031)	(0.030)				
(3)	Male*schooling of father	−0.081***	−0.069**				
		(0.028)	(0.029)				
(4)	Schooling of mother (years)			0.170***	0.192***		
				(0.030)	(0.033)		
(5)	Male*schooling of mother			−0.100***	−0.098***		
				(0.030)	(0.030)		
(6)	Schooling of parents (years)					0.244***	0.282***
						(0.037)	(0.042)
(7)	Male*schooling of parents					−0.131***	−0.120***
						(0.033)	(0.035)
(8)	cohort_1960s	1.762***		1.838***		1.663***	
		(0.402)		(0.407)		(0.404)	
(9)	cohort_1970s	2.753***		2.822***		2.564***	
		(0.460)		(0.473)		(0.470)	
(10)	cohort_1980s	4.961***		4.894***		4.571***	
		(0.462)		(0.495)		(0.483)	
(11)	cohort_1990s	6.138***		6.009***		5.660***	
		(0.477)		(0.504)			
(12)	Male*Cohort_1960s	−0.658	−0.497	−0.747	−0.546	−0.629	−0.448
		(0.533)	(0.652)	(0.542)	(0.654)	(0.539)	(0.653)
(13)	Male*Cohort_1970s	−1.111**	−0.996	−1.210**	−1.056	−1.045*	−0.911
		(0.540)	(0.668)	(0.553)	(0.674)	(0.555)	(0.677)
(14)	Male*Cohort_1980s	−1.292**	−1.161*	−1.333**	−1.155*	−1.121**	−0.974
		(0.542)	(0.680)	(0.571)	(0.692)	(0.561)	(0.689)
(15)	Male*Cohort_1990s	−2.648***	−2.674***	−2.615***	−2.607***	−2.420***	−2.442***
		(0.566)	(0.677)	(0.587)	(0.684)	(0.582)	(0.687)
(16)	Age when child is born, father	−0.030***	−0.030**			−0.000	−0.035
		(0.011)	(0.012)			(0.029)	(0.033)
(17)	Age when child is born, mother			−0.030**	−0.026**	−0.024	0.016
				(0.011)	(0.013)	(0.032)	(0.036)
(18)	Minority (1 = yes)	0.074	0.139	0.080	0.181	0.097	0.200
		(0.666)	(0.719)	(0.683)	(0.714)	(0.666)	(0.710)
(19)	Village*Cohort	No	Yes	No	Yes	No	Yes
(20)	Constant	4.707***	3.727***	4.931***	4.346***	4.510***	3.595***
		(0.449)	(0.350)	(0.399)	(0.381)	(0.431)	(0.326)
(21)	Observations	6119	6119	6119	6119	6119	6119
(22)	R-squared	0.232	0.324	0.232	0.324	0.235	0.328
(23)	Number of household	1924	1924	1924	1924	1924	1924

Data source: Authors' survey.
Notes: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The interaction terms of villages and birth cohorts are included in (2), (4) and (6).

1994; Li, 2010; Ye and Wu, 2011; Wang et al., 2020). Some studies have attempted to explore the reasons for the narrowing of the educational gender gap. On this issue, most existing studies have considered the trend of gender inequality in education from a macroeconomic or structural perspective. According to the literature, the continuous expansion of Chinese education, the practice of gender equality in the redistribution period, the decline in the birth rate caused by China's population policy, and the change of population structure are the main factors leading to the decline in gender inequality in Chinese children's education (Hannum and Xie, 1994; Lavely et al., 1990; Ye and Wu, 2011).

However, our study shows that the improvement in parents' educational attainment is also an important factor in narrowing the educational gender gap between male and female children. Due to China's reform and economic development, parents may have become more aspirational for their children than they were in the past, and gender norms in the broader social setup may also be changing (Basit, 2012; Qian, 2008). Additionally, parents with different educational levels may have different effects on the education of children of different genders in society. For example, for parents with lower educational levels or those living in rural areas, the preference toward the education of male children may be more acute (Chung and Gupta, 2007; Graham et al., 1998). In the context of grand social changes, improvement in parents' educational attainment may be one of the micro reasons for the narrowing of gender difference in education, occurring through the following three main channels. First, more educational attainment results in a higher household income level, thus helping to ease the budget constraints of achieving education for each child (Antman, 2012; Du et al., 2005; Yang, 2008). As such, the preference for educating a boy over a girl, for example, is lessened proportionately. Second, higher levels of parental educational attainment accelerate the departure from traditional attitudes toward gender, and foster the acceptance of new ideas caused by economic development and social evolution. These effects are coupled with a greater ability to adapt to the trend of gender equality (Fernández, 2013). Third, more educated parents may have a better understanding of how to raise children in accordance with each child's specific aptitudes, rather than tending to their education simply by putting them into gender-based categories.

In South Asia and Africa, as well as in developing countries in other parts of the world, gender inequality in educational attainment is still very significant. About one third of developing countries have not achieved gender equality in primary education. In sub-Saharan Africa, Oceania, and Western Asia, girls still face many barriers to entering both primary and secondary school. In addition to poverty, barriers to

Table 5
Relationship between parent's and child's schooling with a gender perspective: Estimation of the OLS model, subsample.

	Explanatory variables	Dependent variable: Schooling of child (years)					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Male (1 = yes)	2.363***	2.229***	2.269***	2.124***	2.310***	2.208***
		(0.608)	(0.661)	(0.636)	(0.717)	(0.621)	(0.688)
(2)	Schooling of father (years)	0.353***	0.295***				
		(0.030)	(0.027)				
(3)	Male*schooling of father	−0.105***	−0.084***				
		(0.028)	(0.029)				
(4)	Schooling of mother (years)			0.352***	0.272***		
				(0.036)	(0.031)		
(5)	Male*schooling of mother			−0.114***	−0.102***		
				(0.030)	(0.033)		
(6)	Schooling of parents (years)					0.515***	0.431***
						(0.036)	(0.033)
(7)	Male*schooling of parents					−0.161***	−0.137***
						(0.033)	(0.036)
(8)	Cohort_1960s	0.897**		1.233***		0.707	
		(0.430)		(0.440)		(0.430)	
(9)	Cohort_1970s	1.288***		1.777***		1.004**	
		(0.458)		(0.494)		(0.475)	
(10)	Cohort_1980s	2.800***		3.204***		2.172***	
		(0.504)		(0.531)		(0.513)	
(11)	Cohort_1990s	3.880***		4.048***		3.021***	
		(0.463)		(0.494)		(0.470)	
(12)	Male*Cohort_1960s	−0.473	−0.265	−0.633	−0.316	−0.361	−0.173
		(0.585)	(0.681)	(0.636)	(0.738)	(0.607)	(0.711)
(13)	Male*Cohort_1970s	−0.725	−0.713	−0.913	−0.823	−0.583	−0.598
		(0.626)	(0.715)	(0.683)	(0.777)	(0.654)	(0.748)
(14)	Male*Cohort_1980s	−0.967	−1.046	−1.064	−1.070	−0.688	−0.805
		(0.633)	(0.724)	(0.697)	(0.783)	(0.661)	(0.756)
(15)	Male*Cohort_1990s	−2.167***	−2.350***	−2.323***	−2.373***	−1.883***	−2.091***
		(0.644)	(0.720)	(0.698)	(0.774)	(0.666)	(0.750)
(16)	Age when child is born, father	0.016	0.002			−0.005	−0.014
		(0.012)	(0.011)			(0.021)	(0.021)
(17)	Age when child is born, mother			0.027**	0.005	0.044**	0.035
				(0.013)	(0.013)	(0.021)	(0.024)
(18)	Minority (1 = yes)	0.529	0.184	0.139	−0.042	0.114	0.081
		(0.341)	(0.494)	(0.295)	(0.536)	(0.262)	(0.509)
(19)	Village*Cohort	No	Yes	No	Yes	No	Yes
(20)	Constant	3.867***	1.652**	4.144***	1.998***	3.447***	1.658**
		(0.501)	(0.687)	(0.491)	(0.705)	(0.481)	(0.693)
(21)	Observations	4864	4864	4864	4864	4864	4864
(22)	R-squared	0.224	0.385	0.217	0.374	0.256	0.397

Data source: Authors' survey.
Note: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The interaction terms of villages and birth cohorts are included in (2), (4) and (6).

education can include caste, ethnic and linguistic background, race, and children's gender (United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015). Undoubtedly, this has stagnated social progress in most developing countries. Disadvantages in education translate into lack of access to skills and limited opportunities in the labor market (World Economic Forum, 2017). What is known is that many less-educated parents lack the resources and knowledge to boost their children's early cognitive development and socioemotional development (United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015). This is similar to the situation observed in China for many years. The findings of this study on China may be helpful in understanding the gender gap in educational attainment of other developing countries. With the development of the economy and the progress of society, the gender gap in education is narrowing. In addition, parents' schooling also plays an important role in narrowing the gender gap in their children's schooling. The findings obtained in this study indicate that parents' schooling has a positive effect on narrowing the gender gap in their children's schooling, which could be the case in other developing countries as well. Some measures implemented in China, like a compulsory education law, which does not distinguish between genders, may be extended to other developing countries and may help narrow those countries' gender gaps in educational attainment.

However, there is still a significant lack of studies on the intergenerational transmission effect of parents on their children from a gender perspective in developing countries. We found only one study on this topic that showed that women are more likely to benefit from additional parental education and take advantage of the increasing availability of schooling in Mexico (Binder and Woodruff, 2002). This result can also be seen in the case of Malaysia (Lillard and Willis, 1994). While these two studies reflect the situation of each country more than twenty years ago, their economic development at that time was similar to the present rural China. Therefore, the conclusion that female children would benefit if their parents have high educational attainment may be expanded to other developing countries with economies similar to that of China. This may also predict the trends in educational attainment with respect to gender in less developed countries.

Due to the data limitation, we have no information on the schools these children attend to. However, we have included the interaction terms of villages and birth cohorts in the model. At the stage of compulsory education, China implements the policy of "Enrollment at Nearest Schools" based on the place of residence (Wu and Huang, 2017). Generally, there is one primary school in most villages and one junior high school in most townships in rural China. Most rural children complete their primary school education in the village and junior high school education in the township. So the impact of quality of schools on

Table 6
Relationship between parent's and child's schooling with a gender perspective: Estimation of the FFE model, subsample.

	Explanatory variables	Dependent variable: Schooling of child (years)					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Male (1 = yes)	2.617***	2.525***	2.534***	2.440***	2.633***	2.530***
		(0.514)	(0.643)	(0.502)	(0.633)	(0.506)	(0.636)
(2)	Schooling of father (years)	0.146***	0.171***				
		(0.032)	(0.033)				
(3)	Male*schooling of father	−0.082***	−0.071**				
		(0.028)	(0.030)				
(4)	Schooling of mother (years)			0.164***	0.190***		
				(0.031)	(0.036)		
(5)	Male*schooling of mother			−0.097***	−0.091***		
				(0.031)	(0.031)		
(6)	Schooling of parents (years)					0.235***	0.275***
						(0.038)	(0.046)
(7)	Male*schooling of parents					−0.129***	−0.117***
						(0.033)	(0.037)
(8)	Cohort_1960s	1.763***		1.840***		1.670***	
		(0.406)		(0.415)		(0.409)	
(9)	Cohort_1970s	2.688***		2.768***		2.517***	
		(0.468)		(0.485)		(0.479)	
(10)	Cohort_1980s	5.006***		4.946***		4.628***	
		(0.475)		(0.518)		(0.499)	
(11)	Cohort_1990s	6.165***		6.049***		5.705***	
		(0.471)		(0.511)		(0.507)	
(12)	Male*Cohort_1960s	−0.575	−0.551	−0.662	−0.597	−0.543	−0.502
		(0.553)	(0.667)	(0.559)	(0.669)	(0.559)	(0.669)
(13)	Male*Cohort_1970s	−1.098**	−1.062	−1.204**	−1.134	−1.034*	−0.987
		(0.553)	(0.687)	(0.565)	(0.692)	(0.567)	(0.695)
(14)	Male*Cohort_1980s	−1.281**	−1.222*	−1.333**	−1.249*	−1.109*	−1.051
		(0.547)	(0.683)	(0.576)	(0.695)	(0.567)	(0.692)
(15)	Male*Cohort_1990s	−2.734***	−2.838***	−2.714***	−2.813***	−2.510***	−2.626***
		(0.572)	(0.669)	(0.597)	(0.678)	(0.591)	(0.680)
(16)	Age when child is born, father	−0.031**	−0.033**			−0.005	−0.034
		(0.012)	(0.014)			(0.031)	(0.036)
(17)	Age when child is born, mother			−0.031**	−0.029*	−0.021	0.011
				(0.012)	(0.014)	(0.032)	(0.038)
(18)	Minority (1 = yes)	0.014	0.145	0.050	0.264	0.062	0.275
		(0.810)	(0.918)	(0.829)	(0.906)	(0.810)	(0.904)
(19)	Village*Cohort	No	Yes	No	Yes	No	Yes
(20)	Constant	4.738***	5.643***	4.952***	5.852***	4.563***	5.425***
		(0.454)	(0.423)	(0.396)	(0.356)	(0.432)	(0.398)
(21)	Observations	4864	4864	4864	4864	4864	4864
(22)	R-squared	0.242	0.345	0.242	0.346	0.245	0.349
(23)	Number of household	1196	1196	1196	1196	1196	1196

Data source: Authors' survey.
Note: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The interaction terms of villages and birth cohorts are included in (2), (4) and (6).

the results of this study is limited. In addition, previous studies show the heterogeneity in school quality mainly occurs in schools between urban and rural areas and the heterogeneity in school quality in rural China is minute (Jiang, 2017; Wu and Huang, 2017; Zong et al., 2018). Hence it's important to look at the variables of parent's education in this study.

While the focus of this study was on the impact of parents' education on the educational gender gap of children, an important question remains: could schools play a pivotal role in narrowing the educational gender gap? Certainly, there are many studies that have investigated the effectiveness of schools on educational attainment or the educational gender gap (Autor et al., 2016; Coleman et al., 1966; Dobbie and Roland, 2011; Egalite, 2016; Hiatt-Michael, 2014; Muñoz-Chereau, 2019; Rivkin et al., 2005; Rolleston and Krutikova, 2014; Sirin, 2005). But there is no consensus on whether schools can be effective in this regard. Some previous studies on school effectiveness research suggests the role of schools in shaping child outcomes (attainment or achievement) is around 20–25 %, so the educational gender gap needs to be addressed mainly beyond schools (Muñoz-Chereau, 2019). Thus, the cooperation of the government, school, and family may be important in the pursuit of educational gender equality. The government could promote educational gender equality by improving its capability to monitor school performance (Berkowitz et al., 2017; Willms and Somer, 2001). Moreover, school effectiveness depends on parents' attitude to some extent. There needs to be a program or policy in place to encourage families (especially parents) to actively participate in children's educational management through a reasonable and effective mechanism to prevent the decline of the educational function of the family, and instead revitalize it. For example, parenting education initiatives that had been funded by the government across a range of OECD countries for many years could be embedded into the family policy agendas of developing countries (Shulruf et al., 2009). As a result, the educational attainment expectancy of current children would receive a boost, and educational gender inequality for the future generation would be achieved much sooner.

This paper, to the best of our knowledge, has made at least three significant contributions to the literature. First, we verified that an increase in parents' schooling influences the narrowing of the educational gender gap of their children. Second, we used China's rural data to understand the role of parents' education on their children's education, with a focus on gender inequality. Finally, the family fixed effects model was used to alleviate the problem of endogeneity.

Despite the abovementioned contributions, we acknowledge at least two limitations to our study. First, we did not control for socio-

Table A1
Descriptions of child's schooling years by gender composition.

	Child gender composition in the same family	Schooling of child (years)	Sample size	Percentage (%)
(1)	Only boy	9.52	792	12.83
(2)	Only girl	10.21	472	7.71
(3)	Both boy and girl	8.83	4905	79.46

Data source: Authors' survey.

Table A2
Child's schooling years by gender and cohort.

Child's birth cohort	Those from households with both boy and girl (1)	Those from households with only boy (2)	Those from households with only girl (3)	Difference = (1) - (2) (4)	t-Test (p-value) H0: (1) = (2) (5)	Difference = (1) - (3) (6)	t-Test (p-value) H0: (1) = (3) (7)
(1) Before 1960	6.21	7.55	NA.	−1.34	0.32	NA.	NA.
(2) Cohort_1960s	7.51	7.47	6.78	0.04	0.92	0.73	0.52
(3) Cohort_1970s	8.06	8.88	8.75	−0.81	0.00***	−0.69	0.05**
(4) Cohort_1980s	9.98	10.26	10.70	−0.28	0.25	−0.72	0.00***
(5) Cohort_1990s	10.50	10.31	10.58	0.19	0.52	−0.08	0.81

Data source: Authors' survey.
Note: Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

economic status of the household in the estimation due to data limitation. Though the family fixed effects could account for this absence to a limited extent, the results may still be affected. Meanwhile, the R-square value of estimation results in our study is about 0.32 − 0.40. It implies that there are still many factors, including SES, which have an impact on the educational attainment but not included in our study. Second, the conclusion of this study depends on a hypothesis that seems to be a little strong: that parents and their children share indistinguishable genetics, ability, and family background. It is also worth emphasizing that it's not a causal inference in this study. In further studies, we will attempt to solve these problems by searching for more appropriate data and using more advanced approaches.

Author statement

The authors declared that they have no conflicts of interest to this work. We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the manuscript submitted. We would like to confirm that this manuscript has not been published, nor is it being considered for publication elsewhere. We will make sure that all of the other co-authors are kept informed as to the progress of the review.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Appendix A

See

Appendix B. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ijedudev.2020.102220.

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