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Gender differences in intergenerational effects of laid-off parents

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ABSTRACT

This paper evaluates the gender differences in intergenerational effects of laid-off parents on children's adult outcomes. Using the China Health and Nutrition Survey (CHNS) over the period from 1991 to 2015, we construct the children's lengths of exposure to fathers'/mothers' layoffs from state-owned enterprises (SOEs) retrenchment starting in the 1990 s before they turn 18 years old. We find that, when experiencing fathers' layoffs for a longer period, only girls suffer a significant reduction in education outcomes and are hence more likely to have manual occupations; when suffering mothers' layoffs for a longer period, boys' education levels increase, but this advantage does not reduce their probability of having manual occupations. Although the gender difference in children's education persists in their occupations, girls do not underperform in adult earnings compared to boys with similar family backgrounds. Instead, for girls with manual occupations, fathers' layoffs increase their gardening income.

1. Introduction

It is well documented that significant gender differences exist in adult outcomes, which could be explained by different responses to family backgrounds and/or childhood environments across gender (Chetty et al., 2016; Brenøe and Lundberg, 2018; Figlio et al., 2019). When a family's economic status changes, girls often respond differently from boys in education attainment (Johnston et al., 2014; Liu and Hannum, 2017), but in addition parents also invest differently in children's human capital based on gender (Brown and Park, 2002; Bhalotra and Rawlings, 2011; Duflo, 2012; Roy, 2015). However, there has not been a thorough discussion whether or not such different responses could persistently affect children's labor market performance when they grow up.¹

A typical example is China's SOE retrenchment starting in the 1990 s, during which period many urban workers suffered involuntary layoffs (Giles et al., 2006; Naughton, 2006). Losing "iron bowl" jobs led to substantively negative impacts on these workers' family incomes, social ties and health (Dong and Xu, 2008; Tian et al., 2022). During that period of time, they also invested less in their children, who have grown up and entered the labor market by now (Liu and Zhao, 2014). Could this shortage of investment suffered by children lead to further disadvantages in their labor market performance as adults? This question still remains unanswered.

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¹ Both Liu and Zhao (2014) and Pieters and Rawlings (2020) find heterogeneous effects on children's health across gender in the short run. Oreopoulos et al. (2008) show that the negative effect for boys on earnings is similar to that for girls in Canada. Huttunen and Riukula (2019) suggest that the effects on career decisions do not show gender differences in Finland.

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To this end, our paper examines gender differences in the effects of laid-off parent(s) on children's adult outcomes in China by exploiting nine waves of longitude data from CHNS over 1991–2015. These waves cover both the entire period of SOE retrenchment starting from the 1990 s and the post 1990 s era. Our sample is restricted to individuals who were under 18 years old during the period 1991–2004 and whose parent(s) had a working history in public institutions, SOEs, or collective enterprises in this time. Individuals' adult outcomes are collected from the wave 2006–2015 in CHNS.

To identify the intergenerational effects, we construct the duration of exposure, which is equal to eighteen minus one's age when an individual's parent(s) suffered layoff from SOEs plus one. The coefficient of the duration of exposure measures the treatment effect. This is because a dummy variable of the layoff itself could not capture the multi-valued treatment when a child experienced the layoff for a longer period. During the SOE retrenchment period, a child's characteristics barely affect his/her father's and/or mother's decision of quitting an "iron bowl" job. Being laid off from such a job would lead to a significant negative shock on the family's income and economic status. We consider three scenarios of layoffs separately: 1) an individual only has a laid off father; 2) he/she only has a laid off mother; 3) he/she has a laid off father and/or mother. To alleviate potential bias, we control individuals' characteristics at individual, family, community and provincial levels, along with individuals' birth year fixed effect and wave fixed effect. Moreover, to emphasize the potential gender difference in individuals' adult outcomes, we construct the interaction term between an individual's gender and his/her duration of exposure to the father's/mother's layoff, which measures the increment of the effects for being a girl compared to being a boy.

We investigate the intergenerational effects by analyzing children's long-term outcomes, including education and labor market outcomes. We find significant gender differences in children's education and occupational outcomes: when being exposed to fathers' layoffs for a longer period, only girls suffer a significant reduction in education outcomes and are hence more likely to have manual occupations. In contrast, when being exposed to mothers' layoffs for a longer period, only boys' education levels increase. However, these differences do not lead to disadvantages for girls in adult earnings. Our results also suggest that investing in children's education based on gender is not efficient for Chinese families.

Specifically, when suffering fathers' layoffs for a longer period, only girls have lower education levels, while those of boys are not affected. When suffering mothers' layoffs for a longer period, boys have higher education years and a higher probability of having a college degree; by contrast, relative to boys, girls experience lower education years and a lower probability of having a college degree. The existence of gender differences in education outcomes from fathers'/mothers' layoffs implicitly shows unequal family investment in children's education across genders. When a family suffers a negative economic/income shock, girls suffer more from the re-balance between family expenditures and investment in children's education compared to boys. Thus, together with the perception of gender roles (Johnston et al., 2014), girls are more likely to drop out of school and work to subsidize the loss of family income, while boys are less likely to be asked to do so. Although a laid-off mother, whose salary is not the main source of the family's income, could spend more time on taking care of the children (Liu and Zhao, 2014), we only observe a significant positive effect on education for boys.

Following Acemoglu and Autor (2011) and Cortes et al. (2017), we consider the cognitive dimension of occupations according to task content and categorize occupations into two groups: cognitive and manual ones. When suffering fathers' layoffs for a longer period, girls are more likely to work in manual occupations relative to cognitive ones that require a certain level of education. Instead, boys with a similar family background are not affected. This gender difference is a persistent result of the gender difference in education from fathers' layoffs. When suffering mothers' layoffs for a longer period, a similar result is obtained.² This is also caused by the gender difference in education from mothers' layoffs. The significant increase in boys' education from mothers' layoffs does not reduce the probability of having a manual occupation. This is due to the less important role of mothers in children's career choices (Huttunen and Riukula, 2019).

We demonstrate that boys do not outperform girls in adult earnings even though they receive more family support. For boys, neither education nor occupations are affected by fathers' layoffs, so their adult earnings are also not affected. However, girls' adult earnings are not affected either, given the significant negative impact on their education and occupations. Even though girls with manual occupations suffer losses in education, they earn more in gardening income relative to boys with a similar family background.

We apply both a placebo test and an instrumental variable (IV) approach to guarantee our results' robustness. In the placebo test, we randomly assign the treatment group and construct the placebo treatment status for the same sample of individuals as in our main analysis. Following Xiao et al. (2017), after 500 bootstraps, we show that our baseline regression results lie outside the range of those in our placebo tests and the corresponding p-values are all zero. In the IV approach, we exploit the percentage reduction in the numbers of workers in SOEs and collective enterprises in the individual's corresponding province when he/she suffered the father's/mother's layoff. Based on this proxy, we calculate the quasi-exposure and interact it with the gender dummy. The results from the 2SLS estimations show the robustness of our conclusions.

This paper contributes to the research on the long-term impact of laid-off parents in the following two ways. In the first place, we emphasize the existence of gender differences in intergenerational effects. Oreopoulos et al. (2008) and Hilger (2016) show a significant negative effect of laid-off fathers on children's adult earnings in Canada and the US, while Bratberg et al. (2008), Hilger (2016) and Fradkin et al. (2019) document that such an effect does not exist in Norway or Belgium. None of them suggest heterogeneous intergenerational effects across genders. In terms of effects on school performance (Rege et al., 2011), education investment (Pan and Ost, 2014) and career choices (Huttunen and Riukula, 2019), the current literature also does not suggest a

² Note that the corresponding estimate for girls is significant under the Logistics specification, but not under the OLS specification. Thus, we should be cautious when interpreting the significant effect of mothers' layoffs on girls' occupational outcomes. Details are shown in Table 2.

significant difference between boys and girls. On the contrary, we find that only girls suffer lower education levels from laid-off fathers and hence higher probabilities of having manual occupations. Moreover, the significant gender difference in the negative effects of mothers' layoffs on children's education is persistent in their occupations, an effect that is also absent in previous studies.

Secondly, this paper complements the evidence on intergenerational effects of laid-off parents on children in developing countries. The existing conclusions are based on studies in western developed countries, such as Canada (Oreopoulos et al., 2008), Finland (Huttunen and Riukula, 2019), Norway (Bratberg et al., 2008), the US (Hilger, 2016), and Belgium (Fradkin et al., 2019), while the evidence for developing countries is still limited. China, the largest developing country, has been experiencing urban labor market reforms since the middle of the 1980 s, and many workers suffered involuntary job loss from SOEs since the 1990 s. Scholars have discussed the effect of such reforms on workers of that generation as well as the short-run outcomes of the second generation (Liu and Zhao, 2014; Liu and Hannum, 2017; Kong et al., 2019). However, it is still unknown how this reform affects the successive generation in the long run.³ Most children who experienced their father's and/or mother's layoff from SOEs are over 18 years old now, providing an opportunity for us to investigate their performance. To our best knowledge, this is the first paper examining the intergenerational effects of laid-off parents on children in developing countries.

This paper is also related to studies on the gender differences in the effects of the family background and/or childhood environment on child development and adult outcomes (Chetty et al., 2016; Brenøe and Lundberg, 2018; Figlio et al., 2019). These papers conclude that boys benefit (suffer) more from an advantageous (disadvantageous) family than girls in terms of cognitive and behavioral outcomes. In contrast, we investigate whether gender gaps also exist in intergenerational effects when a family's socio-economic background suffers a negative shock, i.e., layoff. We show that boys do not outperform girls in terms of adult earnings, although they receive more family support than girls. Thus, the education investment in children based on gender is inefficient.

The rest of the paper is organized as follows. Section 2 summarizes the background of SOE retrenchment in China. Section 3 describes the dataset, the measures of key variables and the empirical strategy that we apply. Section 4 demonstrates the main results of our analysis as well as tests for robustness. Finally, Section 6 concludes. Detailed variable definitions are shown in Appendix A.

2. The background of SOE retrenchment in China

Before the end of 1992, China's reform was labeled as a "reform without losers" protecting the position of workers in SOEs and collectively owned firms (Lau et al., 2000; Naughton, 2006, p.90). However, the severe labor redundancy problem made SOEs unprofitable and drained local government budgets (Dong and Putterman, 2003; Liu and Zhao, 2014). In 1992, the "iron bowl", providing lifetime job security and generous non-wage welfare benefits, was criticized in the official press (Berkowitz et al., 2017).

To reverse the loss, SOE retrenchment gradually began following Deng Xiaoping's "south tour" and the 14th National Congress of the Communist Party in 1992.⁴ This retrenchment was labeled a "reform with losers" (Naughton, 2006, p.91). In this phase, millions of employees involuntarily lost their jobs from SOEs, collective enterprises and public service units. Layoffs exceeded 50 million employees between 1993 and 2004 (Dong and Xu, 2008). We show a similar trend in Fig. 1 using data from China Stock Market & Accounting Research (CSMAR). In Fig. 1, the number of workers at SOEs began to shrink in 1993, and the most massive layoffs occurred in 1998. The growth rate of SOE workers remains negative between 1999 and 2006.

Being laid-off from such an "iron bowl" job would lead to a significant negative shock on family income and economic status. Giles et al. (2006) demonstrate that "nearly two-thirds of job separation was involuntary during the retrenchment period, and of those who left jobs voluntarily, 62.3% found new jobs within a year, while the re-employment rate was only about 30% for those losing their jobs because of restructuring or other involuntary reasons". Tian et al. (2022) find that workers displaced during the SOE reform suffered substantial and long-lasting earnings losses because they were more likely to work in low-skilled occupations in the private sector, less likely to receive bonuses, tended to receive smaller bonuses, and were more likely to have temporary jobs.

3. Data and empirical strategy

3.1. Regression sample

We exploit nine waves of data from CHNS for the period 1991–2015. This longitudinal survey is an international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health (former National Institute of Nutrition and Food Safety) at the Chinese Center for Disease Control and Prevention.

CHNS covers 15 out of 31 provinces in China, including coastal, middle, northeastern, and western provinces.⁵ The survey took

³ Although Liu and Zhao (2014) show the short-term effect on children's health, a discussion on the long-term outcomes of these children is missing. Tian et al. (2022) show the long-term effect on laid-off workers, but the intergenerational effects are not discussed.

⁴ This congress convened and endorsed a "socialist market economy", making clear that markets must extend to all main sectors of the economy. Detailed information can be found under the following link: <http://www.chinatoday.com/org/cpc/cpc14thcongressstandingpolibureau.htm>.

⁵ The CHNS was designed to examine the effects of the health, nutrition and family planning policies and programs implemented by national and local governments, and to see how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population. The impact on nutrition and health behaviors and outcomes is gauged by changes in community organizations and programs as well as by changes in sets of household and individual economic, demographic and social factors. Detailed community data were collected in surveys of food markets, health facilities, family planning officials, and other social services and community leaders.



Fig. 1. Workers in SOEs from CSMAR.

place over a 7-day period using a multistage, random cluster process to draw a sample in municipal cities. Currently, there are about 7200 households with over 30,000 individuals in multiple urban and rural areas, which vary widely across geography, economic development, public resources, and health indicators. Ten waves of data have been collected in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011 and 2015. This is the only available longitudinal survey that covers both the entire period of SOE retrenchment starting from the 1990s and its post era. Also, it covered the provinces that were massively affected during the SOE retrenchment period.

Our sample consists of individuals in the CHNS in 2006–2015 who satisfy the following characteristics: the individual lived in an urban area, was born after 1973, below 18 years old over the period 1991–2004, and above 16 years old, which is the lowest legal working age in China, over the period 2006–2015.

3.2. Measures of adult outcomes

In the main analysis, we investigate children’s education and labor market outcomes.

Education outcomes could be treated as the measure of human capital accumulation. A higher education level is positively associated with higher cognitive skills (Cunha et al., 2006, chapter 12; Cunha and Heckman, 2007). On the one hand, a child with higher cognitive skills is more likely to achieve a higher education level (Cunha and Heckman, 2008). On the other hand, education in school could also improve a child’s cognitive skill (Todd and Wolpin, 2003; Carlsson et al., 2015). The following three variables are considered separately: *education years*, *high school diploma*, and *college degree*. *Education years* are calculated as the logarithm of an individual’s education years. *High school diploma* is a dummy variable that is equal to 1 if an individual has a high school, technical, or vocational degree, and 0 otherwise. *College degree* is also a dummy variable, which is 1 if an individual holds a college or university degree or above and 0 otherwise.

As labor market outcomes, we include occupational outcomes and adult earnings. As occupational outcomes, following Acemoglu and Autor (2011) and Cortes et al. (2017), we consider “cognitive” versus “manual”, in which the distinction is based on the extent of mental versus physical activity. Thus, we construct a dummy variable *Manual*, which indicates whether an individual’s occupation is manual. The default type of occupation is thus cognitive, in which a certain level of education, such as a college degree, is necessary.

As adult earnings, we consider both the individual’s *wage* and *annual income*. *Wage* is an individual’s salary from his/her job, while *annual income* is their total yearly net income. Both are inflated to the year 2015 and the logarithms are taken.

3.3. Control variables

To control for potential omitted variable bias, we consider several levels of control variables over the period 2006–2015. All detailed variable definitions are shown in Table A1 in the Appendix.

Individual level. To exclude the effect of individual characteristics on the labor market performance, following Carneiro et al. (2021), we control for an individual’s birth year fixed effect, *age*, *marital status*. In addition, we also control for the individual’s urban household registration, *urban*.⁶

Family level. Since family characteristics are correlated to intergenerational human capital transmission, we control for a set of variables measured at the family level. To control for the characteristics of parents, following Coelli (2011), we control for father’s/mother’s average income during the layoff period 1991–2004, whether the father/mother has a high school diploma during the layoff period, and *high school rate*, measuring the proportion of family members with at least a high school diploma.⁷ Also, we control for

⁶ *Urban* indicates whether an individual has an urban household registration, which is considered as an important determinant of labor market outcomes in China. See Wang and Zuo (1999), Liu (2005), and Pi and Zhang (2016).

other family characteristics, which include: whether the father or mother was the household head; *home scale*, measuring the number of family members; *flat*, indicating whether the family owns flats/houses or not; *vehicle*, indicating whether the family owns a vehicle; and *transfers*, measuring the amount of money received from parents in a year.⁸

Community level. We include the *urbanicity scale*, which is a multicomponent scale measuring urban features at the community level (Jones-Smith and Popkin, 2010) constructed by using CHNS.

Provincial level. We include *provincial dummies* to control for the province fixed effect. Other characteristics at the regional level also play a role in the analysis (Oreopoulos et al., 2008; Coelli, 2011; Huttunen and Riukula, 2019). To exclude the effect of economic growth and labor market tightness, we control for the *number of enterprises above designated size*, *number of private firms*, *number of self-employed business*, *unemployment rates*, and *GDPs*. To control the impact of the University Enrollment Expansion starting from the late 1990s, both the *number of college students* and the *number of high school students* at the provincial level are included. Finally, since China's accession to the World Trade Organization (WTO) had a positive effect on China's economy, we control for the *provincial level of foreign direct investment (FDI)*, and the *provincial consumption level*. All of these variables are measured at the provincial level over waves from 2006 to 2015, and were collected from the National Bureau of Statistics of China.

Moreover, we also control for the wave fixed effect by including wave dummies to exclude the impact of policies and the macroeconomic environment at the national level.

3.4. Empirical strategy

In our sample, we identify laid-off parents over the period 1991–2004 by the following criteria: the parent(s), who worked in public institutions, SOEs, or collective enterprises in the previous wave, reported job transitions from full to part-time or from working to unemployed in the current wave.⁹ An individual is not included in our treatment group if his/her parents did not work in public institutions, SOEs, or collective enterprises despite experiencing a change of employment status between two consecutive waves. A change of employment status due to retirement is also excluded. As Giles et al. (2006) and Tian et al. (2022) mentioned, being laid-off from a job in SOEs or collective enterprises would lead to a significant negative shock on family income and economic status as the laid-off worker cannot find a job with the same stability and good welfare benefits. Such a definition is also applied in Liu and Zhao (2014) and Tian et al. (2022). As the survey took place every 3 or 4 years, it is very unlikely for a working age adult with work experience to continue to be unemployed after suffering a lay-off several years ago.

Thus, we say that an individual suffered the father's (mother's) layoff in wave k if a laid-off father (mother) is identified in wave k , where $k \in \{1993, 1997, 2000, 2004\}$. Accordingly, we introduce a set of dummy variables: $Layoff_{k_i}$ equals 1 if the individual i suffered the father's/mother's layoff in wave k , and 0 otherwise. An individual is in the reference group if his/her parents did not experience such a layoff. We also introduce the duration of exposure to the father's/mother's layoff. It is defined as follows:

$$Exposure_i = \begin{cases} 18 - (k - Birth_Year_i) + 1 & \text{if } Layoff_k_i = 1 \text{ and } k - Birth_Year_i \leq 18 \\ 0 & \text{if } Layoff_k_i = 0 \end{cases} \quad (1)$$

If an individual suffered the father's/mother's layoff, their duration of exposure is equal to 18 minus their age in wave k plus 1; if they did not suffer the father's/mother's layoff in wave k , the duration equals 0. In our sample, individuals who suffered the father's/mother's layoff are all below 18 years old. Thus, the values of the duration variable are always non-negative. Since some individuals suffered the father's/mother's layoff when they were just 18 years old, the difference between 18 and their age in wave k is 0 for them. To distinguish these observations from those in the reference group, we shift up the values of the duration by 1. The duration of exposure is always zero for those in the reference group.

Noting the different roles of fathers and mothers in families, we consider the following three scenarios of being exposed to the father's/mother's layoff separately: 1) an individual only has a laid-off father; 2) he/she only has a laid-off mother; 3) he/she has a laid-off father and/or mother. Thus, the aforementioned variables, $Exposure_i$ and $Layoff_{k_i}$, would also be calculated according to these three scenarios, respectively. In particular, when considering laid-off parents, if both the individual's father and mother were laid off, we choose the longer duration of exposure between the one calculated from the laid-off father and that from the laid-off mother.

Since $Exposure_i$ and $Layoff_{k_i}$ do not vary across survey waves, a fixed effect model could not be applied. Otherwise, these indicators would be eliminated by the within-group difference. Instead, following Xiao et al. (2017), we construct a quasi-experiment as difference-in-differences (DID) in Pooled OLS estimation.

Eqs. (2) and (3) show the two most comprehensive models of the different estimated specifications that we apply in this paper:

$$Y_{i,t} = \tilde{\beta}_0 + \tilde{\beta}_1 Exposure_i + \sum_{k=1993}^{2004} \tilde{\gamma}_k Layoff_k_i + \tilde{\beta}_3 Female_i + \mathbf{X}_{i,t} \tilde{\phi} + \sum_l \alpha_l Birth_Year_l_i + \tilde{\varepsilon}_{i,t}, \quad (2)$$

⁷ Coelli (2011) show that both education and income levels of parents could affect children's long-term performance through the accumulation of human capital.

⁸ Mörk et al. (2020) show the importance of household economic status and control for household disposable income. According to the availability of CHNS, we control for important properties in a family: vehicles and flats.

⁹ CHNS did not distinguish workers in SOEs from those in public institutions in its questionnaires before 2000.

$$Y_{i,t} = \beta_0 + \beta_1 Exposure_i + \beta_2 Exposure_i \times Female_i + \sum_{k=1993}^{2004} \beta_k Layoff_k_i \times Female_i + \beta_3 Female_i + \sum_i \alpha_i Birth_Year_l_i \times Female_i + \sum_{k=1993}^{2004} \gamma_k Layoff_k_i + X_{i,t} \phi + \sum_i \alpha_i Birth_year_l_i + \varepsilon_{i,t}. \quad (3)$$

$Y_{i,t}$ is individual i 's adult outcome in wave $t \in \{1996, 2009, 2011, 2015\}$ including *education years, high school diploma, college degree, manual, wage, and annual income*, which are defined in Section 3.2. $Exposure_{i,t}$ and $Layoff_k_i$ are defined as before, and calculated and discussed accordingly in three different scenarios: laid-off father only, laid-off mother only, and laid-off parent(s). $Female_i$ is the gender dummy indicating whether an individual is female. $Birth_Year_l_i$ is individual i 's birth-year dummy variable, indicating whether he/she was born in year l . $X_{i,t}$ is a collection of control variables at the individual, family, community, and provincial level. Details of the outcome $Y_{i,t}$ and control variables are discussed in Sections 3.2 and 3.3, respectively.

We mainly focus on the coefficient of $Exposure_i$ in Eq. (2) and the coefficients of $Exposure_i$ and $Exposure_i \times Female_i$ in Eq. (3). Since fathers'/mothers' layoffs from SOEs, where jobs were considered as "iron bowl", happened before the individuals turned 18, the observations in our sample are randomly assigned to the treatment or control group. Also, a child's characteristics barely affect the decision of a father, whose income is the main source of family income, to quit an "iron bowl" job. Though $Layoff_k_i$ helps compare individuals suffering fathers'/mothers' layoffs with those not suffering layoffs, it could not capture the multi-valued treatment of fathers'/mothers' layoffs across time. Thus, by introducing $Exposure_i$ in Eq. (2), $\tilde{\beta}_1$ could evaluate the increment of the intergenerational effect when an individual was exposed to fathers'/mothers' layoffs for a longer period.¹⁰

Moreover, to capture the gender differences in these intergenerational effects, we interact $Female_i$ in Eq. (3) with $Exposure_i$, $Layoff_k_i$, and $Birth_Year_l_i$. In this model specification, given others are constant, β_1 is interpreted as the increment of the effect of fathers'/mothers' layoffs for male children, and $\beta_1 + \beta_2$ as the increment of the effect for female children. Therefore, β_2 measures the gender difference in the increment of the intergenerational effect of fathers'/mothers' layoffs.

In addition, for those individuals who are surveyed in multiple waves of CHNS, standard errors in our empirical results might be underestimated due to serial correlation. To overcome this concern, we have clustered robust standard errors at the individual level.

3.5. Descriptive statistics

Panel A of Table A2 displays the summary statistics of individual's adult outcomes in the full sample, boys-only sample, and girls-only sample. It shows the number of observations, sample means, and standard deviations of variables that measure children's adult outcomes over the years 2006–2015. Panels B, C and D of Table A2 present the summary statistics of the control variables at the individual, family, and community and provincial level, respectively.

Table A3 illustrates the average durations of exposure in the boys-only, girls-only and full sample separately. The durations of exposure with laid-off parent(s), father and mother are also displayed separately.

4. Results

We first examine the effect(s) of the father's and/or mother's layoff on children's education outcomes, and then investigate children's labor market performance, including occupational choices and adult earnings. Tables 1–2 report the main results of our empirical strategy. Each table discusses the impacts of laid-off parent(s), father, and mother separately. The detailed discussions are presented in the following subsections.

4.1. Children's education outcomes

From Table 1, it is evident that girls suffer significantly more in human capital accumulation compared to boys when being exposed to fathers' layoffs for a longer period. Our results suggest that boys' years of education, as well as the probabilities of having a high school diploma and college degree, are not affected. However, relative to boys, girls' education years are lowered by 3.3%, they are 6.6% less likely to have a high school diploma, and 6.7% less likely to have a college degree.

Table 1 also suggests a significant gender difference in children's education outcomes when they are exposed to mothers' layoffs for a longer period. Our results show that boys have higher education years and a higher probability of having a college degree, while their probabilities of having a high school diploma are not affected. In contrast, relative to boys, girls have lower education years and lower probabilities of having a college degree when suffering mothers' layoffs for a longer period. Moreover, the magnitude of the coefficients on the interaction term is larger than those on $Exposure_i$.

These gender differences could be explained as follows. Girls normally receive less family support than boys (García et al., 2018; Kim et al., 2018); this patriarchy thinking also dominated in China in the 1990s and 2000s. When parent(s) suffered from losing an "iron bowl" job, there was a reduction in economic status and a tightened household budget constraint. Thus, when a family suffered a negative economic/income shock, a girl is more likely to drop out of school and work to subsidize the loss of family income, while a boy is less likely to be asked to do so relative to a girl. Therefore, when a family experiences a negative shock on economic status, the investment in girls' human capital drops sharply.

¹⁰ Specifically, consider two individuals: both of them suffer fathers' layoffs in wave k , and the first individual is age 12 and the second 13. Thus, given the others are constant, the effect for the first individual is $\tilde{\beta}_1 \times (18 - 12 + 1) + \tilde{\gamma}_k$ and the effect for the second one is $\tilde{\beta}_1 \times (18 - 13 + 1) + \tilde{\gamma}_k$. By taking the difference of these two levels, $\tilde{\beta}_1$ then measures the increment of the effect.

Table 1
Education outcomes.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: education years (Ln)</i>						
Exposure	-0.001 (0.005)	0.012 * (0.007)	-0.003 (0.006)	0.009 (0.006)	0.001 (0.008)	0.037 ** (0.018)
Exposure × Female		-0.029 *** (0.010)		-0.033 *** (0.013)		-0.050 ** (0.020)
Controls	YES	YES	YES	YES	YES	YES
N	1255	1255	1145	1145	1088	1088
Adjusted R-sq	0.516	0.517	0.512	0.510	0.494	0.496
<i>Panel B: high school diploma</i>						
Exposure	-0.010 (0.009)	-0.002 (0.012)	-0.026 ** (0.013)	-0.018 (0.016)	0.004 (0.013)	0.026 (0.037)
Exposure × Female		-0.026 (0.020)		-0.066 ** (0.026)		-0.031 (0.041)
Controls	YES	YES	YES	YES	YES	YES
N	1259	1259	1149	1149	1092	1092
Pseudo R-sq	0.485	0.505	0.499	0.524	0.476	0.502
<i>Panel C: college degree</i>						
Exposure	0.017 (0.012)	0.045 ** (0.018)	0.007 (0.017)	0.029 (0.022)	0.026 (0.016)	0.080 ** (0.040)
Exposure × Female		-0.054 ** (0.024)		-0.068 * (0.038)		-0.092 ** (0.043)
Controls	YES	YES	YES	YES	YES	YES
N	1244	1244	1134	1134	1080	1080
Pseudo R-sq	0.357	0.389	0.367	0.400	0.357	0.397

Notes: This table reports the intergenerational effect of father's and/or mother's layoff on children's education outcomes, which include the logarithm of education years, a high school diploma dummy, and a college degree dummy. Panel A reports the results from OLS regressions. Panels B and C report marginal effects of exposure from the Logistics regressions. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Table 2
Children's occupational outcomes.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Manual occupations (Logistics)</i>						
Exposure	0.017 (0.017)	-0.017 (0.025)	0.019 (0.024)	-0.041 (0.034)	0.017 (0.020)	-0.117 * (0.060)
Exposure × Female		0.048 (0.035)		0.102 * (0.057)		0.136 ** (0.066)
Controls	YES	YES	YES	YES	YES	YES
N	1020	1020	931	931	877	877
Adjusted R-sq	0.205	0.236	0.208	0.245	0.199	0.242
<i>Panel B: Manual occupations (OLS)</i>						
Exposure	0.016 (0.018)	-0.020 (0.031)	0.015 (0.024)	-0.048 (0.036)	0.021 (0.023)	-0.060 (0.040)
Exposure × Female		0.050 (0.039)		0.096 ** (0.045)		0.082 (0.051)
Controls	YES	YES	YES	YES	YES	YES
N	1020	1020	931	931	877	877
Adjusted R-sq	0.195	0.204	0.194	0.207	0.180	0.197

Notes: This table reports the intergenerational effects of fathers'/mothers' layoffs on children's occupational outcomes, in which the dependent variable indicates whether an individual has a manual occupation or not. Samples are restricted to those who have jobs. Panel A reports the marginal effects from the Logistics regressions. Panel B reports the results from OLS regressions. All regressions include control variables at the individual, family, community, and provincial level as well as the birth-year fixed effect. Education variables are not included due to concerns of bad controls. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

The negative effect for girls could also be treated as gender role attitudes. As is argued in Johnston et al. (2014), girls are expected to have less education, especially when mothers are laid off. Our results show that mothers' layoffs have positive effects on boys' education outcomes. This is because a mother, whose salary is normally not the main source of family income, could spend more time tending to children, such as providing teaching and homework assistance (Rege et al., 2011). However, such a positive effect does not exist for girls, which could still be treated as a consequence of gender roles. This result implies the existence of gender role attitudes.

4.2. Children's occupational outcomes

As a direct outcome of education, we now investigate how the father's and/or mother's layoff affects children's occupational outcomes. In the corresponding regressions, the sample is restricted to those having jobs. We include the results from both the Logistics and OLS regressions in Table 2.

Panel A of Table 2 suggests that, when suffering fathers' layoffs for a longer period, girls are 10.2% more likely to have manual occupations relative to cognitive ones, while such a negative effect is not significant for boys. This gender difference in occupations could be explained as follows. Note that cognitive occupations require high levels of formal education and a college degree may be necessary when applying. Since girls are less likely to have a college degree relative to boys under mothers' layoffs (Column (6) in Panel C of Table 1), it is very difficult for girls to find a job requiring high human capital. Thus, they have to take jobs with low barriers to entry, i.e., manual ones. In contrast, boys with a similar family background do not suffer losses in education investment when they are young (see Table 1). This gender difference in occupation is therefore a persistent result from the gender difference in education due to fathers' layoffs. Similar results are also obtained in the OLS specification in Panel B of Table 2.

When suffering mothers' layoffs for a longer period, Panel A of Table 2 suggests that only girls suffer a higher probability of having manual occupations. However, under the OLS specification, Panel B of Table 2 does not suggest significant effects of mothers' layoffs or gender differences. Thus, we need to be cautious when interpreting the significant gender difference due to mothers' layoffs in Panel A. Although boys' education levels increase (Column (6) of Table 1), this does not reduce their probabilities of having manual occupations. This is because, relative to fathers, mothers play a less important role in children's occupations (Huttunen and Riukula, 2019).

4.3. Children's adult earnings

Table 3 demonstrates the impacts of fathers'/mothers' layoffs on children's wages and annual income, which are all measured with the price in 2015. These results suggest neither significant intergenerational effects on children's adult earnings nor significant gender differences in these effects.

Table 3
Children's adult earnings.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: wages (Ln)</i>						
Exposure	-0.025 (0.027)	-0.013 (0.042)	-0.035 (0.040)	-0.032 (0.043)	-0.024 (0.041)	-0.020 (0.070)
Exposure × Female		-0.030 (0.059)		-0.011 (0.057)		-0.028 (0.103)
Controls	YES	YES	YES	YES	YES	YES
N	963	963	884	884	827	827
Adjusted R-sq	0.303	0.313	0.308	0.318	0.282	0.286
<i>Panel B: annual income (Ln)</i>						
Exposure	0.048 (0.037)	0.015 (0.041)	0.037 (0.053)	-0.003 (0.048)	0.072 (0.051)	0.124 (0.129)
Exposure × Female		0.028 (0.063)		0.080 (0.082)		-0.104 (0.144)
Controls	YES	YES	YES	YES	YES	YES
N	1259	1259	1149	1149	1092	1092
Adjusted R-sq	0.193	0.199	0.197	0.205	0.169	0.168

Notes: This table reports the intergenerational effects of fathers'/mothers' layoffs on children's adult earnings, including the logarithms of wages and annual income, which are measured with the price in 2015. Samples are restricted to those who have jobs and report annual income in Panels A and B, respectively. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Education and occupation variables are not included due to concerns of bad controls. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

We consider boys first. The aforementioned insignificant effects from fathers' layoffs for boys could be explained by the insignificant intergenerational effects on boys' education. Also, since the positive effect on boys' education from mothers' layoffs does not reduce their probabilities of having manual occupations, their wages and annual income are also not affected.

It is worth noting that, given the significant negative impacts on girls' education and occupations when being exposed to fathers' layoffs for a longer period, our results in Table 3 do not show a significant drop in girls' wages and income. This means that, although girls receive less family support in education and hence have higher probabilities of having disadvantageous occupations, they do not underperform in adult wages or annual income compared to boys.

In addition, when fathers are laid off, mothers increase their labor supply to compensate for the loss of household income (Blundell et al., 2016; Halla et al., 2020). As a role model, mothers' labor market participation would increase the daughters' intention to work (Morrill and Morrill, 2013; Bredtmann et al., 2020). This link then increases girls' adult earnings for those who experience fathers' layoffs.

We further investigate children's adult earnings for those with manual occupations. Table 4 suggests that, when exposed to fathers' layoffs for a longer period, girls with manual occupations earn more in non-wage income, which is defined as the difference between the annual income and wages in CHNS. However, boys' adult earnings in such occupations are not affected. Thus, although these girls have disadvantages in education and occupations, they seem to experience positive effects in work-related traits and hence have higher earnings. In other words, girls seem to outperform boys in adult earnings given their education outcomes. This observation implicitly suggests inefficiency in Chinese family investment in children's education based on gender.

The insignificant results from fathers' layoffs in Table 3 are similar to Bratberg et al. (2008), but differ from the significant negative effects in Oreopoulos et al. (2008) and Hilger (2016). In contrast, these works do not suggest a significant gender difference in children's education outcomes, leading to different interpretations of these insignificant results.

We further categorize the difference between the individual's annual income and wage income. In Panel C of Table 4, we show that the gardening income, including orchard and vegetable gardens, is higher for women who suffered fathers'/mothers' layoffs and then worked in manual occupations. This result implies that, besides their main jobs, these women are more willing to seek various ways of increasing income by taking on extra work, such as gardening. This willingness is correlated with their

Table 4
Children's adult earnings in manual occupations.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: wages in manual occupations (Ln)</i>						
Exposure	-0.009 (0.032)	-0.024 (0.050)	0.010 (0.056)	-0.031 (0.048)	-0.049 (0.045)	-0.089 (0.096)
Exposure × Female		0.031 (0.075)		-0.036 (0.131)		0.090 (0.114)
Controls	YES	YES	YES	YES	YES	YES
N	542	542	503	503	470	470
Adjusted R-sq	0.370	0.380	0.363	0.377	0.365	0.375
<i>Panel B: annual income in manual occupations (Ln)</i>						
Exposure	0.061 (0.057)	-0.031 (0.054)	0.151 (0.116)	-0.044 (0.052)	-0.032 (0.054)	-0.109 (0.103)
Exposure × Female		0.212 (0.134)		0.919 *** (0.327)		0.108 (0.112)
Controls	YES	YES	YES	YES	YES	YES
N	597	597	547	547	518	518
Adjusted R-sq	0.265	0.277	0.281	0.322	0.242	0.243
<i>Panel C: gardening income in manual occupations (Ln)</i>						
Exposure	-0.005 * (0.003)	-0.005 (0.004)	-0.006 (0.004)	-0.010 (0.007)	-0.001 (0.001)	-0.005 (0.006)
Exposure × Female		-0.000 (0.007)		0.016 * (0.008)		0.004 (0.007)
Controls	YES	YES	YES	YES	YES	YES
N	597	597	547	547	518	518
Adjusted R-sq	0.040	0.021	0.039	0.074	0.027	-0.006

Notes: This table reports the intergenerational effects of fathers'/mothers' layoffs on children's adult earnings for those with manual occupations, including the logarithms of wages, annual income, and non-wage income, which are measured with the price in 2015. Samples are restricted to those who have manual occupations and report annual income in Panels A, B and C, respectively. Non-wage income is calculated by the difference between annual income and wages. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Education and occupation variables are not included due to concerns of bad controls. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. Note that there are too few females who suffered mothers' layoffs, and have manual occupations and gardening income in the sample. Thus, the linear regression model could not accurately fit their gardening income, leading to a negative adjusted R-squared value.

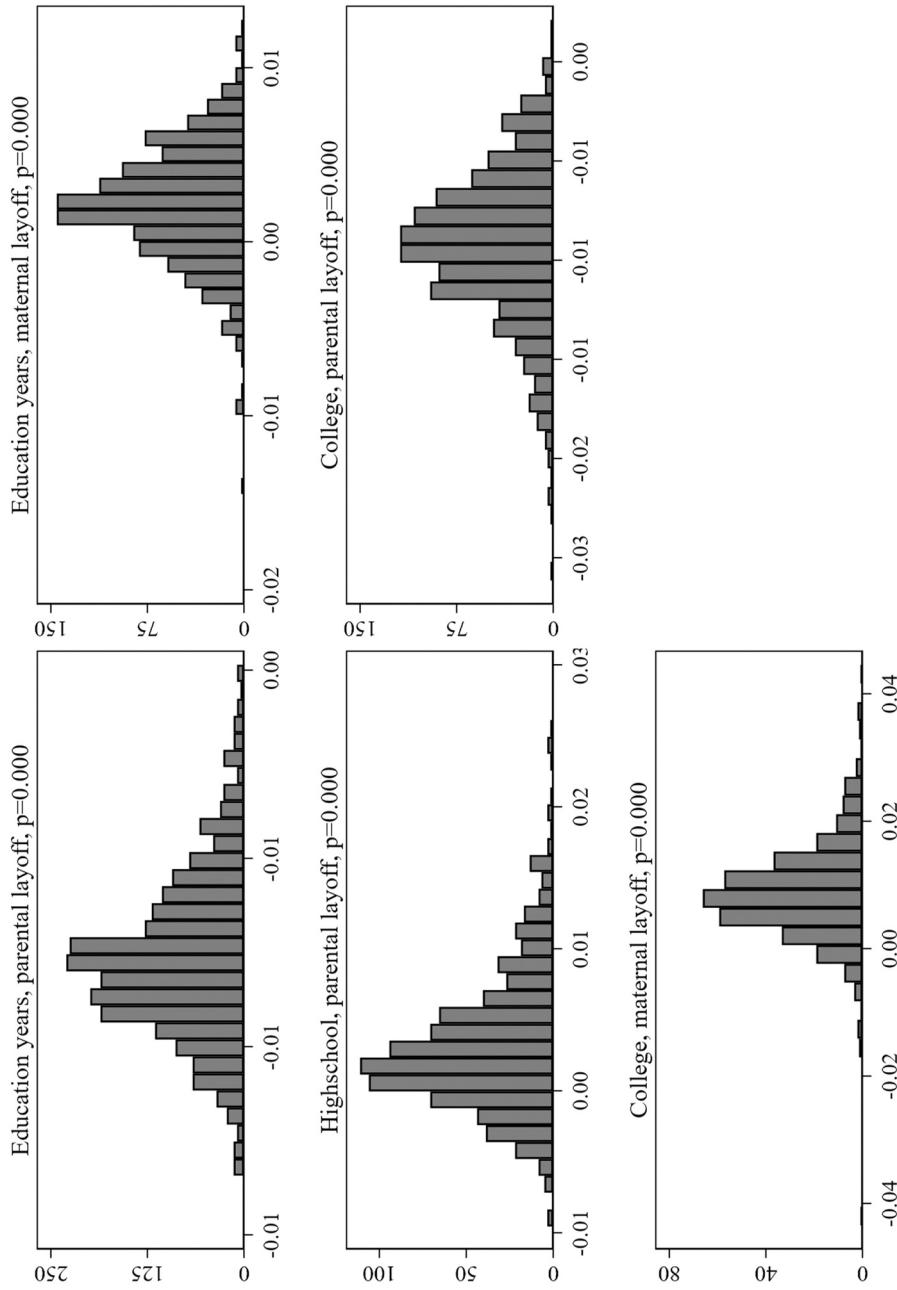


Fig. 2. Results of placebo tests for interaction terms in education outcomes. *Notes:* These five figures display the distributions of placebo estimates of *Exposure*Female* in education outcomes from 500 bootstraps random assignments, in which the results from fathers' and mothers' layoffs are shown separately. The distributions of these estimates are all around zero. The corresponding p-values are also displayed. All y-axes are frequencies and x-axes are coefficients of placebo treatment effects.

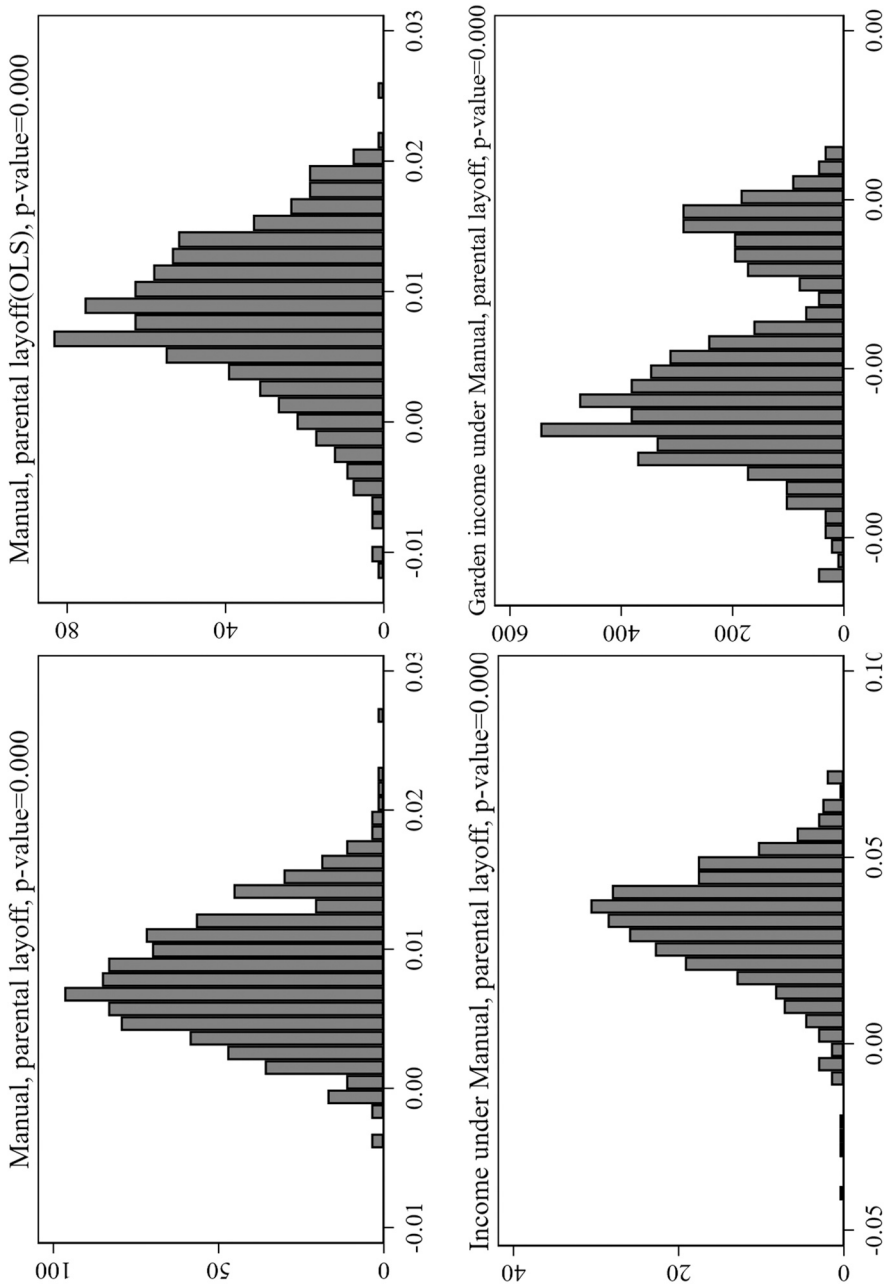


Fig. 3. Results of placebo tests for interaction terms in labor market outcomes. Note: These four figures display the distributions of placebo estimates of $Exposures \times Female$ in labor market outcomes from 500 bootstraps random assignments, in which results from fathers' and mothers' layoffs are shown separately. The distributions of these estimates are all centered around zero. The corresponding p-values are also displayed. All y-axes are frequencies and x-axes are coefficients of placebo treatment effects.

childhood experience of fathers'/mothers' layoffs. Note that operating orchards and vegetable gardens is one way for laid-off workers to earn an income in China. On the one hand, laid-off workers themselves operate orchards and vegetable gardens by contracting for land and using land in the suburbs and factories. On the other hand, when local governments organize re-employment training for laid-off workers, they also include orchard and vegetable garden management skills as part of the training. Thus, in the presence of the role model effect, girls are more likely to participate in operating orchards and vegetable gardens. In addition, farmland circulation is allowed since 2008, leaving possibilities for them to operate vegetable and orchard gardens by contracting for suburban land.

5. Robustness

5.1. Placebo test

We conduct a permutation placebo test to guarantee the validity of our empirical strategy. The key identification assumption concerns the observed decreases in education attainment, or that occupation choices are much more likely to occur for children who suffered fathers'/mothers' layoffs, but not for other reasons. The permutation test allows us to test whether our results are statistically significant or just due to random chance.

We randomly assign the treatment group and construct placebo treatment status for the same sample of individuals as in our main analysis. Following Xiao et al. (2017), the placebo test is then completed with the following steps: first, we take the absolute value of the coefficients that are derived from the 500 times bootstraps; second, we calculate the frequency that a bootstrap coefficient is greater than or equal to the corresponding coefficient from our main analysis in absolute value; third, the proportion of bootstrap coefficients that are greater than or equal to the corresponding coefficient from our main analysis in absolute value is the p-value of each permutation placebo test. Similar to Xiao et al. (2017), we only conduct placebo tests for results that are significant in the main regression.

Table 5
Education outcomes: Second stage of 2SLS estimations.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(1)	
<i>Panel A: education years</i>						
Exposure	0.000 (0.006)	0.014 ** (0.007)	-0.003 (0.006)	0.010 (0.007)	0.003 (0.008)	0.037 ** (0.017)
Exposure×Female		-0.028 *** (0.010)		-0.032 ** (0.013)		-0.050 *** (0.019)
Controls	YES	YES	YES	YES	YES	YES
N	1255	1255	1145	1145	1088	1088
Adjusted R-sq	0.516	0.517	0.512	0.510	0.493	0.496
K-P stat	759.686	176.258	964.417	245.055	472.765	112.034
<i>Panel B: high school diploma</i>						
Exposure	-0.015 (0.011)	0.002 (0.019)	-0.031 ** (0.014)	-0.013 (0.023)	-0.005 (0.015)	0.042 (0.031)
Exposure×Female		-0.044 * (0.025)		-0.061 ** (0.029)		-0.071 * (0.038)
Controls	YES	YES	YES	YES	YES	YES
N	1259	1259	1149	1149	1092	1092
Adjusted R-sq	0.488	0.490	0.498	0.500	0.479	0.479
K-P stat	758.222	176.066	963.706	245.093	472.595	111.994
<i>Panel C: college degree</i>						
Exposure	0.018 (0.016)	0.049 ** (0.019)	0.003 (0.018)	0.029 (0.021)	0.034 (0.024)	0.108 ** (0.054)
Exposure×Female		-0.060 * (0.032)		-0.050 (0.042)		-0.129 ** (0.060)
Controls	YES	YES	YES	YES	YES	YES
N	1259	1259	1149	1149	1092	1092
Adjusted R-sq	0.312	0.318	0.319	0.323	0.308	0.321
K-P stat	758.222	176.066	963.706	245.093	472.595	111.994

Notes: This table reports the second stage results in 2SLS estimations under the IV approach. Dependent variables in Panels A, B and C are the logarithm of education years, high school diploma dummy, and college degree dummy, respectively. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Kleibergen-Paap Wald rk F statistics are also reported for the tests of weak instruments. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Table 6
Children's occupations and adult earnings: Second stage of 2SLS estimations.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: manual occupation</i>						
Exposure	0.017 (0.018)	-0.017 (0.029)	0.020 (0.023)	-0.047 (0.033)	0.015 (0.025)	-0.060 (0.038)
Exposure×Female		0.048 (0.039)		0.096 ** (0.044)		0.082 * (0.048)
Controls	YES	YES	YES	YES	YES	YES
N	1020	1020	931	931	877	877
Adjusted R-sq	0.195	0.204	0.194	0.207	0.180	0.197
K-P stat	523.451	203.513	623.451	96.760	442.400	104.838
<i>Panel B: wages</i>						
Exposure	-0.025 (0.027)	-0.017 (0.047)	-0.034 (0.041)	-0.035 (0.048)	-0.021 (0.039)	-0.020 (0.066)
Exposure×Female		-0.022 (0.060)		-0.007 (0.057)		-0.028 (0.095)
Controls	YES	YES	YES	YES	YES	YES
N	963	963	884	884	827	827
Adjusted R-sq	0.303	0.313	0.308	0.318	0.282	0.286
K-P stat	503.131	180.336	758.167	96.617	400.894	95.003
<i>Panel C: annual income</i>						
Exposure	0.059 (0.041)	-0.001 (0.043)	0.052 (0.062)	-0.017 (0.049)	0.077 (0.051)	0.124 (0.123)
Exposure×Female		0.078 (0.071)		0.140 (0.096)		-0.104 (0.138)
Controls	YES	YES	YES	YES	YES	YES
N	1259	1259	1149	1149	1092	1092
Adjusted R-sq	0.193	0.199	0.197	0.205	0.169	0.168
K-P stat	758.222	176.066	963.706	245.093	472.595	111.994

Notes: This table reports the second stage results in 2SLS estimations under the IV approach. Dependent variables in Panels A, B and C are the manual occupation dummy, the logarithm of wages and the logarithm of annual income, respectively. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Education and occupation variables are not included due to concerns of bad controls. Kleibergen-Paap Wald rk F statistics are also reported for the tests of weak instruments. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

5.2. Instrumental variable approach

One potential concern is that the measure applied in the main analysis might suffer random measurement errors relative to the true duration of layoff exposure. This is because an individual's actual age of suffering the father's/mother's layoffs could be between two waves. Thus, the actual duration of experiencing fathers'/mothers' layoffs might be larger than the measure in our main analysis. Such an error is randomly assigned to individuals. Thus, our results might be underestimated. However, supposing the true estimates are indeed underestimated, the significant gender differences that we have highlighted in the main analysis would still hold.

The distributions of placebo estimates of *Exposure×Female* from 500 bootstraps random assignments are displayed in Figs. 2 and 3, in which the results from fathers' and mothers' layoffs are shown separately. The distributions of these estimates are all around zero. Our baseline regression results clearly lie outside the range of those in our placebo tests and the corresponding p-values are all zero. Thus, our empirical strategy is valid.

To further examine this concern, we apply the IV approach by exploiting the percentage reduction in the number of workers in SOEs and collective enterprises in the individual's corresponding province when he/she suffered the father's/mother's layoffs, i.e., $Layoff_k_i = 1$. Between two consecutive waves in CHNS, we treat the year that has the largest percentage reduction in the number of workers in SOEs and collective enterprises as the proxy of the real year when an individual suffered the father's/mother's layoff. Based on this proxy, we calculate the other measure of exposure, i.e., *quasi-exposure*, by using function (1). This quasi-exposure is close to the actual duration of experiencing fathers'/mothers' layoffs, which is the IV for *Exposure* in regressions (2) and (3). Note that both "layoff" and *Exposure* are affected. That is, in regression (3), the interaction of an individual's gender and his/her exposure is also an endogenous variable in our concern. Thus, we also construct the second instrumental variable by interacting an individual's gender and the aforementioned quasi-exposure. We then apply 2SLS estimations to examine all our baseline regressions.

Table 7
Adult earnings in manual occupations: Second stage of 2SLS estimations.

	Laid-off parent (s)		Laid-off father		Laid-off mother	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: wages in manual occupations</i>						
Exposure	-0.003 (0.031)	-0.037 (0.053)	0.023 (0.055)	-0.036 (0.049)	-0.046 (0.046)	-0.089 (0.087)
Exposure×Female		0.071 (0.077)		-0.015 (0.127)		0.090 (0.102)
Controls	YES	YES	YES	YES	YES	YES
N	543	543	503	503	470	470
Adjusted R-sq	0.370	0.380	0.363	0.377	0.365	0.375
K-P stat	334.879	119.778	263.847	119.976	265.160	62.837
<i>Panel B: annual income in manual occupations</i>						
Exposure	0.098 (0.067)	-0.050 (0.058)	0.220 (0.134)	-0.054 (0.054)	-0.031 (0.056)	-0.109 (0.094)
Exposure×Female		0.346 ** (0.153)		1.246 *** (0.390)		0.108 (0.102)
Controls	YES	YES	YES	YES	YES	YES
N	597	597	547	547	518	518
Adjusted R-sq	0.264	0.276	0.280	0.318	0.242	0.243
K-P stat	316.174	73.919	222.217	76.638	242.906	57.563
<i>Panel C: gardening income in manual occupations</i>						
Exposure	-0.005 * (0.003)	-0.005 (0.003)	-0.006 (0.004)	-0.007 (0.005)	-0.001 (0.001)	-0.005 (0.006)
Exposure×Female		-0.001 (0.006)		0.012 ** (0.006)		0.004 (0.007)
Controls	YES	YES	YES	YES	YES	YES
N	597	597	547	547	518	518
Adjusted R-sq	0.040	0.021	0.039	0.073	0.027	-0.006
K-P stat	316.174	73.919	222.217	76.638	242.906	57.563

Notes: This table reports the second stage results in 2SLS estimations under the IV approach for those with manual occupations, where dependent variables in Panels A, B and C are the logarithm of wages, the logarithm of annual income, and gardening income, respectively. All regressions include control variables at the individual, family, community and provincial level as well as the birth-year fixed effect. Education and occupation variables are not included due to concerns of bad controls. Kleibergen-Paap Wald rk F statistics are also reported for the tests of weak instruments. Standard errors are clustered at the individual level and shown in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. Note that there are too few females who suffered mothers' layoffs, and have manual occupations and gardening income in the sample. Thus, the linear regression model could not accurately fit their gardening income, leading to a negative adjusted R-squared value.

We report the corresponding second stage results of the 2SLS estimations in Tables 5–7. These results confirm that the significance of the coefficients in our baseline regressions still holds. In addition, we report the corresponding Kleibergen-Paap rk Wald F (K-P) statistics to detect a potential weak instrument problem. All K-P statistics are way above 16.38, indicating that our regressions do not suffer from a weak instrument problem. As a result, our baseline results are robust.

6. Conclusion

This paper provided evidence on gender differences in intergenerational effects of laid-off parents on children's adult outcomes. We demonstrated that, when experiencing fathers'/mothers' layoffs for a longer period before age 18, girls experience worse education outcomes, while such negative effects are not significant for boys with a similar family background. This could be interpreted as girls receiving less family support in education when families suffer a negative resource shock.

When investigating children's occupational outcomes, our results suggest that girls have a significantly higher probability of having manual occupations relative to boys when experiencing fathers'/mothers' layoffs for a longer period. Such a gender difference in occupations is a persistent result of the gender difference in education from fathers'/mothers' layoffs. We further show that the abovementioned gender differences are not persistent in children's adult earnings. Instead, for girls with manual occupations, fathers' layoffs increase their gardening income. Our results are still robust after applying placebo tests.

This paper could help better understand the long-term impact of the SOE retrenchment starting from the 1990s in China. The rise of private enterprises and the market economy improves people's average economic status. However, we show that the gender difference in the negative impacts still persists among the second generation of those whose parent(s) suffered involuntary layoffs in the retrenchment. Our results implicitly suggest inefficiency in Chinese family investment in children's education, which was based on gender.

Our results provide useful insights into policies for children in disadvantaged families. For instance, the persistent impacts on children's education and occupations from laid-off parents highlight the potential value of compensatory programs targeting basic

education. For disadvantaged youths who have already left the formal schooling system, training programs are a potential solution for the problem of lack of skill.¹¹

In addition, the existence of gender differences in the long-term effect of laid-off parents necessitates the implementation of programs aiming to improve women's education and labor market outcomes, such as gender empowerment programs, subsidies aimed at increasing women's school enrolment or completion, and woman-specific vocational training intervention. Moreover, future policies should keep eliminating gender-based employment barriers in the labor market, especially those that are caused by restricted mobility, culture and social norms.

Acknowledgements

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Appendix A

See Appendix Tables A1–A3 here.

Table A1

Variable definitions.

Layoff- k	A dummy variable where $k \in \{1993, 1997, 2000, 2004\}$. It equals 1 if the individual i suffered the father's/mother's layoff in wave k , and 0 otherwise. It is calculated separately for the three following scenarios: (1) he/she suffers the father's or mother's layoff; (2) he/she suffers the father's layoff; and (3) he/she suffers the mother's layoff.
Exposure	Equal to $18 - (k - \text{Birth_Year}_i) + 1$ if $\text{Layoff_}k_i = 1$ for individual i , and 0 if $\text{layoff_}k_i = 0$. It is calculated separately for the three following scenarios: (1) he/she suffers the father's or mother's layoff; (2) he/she suffers the father's layoff; and (3) he/she suffers the mother's layoff.
Female	A dummy variable that is 1 if an individual is female and 0 otherwise.
<i>Children's adult outcomes</i>	
Education years (Ln)	Natural logarithm of education years. Pre-primary education years are not counted. We scale up the education years by 1 before the logarithm is taken.
Highschool diploma	A dummy variable that is equal to 1 if an individual has a high school, technical, or vocational degree, and 0 otherwise.
College degree	A dummy variable that is equal to 1 if an individual has a college or university degree or above, and 0 otherwise.
Wages (Ln)	Natural logarithm of an individual's salary (1000 CNY) from their job. It is inflated to year 2015 and scaled up by 1 before the logarithm is taken.
Income (Ln)	Natural logarithm of an individual's total yearly net income (1000 CNY). It is inflated to year 2015 and scaled up by 1 before the logarithm is taken.
Cognitive	A dummy variable that equals 1 if an individual's primary occupation is senior professional/technical worker, junior professional/technical worker, administrator/executive/manager, athlete, actor, musician, or office staff, and 0 otherwise.
Manual	A dummy variable that equals 1 if an individual's primary occupation is service worker, skilled worker, non-skilled worker, or driver, and 0 otherwise. Particularly, Cognitive+Manual= 1. In the corresponding regressions, we focus on those who have jobs, and exclude individuals whose occupations are ordinary soldier, army officer, policeman, police officer, farmer, fisherman, and hunter in our sample.
<i>Control variables</i>	
Birth-Year- l	A dummy variable that is 1 if an individual was born in the year l and 0 otherwise.
Age	An individual's age.
Marital status	A dummy variable that is 1 if an individual is married or remarried and 0 otherwise.
Urban	A dummy variable that is 1 if an individual holds an urban hukou and 0 otherwise.
Income-father	Natural logarithm of father's average income during the layoff period, which is inflated to year 2015.
Income-mother	Natural logarithm of mother's average income during the layoff period, which is inflated to year 2015.
Education-father	A dummy variable that is 1 if the father has a high school diploma and 0 otherwise.
Education-mother	A dummy variable that is 1 if the mother has a high school diploma and 0 otherwise.
House-head-p	A dummy variable that is 1 if the father was the household head during the layoff period and 0 otherwise.
Home scale	Number of family members.
Flat	A dummy variable that is 1 if the family owns a flat or house and 0 otherwise.
Vehicle	A dummy variable that is 1 if the family owns a car and 0 otherwise.
Highschool-rate	Proportion of family members with at least a high school diploma.
Transfers	Natural logarithm of money received from parents in a surveyed wave over the period 2006–2015, which is inflated to year 2015.
Urbanicity scale	Constructed by using CHNS, it is a multicomponent scale measuring urban features at the community level (Jones-Smith and Popkin, 2010), and is counted in each surveyed wave over the period 2006–2015.
Enterprises	Number of enterprises above designated size in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015.

(continued on next page)

¹¹ Attanasio et al. (2011) and Chakravarty et al. (2019) find that these programs improve poor youths' hard and soft skills, increasing their employment and wages in the long term.

Table A1 (continued)

Private firms	Number of private firms in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015.
Self-employment	Number of self-employed businesses in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015
Unemployment	Unemployment rates in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015.
GDPs	Real GDP in the province where an individual lives, which is inflated to year 2015 and counted in each surveyed wave over the period 2006–2015. The unit is 100,000,000 CNY.
College students	Number of college students in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015.
Highschool students	Number of high school students in the province where an individual lives, which is counted in each surveyed wave over the period 2006–2015.
FDI	Provincial level of foreign direct investment in a surveyed year, which is inflated to year 2015. The unit is 1,000,000 USD.
Consumption	Provincial consumption level per capita in each surveyed wave over the period 2006–2015, which is inflated to year 2015. The unit is 1 CNY per capita.
Provincial dummies	A set of dummy variables that control the province-fixed effect.

Table A2
Summary statistics.

Variable	Full sample			Boys subsample			Girls subsample		
	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.
Education years(Ln)	1346	2.521	0.256	904	2.495	0.268	442	2.575	0.221
Highschool diploma	1350	0.490	0.500	908	0.439	0.497	442	0.595	0.491
College degree	1350	0.293	0.455	908	0.250	0.433	442	0.382	0.487
Income (Ln)	1350	9.512	1.845	908	9.518	2.012	442	9.499	1.443
Wages (Ln)	1021	7.560	0.879	660	7.637	0.848	361	7.420	0.918
Manual	1021	0.574	0.495	660	0.633	0.482	361	0.465	0.499
Female	1350	0.327	0.469	908	0	0	442	1	0
<i>Control variables</i>									
Age	1350	27.80	5.426	908	28.49	5.382	442	26.39	5.247
Urban	1350	0.627	0.484	908	0.623	0.485	442	0.633	0.482
Marital status	1350	0.451	0.498	908	0.541	0.499	442	0.267	0.443
Flat	1350	0.406	0.491	908	0.416	0.493	442	0.385	0.487
Vehicle	1350	0.158	0.365	908	0.157	0.364	442	0.158	0.366
Home scale	1350	4.706	1.607	908	4.753	1.606	442	4.609	1.606
Highschool–rate	1350	0.458	0.373	908	0.429	0.375	442	0.517	0.362
Transfers (Ln)	1350	0.112	0.866	908	0.124	0.910	442	0.0871	0.770
Education–father	1350	0.197	0.398	908	0.204	0.403	442	0.183	0.387
Education–mother	1350	0.143	0.350	908	0.141	0.348	442	0.147	0.355
Income–father	1350	7.482	3.394	908	7.500	3.364	442	7.445	3.459
Income–mother	1350	7.039	3.356	908	6.969	3.376	442	7.184	3.312
House–head–p	1350	0.926	0.262	908	0.915	0.279	442	0.948	0.222
Urbanicity scale	1350	77.74	16.68						
Private firms	1350	35.06	33.90						
Enterprises	1350	16397	14994						
Unemployment	1350	3.760	0.623						
Self-employment	1350	161.4	83.19						
College students	1350	96.80	45.85						
Highschool students	1350	112.4	45.37						
FDI	1350	823,532	882,330						
Consumption	1350	11,005	4871						
GDPs	1350	20,615	14,418						

Notes: This table shows the summary statistics of our sample. Summary statistics of control variables at the community and provincial level are reported only in the full sample, these are the same in the boys only and girls only subsamples. The consumption level, FDI and GDP are all calculated according to the price of 2015.

Table A3

The average duration of exposure.

	Laid-off parent (s)	Laid-off father	Laid-off mother
Boys	5.905 (3.875)	4.286 (4.008)	2.667 (3.830)
Girls	4.438 (3.476)	2.917 (3.494)	2.083 (3.524)
Total	5.122 (3.720)	3.556 (3.784)	2.356 (3.661)

Notes: Standard errors are shown in parentheses.

Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ecosys.2023.101120](https://doi.org/10.1016/j.ecosys.2023.101120).

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