Higher education expansion and gender norms: evidence from China

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Abstract
This paper explores whether the expansion of higher education can influence attitudes regarding gender norms. I evaluate the impact of China’s higher education expansion since 1999. The results show that the reform has significantly increased higher educational attainment for both women and men. However, women’s progressive views on gender roles are negatively affected following the expansion. The erosion of women’s egalitarian ideology can be attributed to the findings that women’s opportunities in the labor market are worsening relative to those of men. The results are significantly driven by married women and people who live in areas with a high male-to-female sex ratio. Practical conditions in the labor market and at home may adversely affect women’s ability to fulfill egalitarian gender roles.

Keywords Higher education expansion · Gender-role attitudes · Gender inequality · Labor market · Marriage market

JEL Classification I23 · J16

1 Introduction

Although women have made significant progress in education and gender equality has improved over time, gaps between women and men in labor markets and households remain significant in modern societies in both developed and developing countries (Bertrand et al. 2010, 2015; Blau and Kahn 2017; Jayachandran 2015; Sasser 2005). China has experienced rapid economic growth since its economic
reform launched in 1978. All levels of education in China have experienced tremendous expansions in recent decades. However, gender inequality remains noticeable in China (Chen et al. 2021; Jayachandran 2015; Liu et al. 2014). The recently released *Global Gender Gap Report 2020* by the World Economic Forum shows that China ranks 106th among 153 countries worldwide in terms of gender equality.\(^1\)

In this paper, I investigate the effects of China’s vast expansion of higher education since 1999 on attitudes concerning gender norms and the potential mechanisms underlying those effects by exploring the expansion’s impact on the labor market and the marriage market.

Expanding higher education can affect gender norms and gender equity through the following channels. First, while the expansion of higher education is a gender-neutral policy, it does provide women with more opportunities to gain higher education. Policy interventions have played an essential role in closing the educational gender gap (Heath and Jayachandran 2018). Second, people’s gender ideology may be changed directly by higher education, from more traditional gender-role attitudes that stress women’s family responsibilities and men’s career aspirations, to more egalitarian and progressive views that emphasize gender equality, women’s rights, and autonomy. The expansion of higher education has the potential to enlighten and liberalize both women and men (Brewster and Padavic 2000; Fortin 2005; Kane 1995; Mason and Lu 1988). Third, the expansion of higher education can impact the labor market and, in turn, gender norms. Recent studies have demonstrated a strong association between women’s labor market outcomes and gender norms of people and society (Fortin 2005; 2015; Jayachandran 2021; Miyata and Yamada 2016; Ye and Zhao 2018). Jayachandran (2021) argues that creating more equality in the labor market might support a virtuous cycle by eroding restrictive norms. Moreover, the expansion of higher education may affect outcomes in the marriage market, which are linked to gender norms (Antman et al. 2021; Bertrand et al. 2015, 2021).

A recent thread in the literature highlights the impact of social norms and gender ideology on gender equality and gender gaps (Akerlof and Kranton 2000; Bertrand 2011; Bertrand et al. 2015; Campa et al. 2011; Charles et al. 2018; Fortin 2005; 2015; Kandpal and Baylis 2019; Kleven and Landais 2017; Lippmann et al. 2020; Vella 1994). Causal evidence has revealed that institutions or social conduct can change traditional gender views to egalitarian ones, and also cause egalitarian views to retreat backward (Fortin 2015; Lippmann et al. 2020). Dincer et al. (2014), Du et al. (2021), Erten and Keskin (2018) and Ralsmark (2017) investigate the impact of education on gender norms and women’s rights and equality, but the findings are inconclusive. Studying the impact of Turkey’s compulsory schooling law reform and increased education of women, Dincer et al. (2014) find no evidence of changing attitudes on gender inequality. Erten and Keskin (2018) show that the educational reform in Turkey improves women’s labor market outcomes, but find no evidence of female

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\(^1\)See Table 1 The Global Gender Gap Index 2020 rankings in *Global Gender Gap Report 2020* for detailed information. Available online: http://www3.weforum.org/docs/WEF_GGGR_2020.pdf.
empowerment within households. Ralsmark (2017) exploits the educational reforms of mandatory schooling in 15 European countries and finds that increased mandatory education affects gender norms in the labor market but not in the household. A recent paper by Du et al. (2021) examines the impact of China’s Compulsory Education Law in 1986 on gender-role attitudes. The results show that the extra schooling induced by the compulsory schooling reform breeds more egalitarian gender views for the cohorts born after the reform and in areas with lower pre-reform educational levels. Most previous studies focus on the effects of mandatory education or compulsory schooling reforms, but little is known about the influence of higher education and its expansion. Different stages of education may have a different impact on gender norms.

My work adds to the literature by investigating the impact of higher education expansion on gender norms and providing additional evidence and insights from China, where traditional gender-role attitudes and substantial gender gaps persist in the labor market and within households. China has a long history of being a patriarchal society and masculine culture, with deeply rooted and rigid traditional gender norms that men should be breadwinners and women should be homemakers (Chen and Ge 2018; Du et al. 2021; Kristof and Wudunn 2010; Ye and Zhao 2018). In consecutive waves of the World Values Survey from 1990 to 2020, respondents in China had a high rate of agreement (about 40%) with the statement “Job scarcity: Men should have more rights to a job than women.” That percentage, which is much higher than the world average (about 25–30%), has been quite stable over the three decades. In contrast, the percentage of US respondents agreeing with this statement dropped from 24 to 5% over those three decades. Another infamous gender-biased cultural tradition is son preference (Jayachandran 2015). Even in recent decades, son preference has not been uncommon in many Chinese families, as evidenced by the imbalanced sex ratio at birth and the “missing girl” problem in China (Almond et al. 2019; Chen et al. 2013; Ebenstein and Sharygin 2009; Qian 2008). Moreover, although it is natural for women in contemporary China to enter the labor market, the existence of gender gaps has long been a problem in the Chinese labor market, especially after market-oriented economic reforms began in 1978 (Attané 2012; Liu et al. 2014). Previous studies have also documented discrepancies in employment distribution and statutory retirement age, wage gaps, and differences in promotion opportunities between male and female workers (Chi and Li 2014; Dong and Bowles 2002; Gustafsson and Li 2000; Hare 2016; Maurer-Fazio and Hughes 2002). In particular, Hare (2016) suggests that promoting women’s education at the upper secondary level and beyond may offset the gender inequality pattern in the labor market.

Using data from the Chinese General Social Survey (CGSS) in 2010, 2012, 2013, 2015, and 2017, I estimate the impact of the expansion of higher education on educational attainment, gender-role attitudes, labor market outcomes, and marriage market outcomes. To identify the causal effect, I use a difference-in-differences strategy that explores two sources of variation. The first is variation in whether birth cohorts

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2The World Values Survey is a global research project that conducts representative national surveys on people’s values and beliefs in 120 countries worldwide. Available from www.worldvaluessurvey.org.
were affected by the expansion. As the expansion began in 1999, the reform mainly affected individuals aged 18 or younger at that time, with older cohorts less likely to be affected. The second source of variation lies in the higher education resources that individuals could potentially access. Individuals whose birth province had relatively rich higher education resources would, in principle, gain more opportunities to go to college due to the expansion. After controlling for year of birth and province of birth fixed effects, the interaction between dummy variables indicating whether the individual belongs to the younger cohort affected by the expansion and whether her or his birth province has rich higher education resources is plausibly exogenous and is thus a key variable of interest for estimating the intention-to-treat effects of the higher education expansion in the empirical strategy.

The results show that higher education expansion significantly increases higher educational attainment for both women and men. However, women’s progressive attitudes toward gender roles are adversely affected, while men’s gender views do not change much after the expansion, although there is evidence of lower parental son preference. The negative impact on women’s gender views can be attributed to the fact that the expansion has failed to promote women in the labor market. Compared to men, women’s labor force participation tends to decrease at both extensive and intensive margins. Women are more likely to have highly educated spouses after the expansion. Among working couples, husbands have more working hours than wives. Further analysis shows that the results are significantly driven by married women and people who live in high sex ratio areas. Overall, the evidence suggests that although China’s higher education expansion has reduced the gender gap in higher educational attainment, women’s opportunities in the labor market have become more disadvantaged relative to men after the expansion, which may reinforce traditional gender arrangements in households. The equilibrium effect of higher education expansion in the labor market interacting with gendered arrangements in the household may erode egalitarian beliefs.

The results are in line with some previous findings in the context of developing countries with rigid traditional gender norms, e.g., Egypt (Miyata and Yamada 2016) and Turkey (Dinc¸er et al. 2014; Erten and Keskin 2018). Compared to the findings of Du et al. (2021) that the introduction of compulsory education fosters egalitarian gender views, the findings here may suggest that gender-role attitudes developed during childhood can change during adulthood. As the results here display an equilibrium effect of higher education expansion, it is possible that even though people’s increased access to higher education promotes egalitarian gender-role attitudes, the practical conditions that women face in the labor market and in households can impede this process. The implications of this study echo findings in the recent literature that women’s spousal overwork exacerbates gender inequality, even among higher-educated women (McKinnish 2020). The results are also in accordance with previous studies on the labor market effects of higher education expansion in China, which generally find a negative impact on the labor market outcomes of college

\[3\text{The Compulsory Education Law should not affect the analysis in this study because it has been carried out for the whole analysis sample.}\]
graduates, at least in the short term, due to increased competition and a depreciating college premium (Knight et al. 2017; Li et al. 2014; Ou and Zhao 2016; Xing et al. 2018). However, this paper specifically investigates the impact of higher education expansion on a range of outcomes related to gender norms and equity.

The rest of the paper is organized as follows. The next section introduces the background of China’s higher education expansion. Section 3 illustrates the empirical strategy and describes the data used for the empirical analysis. Section 4 presents and discusses the results, and the final section concludes the paper.

2 Background: China’s higher education expansion

I study the case of China in the empirical analysis, evaluating its higher education expansion in the late 1990s. China has had a state-run system of public education since 1949 that consists of 6 years of elementary school, 3 years of junior secondary school (middle school), 3 years of senior secondary school (high school), and tertiary education including junior college, bachelor’s, master’s, and doctoral degree programs. Elementary education and junior secondary education have been compulsory and free of charge for all citizens since 1986 and are financed by the government. Elementary schooling usually starts at age 6. After 9 years of compulsory education, a student can either choose to go to a 3-year normal high school by taking the entrance exam or to a career-oriented medium-level professional school, a polytechnic school, or an occupational school, which usually also take 3 years. A university education that grants a bachelor’s degree commonly takes 4 years, and admissions are based on a standardized and highly competitive national college entrance examination that is administered once a year. Candidates whose college entrance exam grades make them unqualified for a bachelor-level program can choose to go on to short-cycle (3-year) junior college studies or to wait and prepare to retake the college entrance exam the following year.

The education system was severely interrupted during the political turmoil of the Cultural Revolution (1966–1976), especially the higher education system (Deng and Treiman 1997). The normal university admission procedure resumed in 1977, and since then, three small-scale higher education expansions occurred in 1978, 1985, and 1992 to 1993 (Bao 2012). The tertiary education enrollment rate increased from 1.55% in 1978 to 9.76% in 1998 (Ou and Zhao 2016). These growth rates, however, were much lower and incomparable to those in 1999. Tuition fees for college were introduced in 1995, and the average annual tuition for a student increased from CNY 800 in 1995 to CNY 5000 in 2006 and has remained stable since 2006 (Li et al. 2014).

4 A recent paper by Dai et al. (2021) uses a regression discontinuity design to estimate the impact of higher education expansion on marginal students who would rarely go to university without the reform and finds positive returns. However, they also confirm that the impact is weaker for women.

5 The per capita annual disposable income of urban households was CNY 4283 and CNY 11759.5 in 1995 and 2006, respectively, and that of rural households was CNY 1577.7 and CNY 3587.0 (National Bureau of Statistics Various years), respectively; 1 Chinese yuan (CNY) ≈ 0.15 US dollars.
At the beginning of 1999, the central government and the Ministry of Education in China promulgated the *Higher Education Law of the People’s Republic of China*, which aimed to expand the higher education sector and expand higher education from the elite to the masses. The higher educational attainment ratio has been very low in China compared to that of its international counterparts, especially before the expansion. Moreover, the gender gap in college attendance was noticeable and steady before the expansion policy (Yeung 2013). The higher education expansion policy was motivated by several factors. One important reason was to meet the growing demand for high-skilled labor and enhance economic development (Heckman and Yi 2014); another purpose was to alleviate unemployment pressure and stimulate aggregate demand against the impact of the Asian financial crisis of 1997–1998 (Che and Zhang 2018; Li et al. 2014). The decision to increase enrollment in tertiary education was finalized and announced in June 1999, and the higher education admission quota increased by 0.55 million in that year (Li et al. 2014; Xing et al. 2018). Considering that the National College Entrance Examination was administered in early July, the expansion policy published 1 month earlier had little chance of altering the behavior of high school students and can thus be treated as a natural experiment.  

As a result of the expansion policy, the number of new entrants in colleges and universities, including both new undergraduate students and junior college students, reached almost 1.60 million in 1999, 40% more than the total number in 1998. The growth in enrollment has continued each year, although at a slower rate. Figure 1 presents the growth rates of new undergraduate students from 1990 to 2010. The large-scale expansion in 1999 and 2000 is particularly obvious, and some growth is also observed in the following years.  

### 3 Empirical strategy and data

#### 3.1 Empirical strategy

To explore the exogenous change in higher education due to the expansion, my identification strategy exploits the variations in “treatment” intensity across the province of birth and the birth cohort, which jointly determine an individual’s exposure to the expansion. Since the expansion began in 1999, the “treated” cohorts who were affected by the policy should be 18 years old or younger in 1999. Moreover, according to Chinese regulations, college candidates must take the entrance examination...
in the province where their hukou (household registration) is located. Admission quotas for new students at each university are set before the entrance examination every year, and the quotas are usually larger for local students in the provinces where the universities are located. In other words, students have a higher probability of enrolling in universities in their home province. Therefore, college candidates from provinces with a larger number of university slots per capita should experience a relatively greater treatment effect from higher education expansion than their peers whose home provinces have a smaller number of university slots per capita.

I use a difference-in-differences strategy to identify the causal effect of higher education expansion on the outcomes of interest by exploiting two variation sources, as mentioned above. The specification is as follows:

\[ Y_{ipc} = \alpha + \beta (RHE_p \times Young_i) + X_i'\gamma + \delta_p + \eta_c + \epsilon_{ipc}, \]  

where \( i, p, \) and \( c \) denote the individual, home province, and birth cohort, respectively. \( Y_{ipc} \) is the outcome variable of individual \( i \). The dummy variable \( RHE_p \) is equal to one if \( i \)'s home province \( p \) ranks within the top tercile of the national rankings for the number of university slots per ten thousand high school graduates in 1998, the year before the expansion. \( Young_i \) is an indicator for the cohort aged 18
years or younger in 1999 (born after 1980) that could be affected by the expansion policy. The key variable of interest is the interaction term $RHE_p \times Young_i$. The coefficient of interest, $\beta$, captures the intention-to-treat effects/reduced-form impact of higher education expansion. In other words, the estimated coefficient of $\beta$ averages the effects of higher education expansion over the cohort born after 1980 whose birth province has rich higher education resources, although not all were directly affected by the expansion. The vector of exogenous covariates $X_i$ includes a gender indicator, a dummy for being born in an urban area, a dummy for Han nationality, sex ratios in each province of each birth cohort, dummies for the parents’ level of education, dummies for parents’ Communist party membership, and parents’ occupation information. The vector of exogenous covariates $X_i$ includes a gender indicator, a dummy for being born in an urban area, a dummy for Han nationality, sex ratios in each province of each birth cohort, dummies for the parents’ level of education, dummies for parents’ Communist party membership, and parents’ occupation information.11 Birthplace fixed effects $\delta_p$ and year of birth fixed effects $\eta_c$ absorb the effects of time-invariant birthplace characteristics and birth cohort effects. Moreover, I also include interactions between their birth region (eastern, central, western, and northeastern) and birth year dummies, in addition to the baseline model, to flexibly control for contemporaneous changes in time-varying unobservable factors at the birth region level that may be correlated with the expansion.12 Standard errors are clustered at the level of birth place-year to account for any arbitrary correlation of the error term, $\epsilon ipc$.

Using this difference-in-differences strategy, the key identification assumption to be satisfied to interpret the results causally is the parallel trends assumption. That is, without higher education expansion, people in regions with richer higher education resources (more university slots per capita, $RHE = 1$) and regions with fewer higher education resources ($RHE = 0$) should not exhibit a differential trend in observable and unobservable characteristics that are correlated with the outcomes of interest in this study. The falsification tests in Section 4.5 find no evidence of pre-existing trends using the older cohort whose educational attainment was not affected by the expansion and no time-varying systematic shocks or confounding trends during the period of study affecting the results, which supports the identification assumption.13

number of university slots per capita of the province/municipality. The plot is based on statistics from the National Bureau of Statistics of the People’s Republic of China.

11An indicator for being born in an urban area is included because there is a large urban-rural gap in educational resources and quality in China. A dummy for Han nationality (the ethnic majority group) is included because ethnic minority students can be enrolled in universities with lower scores than those required of the Han ethnic group under a nationwide policy in China. Sex ratios in each province of each birth cohort are included to control for the effects of peer gender composition. Parents’ characteristics (education, occupation, and Communist party membership) are included, following the implications from Yeung (2013) and Li et al. (2012), which stress the influence of family background and parents’ political status on an individual’s higher education attainment and job opportunities in China.

12Birth provinces are divided into four regions — eastern, central, western, and northeastern. This division is officially standardized and is based on different socioeconomic and geographical levels.

13Moreover, I conduct a balancing test of exogenous characteristics on the key estimator $RHE_p \times Young_i$ to determine whether there is a selection of individuals, following the procedure proposed by Pei et al. (2019), which puts the variables on the left-hand side as an outcome rather than as controls to check whether they are affected by the “treatment.” There is no significant difference in most variables between those cohorts who were most likely to be affected by higher education expansion and the others. The balancing test results are available upon request.

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3.2 Data

I use data from the Chinese General Social Survey (CGSS) in 2010, 2012, 2013, 2015, and 2017. The CGSS is a nationally representative annual/biannual survey project that is part of the International Social Survey Program and has been conducted jointly by the Renmin University of China and Hong Kong University of Science and Technology since 2003 (Bian and Li 2012). The surveys use multistage random sampling and cover urban and rural households from almost every province in mainland China, providing repeated cross-sectional data on socioeconomic measures. The CGSS datasets provide a wealth of information concerning individuals’ demographic characteristics, family background, educational experience, occupation, etc.

I use data from the years 2010, 2012, 2013, 2015, and 2017 because survey questions about gender ideology are included in the questionnaires in these years. Respondents were asked to what extent they agreed with the following five statements related to gender-role attitudes.

Statement 1  A man should focus more on his career, while a woman should focus more on her family.
Statement 2  Males are more capable than females by nature.
Statement 3  For a woman, a good marriage brings her a better life than does a good job.
Statement 4  When jobs are scarce, men should have more rights to a job than women.
Statement 5  Husbands and wives should share household chores equally.

Clearly, statements 1 to 4 indicate traditional gender-role attitudes that stress women’s family-focused role and men’s career-focused role, while statement 5 expresses an egalitarian view. In the survey, each statement is presented as a question with a 5-level Likert scale, and respondents report an answer from 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, to 5 = strongly agree. To obtain a composite index of egalitarian gender-role attitudes, I first recode statement 1 to statement 4 to have the same direction as statement 5; that is, a higher value indicates a more egalitarian and progressive attitude. Then, I standardize the value of each statement to obtain a $Z$-score with zero mean and unit variance in each measure. Finally, a composite index of egalitarian gender-role attitudes is obtained as the average of the five $Z$-scores. As a result, the lower the value of the composite index is, the more traditional the gender-role attitudes of the respondent are; the higher the value is, the more progressive the person is. The lower panel of Table 1 shows the summary statistics of the reported values for each statement and the composite index of egalitarian gender-role attitudes. Women report a more egalitarian opinion than men on every statement except for statement 3 “For a woman, a good marriage

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14 The questionnaires in previous waves of the CGSS do not contain these focal questions about gender-role attitudes.
15 Alternatively, I also implement principal component analysis (PCA) in the final step to generate a composite index of egalitarian gender-role attitudes as a robustness check. Results are consistent and available upon request.
Table 1  Summary Statistics

|                           | All            | Females        | Males          |
|---------------------------|----------------|----------------|----------------|
|                           | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Age                       | 36.17 5.46 |       | 36.17 5.46 |       | 36.18 5.46 |       |
| Male                      | 0.47 0.50 |       | 0.00 0.00 |       | 1.00 0.00 |       |
| Han nationality           | 0.91 0.29 |       | 0.90 0.29 |       | 0.91 0.28 |       |
| Born in urban areas       | 0.26 0.44 |       | 0.25 0.43 |       | 0.28 0.45 |       |
| Sex ratio at birth        | 1.03 0.06 |       | 1.03 0.06 |       | 1.03 0.06 |       |
| Birthplace with rich HE resources | 0.31 0.46 |       | 0.30 0.46 |       | 0.32 0.47 |       |
| Higher-educated           | 0.10 0.30 |       | 0.09 0.28 |       | 0.12 0.32 |       |
| Years of schooling        | 10.48 4.06 |       | 10.01 4.24 |       | 11.00 3.78 |       |
| Marital status            | 0.88 0.32 |       | 0.91 0.28 |       | 0.85 0.36 |       |
| Age at first marriage     | 24.03 3.46 |       | 23.23 3.16 |       | 24.98 3.56 |       |
| Highly educated spouse    | 0.09 0.29 |       | 0.10 0.29 |       | 0.09 0.28 |       |
| Communist party member    | 0.10 0.30 |       | 0.06 0.24 |       | 0.14 0.35 |       |
| Father less-educated      | 0.78 0.41 |       | 0.79 0.41 |       | 0.78 0.41 |       |
| Father more-educated      | 0.19 0.39 |       | 0.18 0.38 |       | 0.19 0.39 |       |
| Father Communist party member | 0.17 0.38 |       | 0.16 0.37 |       | 0.18 0.39 |       |
| Father agricultural worker | 0.53 0.50 |       | 0.54 0.50 |       | 0.51 0.50 |       |
| Father non-agricultural employee | 0.27 0.45 |       | 0.26 0.44 |       | 0.29 0.45 |       |
| Mother less-educated      | 0.87 0.33 |       | 0.88 0.33 |       | 0.86 0.34 |       |
| Mother more-educated      | 0.11 0.31 |       | 0.10 0.30 |       | 0.11 0.32 |       |
| Mother Communist party member | 0.04 0.19 |       | 0.03 0.18 |       | 0.04 0.20 |       |
| Mother agricultural worker | 0.61 0.49 |       | 0.63 0.48 |       | 0.60 0.49 |       |
| Mother non-agricultural employee | 0.16 0.37 |       | 0.15 0.36 |       | 0.18 0.38 |       |
| Currently working         | 0.79 0.40 |       | 0.70 0.46 |       | 0.90 0.30 |       |
| Weekly working hours      | 50.26 18.28 |       | 48.14 18.25 |       | 52.08 18.11 |       |
| Weekly working hour gap in a couple | 3.85 17.61 |       | 4.51 18.16 |       | 3.06 16.89 |       |

*Measures of gender-role attitudes:*

“A man should focus more on his career, while a woman should focus more on her family.”  
3.32 1.22 3.26 1.26 3.37 1.18  

“Males are more capable than females by nature.”  
2.83 1.21 2.79 1.24 2.89 1.17  

“For a woman, a good marriage brings her a better life than does a good job.”  
3.02 1.20 3.06 1.22 2.98 1.18  

“When jobs are scarce, men should have more rights to a job than women.”  
2.00 0.96 1.88 0.94 2.13 0.97
Table 1 (continued)

|                                | All          | Females      | Males        |
|--------------------------------|--------------|--------------|--------------|
|                                | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| “Husband and wife should share household chores equally.” | 3.83 | 1.04 | 3.99 | 0.98 | 3.65 | 1.07 |
| Index of egalitarian gender-role attitudes | −0.00 | 0.61 | 0.06 | 0.62 | −0.07 | 0.59 |
| Observations                   | 16656 |     | 8823 |     | 7833 |     |

“Male” is a dummy variable equal to 1 if the individual is a man. “Han nationality” is an indicator of whether the individual is of the Han ethnic group. “Born in urban area” is a dummy equal to 1 if the individual was born in an urban area. “Sex ratio at birth” measures the ratio of males to females for each birth year in each birth province. “Birthplace with rich HE resources” is an indicator of whether the individual’s birthplace ranks within the top tercile in the national ranking for the number of university slots per ten thousand high school graduates in 1998 in each province. “Higher-educated” is an indicator for having a bachelor’s degree or higher. “Marital status” is a dummy equal to 1 if the individual is married or has a partner. “Age at first marriage” is the age at which the individual married for the first time. “Highly-educated spouse” is an indicator of whether the individual’s spouse is highly educated. “Communist party member” is an indicator of whether the individual is a Communist party member. “Father less educated” is an indicator of whether the schooling level of the individual’s father is not above a junior secondary education. “Father more educated” is an indicator of whether the schooling level of the individual’s father is at least a senior secondary education. “Father Communist party member” is an indicator of whether the individual’s father is a Communist party member. “Father agricultural employee” and “Father non-agricultural employee” are indicators of the individual’s father’s job type. The same indicators are used for mother’s education level, party membership, and job categories. “Currently working” is a dummy equal to 1 if the individual is currently working/has a job. “Weekly working hours” is the individual’s self-reported weekly working hours including overtime hours. “Weekly working hour gap in a couple” is the gap in weekly working hours between the husband and wife for working couples. “Gender-role attitude measure” is a composite index of egalitarian gender-role attitudes: the more negative the value is, the more traditional the gender-role attitudes are, and vice versa.

Women in China appear to attach high importance to marriage. Overall, women have much more egalitarian gender views than men do. The average value of the egalitarian index for the female sample is 0.06, while the average value for the male sample is −0.07.

As the higher education expansion started in 1999, I include individuals who were born between 1981 and 1986 as the young cohort; such individuals were 18 years old or younger in 1999 and should be affected by the policy. Individuals who were born between 1970 and 1980 are included as the control group. Therefore, we have a repeated cross-sectional sample for the analysis that contains 16,656 observations, including 3504 observations in 2010, 3383 observations in 2012, 3464 observations in 2013, 2920 observations in 2015, and 3385 observations in 2017. Table 1 presents summary statistics for the main variables, including key information on individual

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16I exclude individuals born before 1970 to ensure that individuals in the analysis sample have been affected by the enacted Compulsory Education Law. The CGSS 2017 data do not release information on people’s birth months, so I cannot further accurately obtain people’s birth information into months.
characteristics, family background, outcomes related to the labor market and marriage market, and measures of gender ideology for the whole sample and for females and males separately.

Furthermore, I plot the means of key outcomes by birth year and by regions with richer or fewer higher education resources for women and men separately. The red/circle line represents women in $RHE = 1$ regions, the blue/filled circle line represents women in $RHE = 0$ regions, the gray/square line represents men in $RHE = 1$ regions, and the black/filled squared line represents men in $RHE = 0$ regions. Figure 2a presents the means of obtaining a higher education. It shows that women and men in regions where $RHE = 1$ are more likely to be college educated than those in regions where $RHE = 0$. The gap increases for cohorts born after 1980 as a result of the expansion of higher education. Figure 2b presents the means of the composite index of gender-role attitudes. Women in both $RHE = 1$ and $RHE = 0$ regions have a higher egalitarian index level than men. Men in both regions exhibit a similar and negative level of gender attitudes, which is consistent across all birth years. Women in $RHE = 1$ regions are more egalitarian than those in $RHE = 0$ regions, but the gap decreases for cohorts born after 1980, as the red/circle line begins to fluctuate markedly for cohorts younger than 1980. Figure 2 provides descriptive evidence that the expansion has increased higher education attainment for both women and men in $RHE = 1$ regions compared to $RHE = 0$ regions. However, the expansion tends to undermine progressive attitudes for women in regions where $RHE = 1$ as compared to regions where $RHE = 0$. Contrary to this, men’s attitudes are largely unaffected and remain conservative. Additionally, the evidence supports the parallel trends assumption that the trends in the key outcomes for $RHE = 1$ and $RHE = 0$ groups are generally moving in parallel prior to the expansion.

![Fig. 2 Mean outcomes by birth year and treatment-intensive regions. These plots display the means of outcomes by birth year and treatment-intensive regions. Panel a illustrates the means of obtaining a higher education. Panel b plots the means of the composite index of egalitarian gender-role attitudes. The red/circle, blue/filled circle, gray/square, and black/filled square lines represent women from $RHE = 1$ regions, women from $RHE = 0$ regions, men from $RHE = 1$ regions, and men from $RHE = 0$ regions, respectively](image-url)
4 Empirical results

4.1 Higher educational attainment

First, I examine the effect of higher education expansion on an individual’s higher educational attainment. Table 2 presents the results from estimating Eq. 1 on the dependent variable of whether the individual holds a degree of higher education. Columns (1) and (2) present the results for the female sample, and columns (3) and (4) report the results for the male sample. Columns (1) and (3) estimate the results of the baseline model in Eq. 1, which controls for exogenous covariates, birthplace fixed effects, and birth year fixed effects. Columns (2) and (4) also include the interaction terms between the dummies for the birth region and birth year. The results for the female sample show that higher education expansion significantly increases a woman’s probability of attending university by 6.7 percentage points. The estimate decreases slightly to 6.1 percentage points after controlling for the birth region and year interaction fixed effects. For the male sample, the expansion significantly increases a man’s probability of going to college by 7.1 to 8.1 percentage points. Overall, the results show that higher education expansion significantly increases the opportunity to obtain higher education for both women and men. Considering the sample mean for women having a college degree is 8.6% and for men is 11.8%, the estimates indicate that the expansion has had a greater impact on the education of women than men.

To further examine the impact of the higher education expansion, I plot the coefficients of the interactions between $RHE_p$ and the dummies of different birth cohorts in Fig. 3 for both the female and the male samples. The plots connected by each

| Table 2 | Impact of higher education expansion on higher educational attainment |
|-----------------|-----------------------------|
| Dependent variable: | Have a higher education degree |
|                  | Females | Males |
|                  | (1) | (2) | (3) | (4) |
| Young $\times$ rich HE resources | 0.067*** | 0.061*** | 0.081*** | 0.071*** |
| Mean of dep. variable | 0.086 | 0.086 | 0.118 | 0.118 |
| Birth place $+$ birth year | Yes | Yes | Yes | Yes |
| Exogenous covariates | Yes | Yes | Yes | Yes |
| Birth region $\times$ birth year | No | Yes | No | Yes |
| Observations | 8823 | 8823 | 7833 | 7833 |

The dependent variable is whether an individual holds a higher education degree. The set of exogenous covariates includes gender, type of ethnic group, whether born in an urban area, sex ratios in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are included. Robust standard errors in parentheses are clustered at the level of birth place-year. $^* p < 0.1; ^{**} p < 0.05; ^{***} p < 0.01$
solid line correspond to the coefficients of the interactions of $RHE_p \times$ the dummies of different birth cohorts in the education equation controlling for birthplace fixed effects, birth year fixed effects, and exogenous covariates. The birth cohort aged 19–20 years in 1999 is treated as the reference group; thus, the coefficient is plotted as zero. As expected, for the cohorts aged 18 years and younger in 1999, the probability of attending university increases significantly. The figure also lends support to the parallel trends assumption that there is no evident pretrend.\textsuperscript{17} Consistent with the results in Table 2, both women and men reach significantly higher educational attainment under the impact of higher education expansion.

### 4.2 Gender norms

In this section, I explore the key question of whether higher education expansion has an impact on gender ideology. I first present the results for each of the five statements concerning gender-role attitudes in the CGSS questionnaires separately. The higher the score is, the more the respondent agrees with the statement. Then, I estimate the results for a composite index of egalitarian gender-role attitudes based on the five statements to measure an individual’s gender ideology. A higher value corresponds to a more egalitarian gender-role attitude.

The results for each of the five statements are presented in Table 3, panels I to V. Overall, the results indicate that women’s egalitarian opinions regarding gender roles have been adversely affected following the expansion. Women indicate less confidence in themselves (statement 2), put more value on marriage than on a career (statement 3), are willing to sacrifice their job opportunities (statement 4), and share more housework (statement 5). For men, the estimates show a minimally significant

\textsuperscript{17}Notably, the small increase for the cohorts aged 23–24 and 25–26 years in the male sample is likely caused by the small-scale higher education expansion from 1992 to 1993. For the female sample, the pretrend is negligible.
Table 3  Impact of higher education expansion on gender-role attitudes

| Statements on gender-role attitudes | Females | Males |
|------------------------------------|---------|-------|
|                                    | (1)     | (2)   |
| I. Statement 1: “A man should focus more on his career, while a woman should focus more on her family.” |         |       |
| Young × rich HE resources           | 0.084   | 0.101 |
|                                    | (0.059) | (0.062)|
| Mean of dep. variable               | 3.262   | 3.262 |
| Observations                        | 8813    | 8813  |
| Mean of dep. variable               | 3.375   | 3.375 |
| Observations                        | 7823    | 7823  |
| II. Statement 2: “Males are more capable than females by nature.” |         |       |
| Young × rich HE resources           | 0.121** | 0.106*|
|                                    | (0.059) | (0.061)|
| Mean of dep. variable               | 2.787   | 2.787 |
| Observations                        | 8796    | 8796  |
| Mean of dep. variable               | 2.888   | 2.888 |
| Observations                        | 7813    | 7813  |
| III. Statement 3: “For a woman, a good marriage brings her a better life than a good job does.” |         |       |
| Young × rich HE resources           | 0.127** | 0.129**|
|                                    | (0.055) | (0.062)|
| Mean of dep. variable               | 3.056   | 3.056 |
| Observations                        | 8788    | 8788  |
| Mean of dep. variable               | 2.982   | 2.982 |
| Observations                        | 7793    | 7793  |
| IV. Statement 4: “When jobs are scarce, men should have more rights to a job than women.” |         |       |
| Young × rich HE resources           | 0.152***| 0.143***|
|                                    | (0.045) | (0.047)|
| Mean of dep. variable               | 0.033   | 0.005 |
| Observations                        | (0.048) | (0.053)|
Table 3 (continued)

| Dependent variable: | Statements on gender-role attitudes |
|---------------------|-------------------------------------|
|                     | Females                             | Males     |
|                     | (1)                                 | (2)       | (3)       | (4)       |
| Mean of dep. variable | 1.881                               | 1.881     | 2.126     | 2.126     |
| Observations        | 8747                                | 8747      | 7774      | 7774      |
| V. Statement 5: “Husbands and wives should share household chores equally.” |
| Young × rich HE resources | -0.092* (0.053)          | -0.102* (0.058) | -0.055 (0.049) | -0.018 (0.054) |
| Mean of dep. variable | 3.991                               | 3.991     | 3.653     | 3.653     |
| Observations        | 8805                                | 8805      | 7812      | 7812      |
| VI. Composite Index of Egalitarian Gender-role Attitudes |
| Young × rich HE resources | -0.105*** (0.028)               | -0.106*** (0.030) | -0.001 (0.031) | 0.012 (0.034) |
| Mean of dep. variable | 0.0641                              | 0.0641    | -0.0739   | -0.0739   |
| Observations        | 8819                                | 8819      | 7826      | 7826      |
| Birth place + birth year | Yes                                | Yes       | Yes       | Yes       |
| Exogenous covariates | Yes                                | Yes       | Yes       | Yes       |
| Birth region × birth year | No                                 | Yes       | No        | Yes       |

Panels I–V present an individual’s propensity to agree with statements 1–5, respectively, from 1 = totally disagree to 5 = completely agree. The dependent variable in panel VI is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01
impact of higher education expansion on their gender views, except for statement 2. It seems that men think more highly of women’s capability after the expansion.

To obtain a general measure of gender ideology, I construct a composite index of egalitarian gender-role attitudes using the average value of the five measures after recoding the first four statements to have the same direction as the fifth statement and standardizing each statement to obtain a Z-score. Using the composite index as the dependent variable, I present the estimates in Table 3, panel VI. Among the female sample, the estimates show that higher education expansion significantly decreases the egalitarian level of gender norms for the treatment cohorts by 0.105 to 0.106 standard deviations. For men, the estimates are relatively small and nonsignificant. Comparatively speaking, women’s gender-role attitudes (a positive mean value) are more egalitarian than men’s (a negative mean value). However, higher education expansion negatively impacts women’s progressive gender views but no impact on men’s views. Figure 4 illustrates the results by plotting the coefficients of the interactions between $RHE_p$ and the dummies of different birth cohorts. For women, the egalitarian level of gender norms is negatively affected, whereas for men, the level is roughly unchanged.\textsuperscript{18}

4.3 Labor market outcomes

To understand the results regarding attitudes toward gender norms, I explore the potential mechanisms through which the higher education expansion may influence women’s outcomes. The labor market can be a crucial channel. In this section, I examine the impact of higher education expansion on labor market outcomes.

Table 4 panel I reports estimates for labor force participation. The ITT effects for the female and male samples separately indicate that the expansion significantly decreases women’s probability of working by 4.7 percentage points after controlling for the birth region and year interaction fixed effects, while for men, the estimates are positive, though nonsignificant. To check the employment trend, I plot the coefficients of the interactions between $RHE_p$ and the dummies of different birth cohorts in the left panel of Fig. 5 for females and males. For women, there is a decline in employment after the expansion, whereas for men, no such decline is observed. The results suggest that the expansion does not promote women’s participation in the labor market but instead makes their situation even worse compared to that of men.

Moreover, I estimate the impact on an individual’s self-reported weekly working hours (including overtime hours) if she or he has been actively engaged in the labor market to explore the impact on labor force participation at the intensive margin. As shown in Table 4, panel II, women tend to have reduced working hours after the expansion, while men are likely to work more, although most estimates are nonsignificant.

\textsuperscript{18}Note that the dip for the cohort aged 19–20 in each plot is due to normalization because this cohort is treated as the reference group; thus, the coefficient is plotted as zero.
Fig. 4 The level of egalitarian gender-role attitudes by birth cohort. The plots connected by each solid line correspond to the coefficients of the interactions of $RHE_p \times$ the dummies of different birth cohorts in Eq. 1, controlling for birthplace fixed effects, birth year fixed effects, and exogenous covariates. The birth cohorts aged 19–20 years in 1999 are treated as the reference group; thus, the coefficient is plotted as zero. Dotted lines represent the corresponding 95% confidence intervals.

Furthermore, I check the gap in weekly working hours between the husband and wife among working couples in dual-earner households. The ITT estimates in Table 4, panel III, indicate that after the expansion, a man is more likely to work longer than his wife by approximately 2 hours per week. However, the impact on the female subsample is minimal.

Taken together, the labor market analyses suggest that after the expansion, women’s labor force participation tends to decline at both extensive and intensive margins, while men’s situations appear to be the opposite. As previous studies documented, after China’s higher education expansion, college graduates experienced increased peer competition and employment pressure due to the supply shock (Knight et al. 2017; Li et al. 2014; Xing et al. 2018). Given this, the results here imply that gender gaps and women’s disadvantaged status in the labor market seem to have intensified. Women may be more likely to be victims of elevated supply-side competition in the labor market after the expansion. A similar scenario might be found in South Korea in the 1990s, where highly educated women were less likely to be employed because an adequate supply of highly educated men provided employers with few incentives to disobey social patriarchal preferences (Brinton et al. 1995).

The results on labor market outcomes may, to a large extent, explain the findings that women tended to have negative and self-deprecating views on labor force participation after the expansion. The primary reason is that increased higher education opportunities and equality for women in educational attainment fail to raise opportunities and equality in the labor market.

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19 The gap is defined as how many more hours per week a husband works than his wife works. Working couples are defined as couples in which both husbands and wives report working positive hours in a week. I use the sample of working couples instead of all couples to avoid confusion between nonworking and nonreported working caused by potential nonresponse in the surveys.

20 Additionally, the effect of higher education on an individual’s income is estimated. No significant effects on income for women or men are observed after the expansion. The results are available upon request.
Table 4  Impact of higher education expansion on labor market outcomes

|                      | Females          |          | Males          |          |
|----------------------|------------------|----------|----------------|----------|
|                      | (1)              | (2)      | (3)            | (4)      |
| I. Dependent variable: probability of working |                   |          |                |          |
| Young × rich HE resources | −0.002          | −0.047*  | 0.017          | 0.021    |
|                      | (0.023)          | (0.025)  | (0.014)        | (0.017)  |
| Mean of dep. variable | 0.697            | 0.697    | 0.902          | 0.902    |
| Observations         | 8823             | 8823     | 7833           | 7833     |
| II. Dependent variable: weekly working hours of labor market participants |                   |          |                |          |
| Young × rich HE resources | −2.279**         | −1.732   | 1.020          | 1.178    |
|                      | (0.964)          | (1.145)  | (0.834)        | (0.944)  |
| Mean of dep. variable | 48.14            | 48.14    | 52.08          | 52.08    |
| Observations         | 5913             | 5913     | 6894           | 6894     |
| III. Dependent variable: weekly working hours gap between husband and wife among working couples |                   |          |                |          |
| Young × rich HE resources | 0.428            | −0.145   | 2.166*         | 2.408*   |
|                      | (1.087)          | (1.197)  | (1.246)        | (1.279)  |
| Mean of dep. variable | 4.510            | 4.510    | 3.064          | 3.064    |
| Observations         | 4978             | 4978     | 4128           | 4128     |
| Birth place + birth year | Yes              | Yes      | Yes            | Yes      |
| Exogenous covariates | Yes              | Yes      | Yes            | Yes      |
| Birth region × birth year | No               | Yes      | No             | Yes      |

In panel I, the dependent variable is an individual’s probability of working. In panel II, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. In panel III, the dependent variable is, among working couples, the gap in weekly working hours between the husband and wife. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01

4.4 Marriage market outcomes

Marriage market outcomes can also influence gender-role attitudes and intrahousehold specifications. To further understand and interpret the results, I check whether higher education expansion has affected marriage market outcomes.

Table 5, panel I, reports the results for the effect of the higher education expansion on marital status. The probability of marriage declines for both women and men. Figure 6 directly illustrates the trend of decreased marriage rates. Additionally, as shown in Table 11, panel I, women tend to marry at a slightly older age, while there is no significant impact on men’s age at first marriage. Moreover, speaking of the ideal number of children, both women and men tend to have a lower parental son preference after the expansion. The ideal number of sons for women decreases and
**Fig. 5** Probability of working by birth cohort. The plots connected by each solid line correspond to the coefficients of the interactions of $RHE_p \times$ the dummies of different birth cohorts in Eq. 1, controlling for birthplace fixed effects, birth year fixed effects, and exogenous covariates. The birth cohorts aged 19–20 years in 1999 are treated as the reference group; thus, the coefficient is plotted as zero. Dotted lines represent the corresponding 95% confidence intervals.

**Table 5** Effects of higher education on the marriage market

| Marriage market outcomes | Females | Males |
|--------------------------|---------|-------|
|                          | (1)     | (2)   | (3)     | (4)     |
| **I. Dependent variable: probability of marriage** |         |       |         |         |
| Young $\times$ rich HE resources | $-0.047^{***}$ | $-0.027$ | $-0.047^{**}$ | $-0.033$ |
| Mean of dep. variable     | 0.914   | 0.914 | 0.848   | 0.848   |
| Observations              | 8816    | 8816  | 7828    | 7828    |
| **II. Dependent variable: having a highly educated spouse among couples** |         |       |         |         |
| Young $\times$ rich HE resources | $0.050^{***}$ | $0.051^{***}$ | $0.038^{**}$ | $0.024$ |
| Mean of dep. variable     | 0.096   | 0.096 | 0.089   | 0.089   |
| Observations              | 8058    | 8058  | 6636    | 6636    |
| Birth place $+$ birth year| Yes     | Yes   | Yes     | Yes     |
| Exogenous covariates      | Yes     | Yes   | Yes     | Yes     |
| Birth region $\times$ birth year | No    | Yes   | No      | Yes     |

In panel I, the dependent variable is an individual’s probability of being married. In panel II, the dependent variable is, among couples, the probability of having a highly educated spouse. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent education levels, parent party membership, and parent occupation information. Survey city fixed effects and survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
the ideal number of daughters for men increases, as reported in Table 11, panels II and III.

Furthermore, as shown in Table 5, panel II, after the higher education expansion, married people are more likely to have a highly educated spouse. The result is significantly driven by the female sample. This finding is consistent with a pattern of positive assortative matching in terms of education, which is an increasing pattern in China (Nie and Xing 2019). Moreover, Ong et al. (2020) and Qian and Qian (2014) document that under the traditional practice of hypergamy, women have stronger preferences for assortativeness in education than men do. Because of assortative matching, highly educated women are likely to marry highly educated men. The prevailing practice in the marriage market may explain the increased probability of having a highly educated spouse after the expansion, especially for women.

Taken together with the findings in Section 4.3 that highly educated husbands have more working hours than their wives after the expansion, the evidence of the increased probability of women having a highly educated spouse implies that women may reallocate their focus on the household since their husbands have an advantage in being the breadwinner for the family in the labor market. This implication is in accordance with findings in the USA that the labor market outcomes of higher-educated women are negatively affected by their husbands’ long work hours (McKinnish 2020).

The results of the equilibrium impact of the higher education expansion on the labor market and marriage market conform to women’s adapted gender-role attitudes after the expansion. That is, reluctance to compete with men for jobs (statements 2 and 4), increased attachment to marriage (statement 3), and willingness to take more responsibility for household labor (statement 5). The adverse impact on egalitarian gender-role attitudes may come from the reinforced traditional gender specialization and arrangement in the household, induced by the practical conditions that women face in the labor market.
4.5 Falsification tests

In this section, I conduct two sets of falsification tests to validate identifying assumptions and rule out confounding factors.

4.5.1 Falsification tests on cohorts nontargeted by policy

One of the key identifying assumptions of the empirical strategy is that regions with richer higher education resources and regions with fewer higher education resources should not exhibit a differential trend in observable and unobservable characteristics that are correlated with an individual’s probability of obtaining a college education and other outcomes of interest, apart from the higher education expansion. One concern that may arise is that regions with more higher education resources and regions with fewer higher education resources may have different prepolicy trends and thus are on different outcome tracks. To check if such different prepolicy trends exist, I conduct a placebo test using individuals born between 1970 and 1980, who should mostly be exempt from the impact of the expansion policy on their education, as a placebo sample for the test. The younger placebo cohorts include individuals with birth years between 1975 and 1980. The results of the placebo tests are reported in Table 6, columns (1) and (2). Panel I shows that for younger placebo cohorts born in regions with rich higher education resources, the chances of attending a university did not differ from those of the other groups before the higher education expansion policy was introduced. This placebo test eliminates the concern of different time trends of unobservable characteristics concerning the higher educational attainment of individuals between regions with rich higher education resources and others. Moreover, I conduct the same placebo test for the main outcomes of interest, including gender-role attitudes, the probability of working, the weekly working hours of labor market participants, the weekly working hour gap in dual-earner households, marital status, and the likelihood of having a highly educated spouse, and present the results in panel II to panel VII. No significant differences are observed in any of the main outcomes of interest for the placebo sample of individuals who should not be affected by the higher education expansion.

Furthermore, I run a placebo test on the “less-affected” individuals, that is, those who do not enter high school or equivalent schooling. In principle, individuals who finish only compulsory schooling or have a lower secondary education are unlikely to go to college and thus are largely exempt from the direct impact of higher education expansion. The results in Table 6 columns (3) and (4) show no significant differences in most labor market and marriage market outcomes. However, panel II, column (3), reveals that the gender-role attitudes of women with junior high school or lower education levels are also negatively affected by the expansion. The magnitude of the estimate is slightly larger than the estimate of the whole female sample. Several reasons may lead to the result. First, even though higher education expansion does not directly affect lower-educated women’s educational attainment, it could...
### Table 6  Placebo tests on cohorts nontargeted by policy

| Nontargeted group: | Older cohorts | Junior high or below |
|--------------------|--------------|---------------------|
|                    | Females (1)  | Males (2)           | Females (3)  | Males (4)  |
| I. Dependent variable: having a higher education degree |
| Young × rich HE resources | 0.006 | −0.021 | − | − |
| Mean of dep. variable | 0.053 | 0.080 | − | − |
| Observations | 5725 | 5074 | − | − |
| II. Dependent variable: composite index of egalitarian gender-role attitudes |
| Young × rich HE resources | 0.031 | −0.051 | −0.114*** | 0.052 |
| Mean of dep. variable | 0.0420 | −0.0491 | 0.0174 | −0.0252 |
| Observations | 5722 | 5068 | 5175 | 3909 |
| III. Dependent variable: probability of working |
| Young × rich HE resources | 0.007 | −0.026 | −0.062 | 0.011 |
| Mean of dep. variable | 0.717 | 0.900 | 0.623 | 0.861 |
| Observations | 5725 | 5074 | 5177 | 3914 |
| IV. Dependent variable: weekly working hours of labor market participants |
| Young × rich HE resources | 0.892 | 2.048 | −4.827* | 3.226* |
| Mean of dep. variable | 48.76 | 52.65 | 51.28 | 55.86 |
| Observations | 3968 | 4448 | 3157 | 3326 |
| V. Dependent variable: weekly working hours gap between husband and wife among working couples |
| Young × rich HE resources | 0.180 | 1.472 | 2.731 | 1.718 |
| Mean of dep. variable | 4.178 | 2.778 | 5.709 | 4.114 |
| Observations | 3448 | 2920 | 2752 | 1904 |
| VI. Dependent variable: probability of marriage |
| Young × rich HE resources | −0.024 | 0.000 | −0.023 | −0.003 |
| Mean of dep. variable | 0.936 | 0.902 | 0.951 | 0.877 |
| Observations | 5720 | 5072 | 5172 | 3910 |
| VII. Dependent variable: having a highly educated spouse among couples |
| Young × rich HE resources | 0.000 | 0.029 | 0.003 | 0.007 |
| Mean of dep. variable | 0.076 | 0.066 | 0.005 | 0.004 |
| Observations | 4281 | 3730 | 4919 | 3431 |
Table 6 (continued)

| Nontargeted group: | Older cohorts | | Junior high or below | |
|---|---|---|---|---|
| | Females | Males | Females | Males |
| (1) | (2) | (3) | (4) |
| Birth place + birth year | Yes | Yes | Yes | Yes |
| Exogenous covariates | Yes | Yes | Yes | Yes |
| Birth region × birth year | Yes | Yes | Yes | Yes |

Columns (1) and (2) present estimates using cohorts born between 1970 and 1980. Columns (3) and (4) present estimates using individuals with less than a high school education. In panel I, the dependent variable is an individual’s probability of having a higher education degree. In panel II, the dependent variable is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. In panel III, the dependent variable is an individual’s probability of working. In panel IV, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. In panel V, the dependent variable is, among working couples, the gap in weekly working hours between the husband and wife. In panel VI, the dependent variable is an individual’s probability of being married. In panel VII, the dependent variable is, among couples, the probability of having a highly educated spouse. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01

affect some labor market and marriage market outcomes through general equilibrium effects, which may indirectly affect their gender-role attitudes. Second, there could be peer effects among women with different educational levels. As Cislaghi and Heise (2020) noted, gender-role attitudes are embedded in social norms and are produced and reproduced through social interactions among individuals. Overall, this analysis indicates that higher education expansion influences gender norms through general equilibrium effects.

4.5.2 Falsification tests on confounding factors

Another concern is that there might be other confounding trends over time across regions in the country that affected the outcomes of interest. To address the possibility that the documented transformations might be caused by factors other than the higher education expansion, I create three hypothetical “treatment” indicators using predetermined characteristics of confounders to replace the \( RHE_p \) dummy in Eq. 1 for three more placebo tests. The first one takes into account that baseline gender equality can be different across regions in the country, so I create a dummy variable equal to 1 if the individual’s birth province ranks within the top tercile of the national ranking for the most balanced sex ratio at birth, based on the national population census.
data in 2000. An imbalanced sex ratio at birth serves as a strong indicator of gender discrimination. The second considers the impact of the economic status of each province because many factors of interest may correlate with economic development levels. I create a dummy variable equal to 1 if the individual’s birth province ranks within the top tercile of the national ranking for provincial GDP in 1998. Finally, the impact of the market-oriented economic reform in China starting in 1978 may also affect the results. I create a dummy variable equal to 1 if the individual’s birth province ranks within the top tercile of the national ranking for the value added by the financial industry to GDP in 1998. Before the economic reform, the financial industry in China was embryonic, and it only started developing in 1978 when the economic reform began (Huang and Wang 2018). Therefore, value added by the financial industry can be a proxy for the extent of economic reform in different regions in 1998 before the higher education expansion. Table 7 reports the results of the three placebo tests. It shows that higher education expansion does not correlate with the baseline gender ideology, GDP, or the extent of economic reform across different places. Furthermore, there is no significant effect for the main outcomes of interest.

### 4.6 Subsample analysis and heterogeneous effects

The evidence so far suggests that despite the increased educational attainment of women, the gender gap in the labor market tends to increase after higher education expansion, which may result in reinforced traditional intrahousehold specification, in turn negatively affecting women’s egalitarian gender views. To further validate and explore the potential mechanisms for this result, I conduct several subsample analyses in this section. It is important to recognize that the compositions of the following subsamples should be interpreted as ex post outcomes of the expansion; therefore, the results simply describe correlations between outcomes of interest and features of subgroups.

#### 4.6.1 Heterogeneity by marital status

If the rebound in traditional gender-role attitudes of women results from the practical conditions in the labor market and households, then married women should be the most affected. Therefore, I perform a subsample analysis by marital status and

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21 The value added by the financial industry is the contribution of the financial industry to overall GDP. The data used in this analysis are taken directly from the official records of GDP by industry in 1998 via the National Bureau of Statistics website: https://data.stats.gov.cn.

22 At the beginning of the economic reform, the only financial institution in China was the central bank (Huang and Wang 2018).

23 Consistent with the reality that most married couples in China have children, 94.6% of the married sample have children. Specifically, the percentage of married women with children is 95.8% in the sample.
Table 7  Placebo tests on hypothetical treated cohorts

| Hypothetical-treated group: | Sex ratios at birth | GDP | Value added by finance |
|----------------------------|---------------------|-----|------------------------|
|                            | Females (1)         | Males (2) | Females (3) | Males (4) | Females (5) | Males (6) |
| I. Dependent variable: having a higher education degree |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | −0.014 (0.016) | 0.024 (0.020) | 0.007 (0.017) | −0.024 (0.023) | −0.005 (0.024) | 0.004 (0.034) |
| Mean of dep. variable         | 0.086 | 0.118 | 0.086 | 0.118 | 0.086 | 0.118 |
| Observations                  | 8823 | 7833 | 8823 | 7833 | 8823 | 7833 |
| II. Dependent variable: composite index of egalitarian gender-role attitudes |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | 0.047 (0.030) | 0.015 (0.034) | 0.023 (0.035) | −0.025 (0.035) | 0.051 (0.049) | 0.056 (0.048) |
| Mean of dep. variable         | 0.0641 | −0.0739 | 0.0641 | −0.0739 | 0.0641 | −0.0739 |
| Observations                  | 8819 | 7826 | 8819 | 7826 | 8819 | 7826 |
| III. Dependent variable: probability of working |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | 0.026 (0.023) | 0.011 (0.016) | 0.003 (0.023) | −0.004 (0.015) | 0.007 (0.023) | −0.002 (0.015) |
| Mean of dep. variable         | 0.697 | 0.902 | 0.697 | 0.902 | 0.697 | 0.902 |
| Observations                  | 8823 | 7833 | 8823 | 7833 | 8823 | 7833 |
| IV. Dependent variable: weekly working hours of labor market participants |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | −0.421 (1.073) | 0.551 (0.914) | 0.313 (1.074) | −0.041 (0.955) | −0.052 (1.472) | 1.102 (1.392) |
| Mean of dep. variable         | 48.14 | 52.08 | 48.14 | 52.08 | 48.134 | 52.08 |
| Observations                  | 5913 | 6894 | 5913 | 6894 | 5913 | 6894 |
| V. Dependent variable: weekly working hours gap between husband and wife among working couples |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | 0.902 (1.181) | −0.303 (1.176) | −1.949 (1.300) | −0.017 (1.521) | −1.562 (1.720) | 1.096 (2.620) |
| Mean of dep. variable         | 4.510 | 3.064 | 4.510 | 3.064 | 4.510 | 3.064 |
| Observations                  | 4978 | 4128 | 4978 | 4128 | 4978 | 4128 |
| VI. Dependent variable: probability of marriage |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | −0.017 (0.028) | 0.034 (0.043) | 0.003 (0.019) | 0.038 (0.025) | −0.023 (0.016) | −0.005 (0.020) |
| Mean of dep. variable         | 0.914 | 0.848 | 0.914 | 0.848 | 0.914 | 0.848 |
| Observations                  | 8816 | 7828 | 8816 | 7828 | 8816 | 7828 |
| VII. Dependent variable: having a highly educated spouse among couples |                     |     |                       |
| Young × top tercile provinces |         |          |                   |          |            |
|                              | −0.020 (0.018) | 0.019 (0.016) | −0.014 (0.021) | −0.020 (0.022) | −0.027 (0.025) | 0.008 (0.030) |
| Mean of dep. variable         | 0.096 | 0.089 | 0.096 | 0.089 | 0.096 | 0.089 |
| Observations                  | 8058 | 6636 | 8058 | 6636 | 8058 | 6636 |
present the results in Table 8. As shown, higher education expansion significantly increases the probability of going to college for both married and unmarried samples. However, it is only married women who are adversely affected significantly in their gender-role attitudes. They also have a decreased probability of working after the expansion. In addition, the weekly working hours for married men increase. The findings support the mechanism by which women’s relative decline in labor force participation is highly correlated with the erosion of egalitarian gender-role attitudes after the expansion. Taken together with the findings of expanding working hour gap between husbands and wives and women’s increasing probability of having a highly educated spouse after the expansion, it is likely that women tend to contribute to marital surplus more through domestic productivity since their husbands have an advantage in being the breadwinner for the family.

4.6.2 Heterogeneity by the contemporary sex ratio in urban areas

The contemporaneous sex ratio of people in urban areas can affect competitiveness in both the labor market (if gender discrimination exists) and marriage market. It may also affect female status and social norms in the area. Therefore, I perform a subsam-

| Table 7 (continued) | Sex ratios at birth | GDP | Value added by finance |
|----------------------|---------------------|-----|------------------------|
|                      | Females | Males | Females | Males | Females | Males |
| Birth place + birth year | Yes     | Yes   | Yes     | Yes   | Yes     | Yes   |
| Exogenous covariates   | Yes     | Yes   | Yes     | Yes   | Yes     | Yes   |
| Birth region × birth year | Yes     | Yes   | Yes     | Yes   | Yes     | Yes   |

Columns (1) and (2) show placebo tests using sex ratio at birth. Columns (3) and (4) present hypothetical treatment indicators constructed using provincial GDP in 1998. In columns (5) and (6), the value added by the financial industry to GDP in 1998 is used as a placebo test. In panel I, the dependent variable is an individual’s probability of having a higher education degree. In panel II, the dependent variable is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. In panel III, the dependent variable is an individual’s probability of working. In panel IV, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. In panel V, the dependent variable is, among working couples, the gap in weekly working hours between the husband and wife. In panel VI, the dependent variable is an individual’s probability of being married. In panel VII, the dependent variable is, among couples, the probability of having a highly educated spouse. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01
### Table 8  Heterogeneous effect by marital status

| Subsample: | Married | | Unmarried | | | | | |
|------------|---------|---|---------|---|---|---|---|---|
|            | Females | Males | Females | Males | | | | |
| I. Dependent variable: having a higher education degree | | | | | | | | |
| Young × rich HE resources | 0.048*** | 0.066*** | 0.112* | 0.104** | | | | |
| Mean of dep. variable | 0.074 | 0.106 | 0.219 | 0.183 | | | | |
| Observations | 8058 | 6636 | 758 | 1192 | | | | |
| II. Dependent variable: composite index of egalitarian gender-role attitudes | | | | | | | | |
| Young × rich HE resources | −0.102*** | 0.025 | −0.135 | −0.013 | | | | |
| Mean of dep. variable | 0.0488 | −0.0731 | 0.2275 | −0.0784 | | | | |
| Observations | 8056 | 6630 | 757 | 1191 | | | | |
| III. Dependent variable: probability of working | | | | | | | | |
| Young × rich HE resources | −0.50** | 0.013 | −0.040 | 0.076 | | | | |
| Mean of dep. variable | 0.687 | 0.915 | 0.797 | 0.830 | | | | |
| Observations | 8058 | 6636 | 758 | 1192 | | | | |
| IV. Dependent variable: weekly working hours of labor market participants | | | | | | | | |
| Young × rich HE resources | −1.983 | 2.538** | −2.242 | −4.542 | | | | |
| Mean of dep. variable | 48.33 | 52.51 | 46.36 | 49.50 | | | | |
| Observations | 5330 | 5919 | 579 | 972 | | | | |
| Birth place + birth year | Yes | Yes | Yes | Yes | | | | |
| Exogenous covariates | Yes | Yes | Yes | Yes | | | | |
| Birth region × birth year | Yes | Yes | Yes | Yes | | | | |

Columns (1) and (2) present estimates for the married sample. Columns (3) and (4) present estimates for the unmarried sample. In panel I, the dependent variable is an individual’s probability of having a higher education degree. In panel II, the dependent variable is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. In panel III, the dependent variable is an individual’s probability of working. In panel IV, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01

ple analysis by comparing the contemporary sex ratio in urban areas in each province based on the national population census data in 2010. The sample is divided into two groups: people in regions with a high sex ratio and people in other locations. The
**Table 9** Heterogeneous effect by the contemporary sex ratio in urban areas

| Subsample: | Locations with a high sex ratio | Other locations |
|-----------|-------------------------------|----------------|
|           | Females | Males | Females | Males |
| (1)       | (2)     |       | (3)     | (4)    |

**I. Dependent variable: having a higher education degree**

| Young × rich HE resources | (1) | (2) | (3) | (4) |
|----------------------------|-----|-----|-----|-----|
| Mean of dep. variable      | 0.103 | 0.140 | 0.056 | 0.074 |
| Observations               | 5766 | 5190 | 3057 | 2643 |

**II. Dependent variable: composite index of egalitarian gender-role attitudes**

| Young × rich HE resources | (1) | (2) | (3) | (4) |
|----------------------------|-----|-----|-----|-----|
| Mean of dep. variable      | 0.0824 | -0.0569 | 0.0297 | -0.1073 |
| Observations               | 5764 | 5187 | 3055 | 2639 |

**III. Dependent variable: probability of working**

| Young × rich HE resources | (1) | (2) | (3) | (4) |
|----------------------------|-----|-----|-----|-----|
| Mean of dep. variable      | 0.727 | 0.916 | 0.639 | 0.875 |
| Observations               | 5766 | 5190 | 3057 | 2643 |

**IV. Dependent variable: weekly working hours of labor market participants**

| Young × rich HE resources | (1) | (2) | (3) | (4) |
|----------------------------|-----|-----|-----|-----|
| Mean of dep. variable      | 3.738 | 2.799 | 6.110 | 3.640 |
| Observations               | 3357 | 2825 | 1621 | 1303 |

**V. Dependent variable: weekly working hours hap between husband and wife among working couples**

| Young × rich HE resources | (1) | (2) | (3) | (4) |
|----------------------------|-----|-----|-----|-----|
| Mean of dep. variable      | 0.119 | 0.107 | 0.055 | 0.056 |
| Observations               | 5195 | 4322 | 2863 | 2314 |
Columns (1) and (2) present estimates for regions with a high sex ratio, and columns (3) and (4) for other regions. In panel I, the dependent variable is an individual’s probability of having a higher education degree. In panel II, the dependent variable is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. In panel III, the dependent variable is an individual’s probability of working. In panel IV, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. In panel V, the dependent variable is, among working couples, the gap in weekly working hours between the husband and wife. In panel VI, the dependent variable is an individual’s probability of being married. In panel VII, the dependent variable is, among couples, the probability of having a highly educated spouse. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. *p < 0.1; **p < 0.05; ***p < 0.01

mean sex ratio in locations with a high sex ratio is 106 (females=100), and the mean sex ratio in other locations is 101. The results are presented in Table 9. As shown, higher education expansion increases people’s chances of going to college for both groups. However, only in regions with a higher sex ratio does the egalitarian level of women’s gender-role attitudes deteriorate significantly after the expansion. Men in high sex ratio areas are more likely to work, whereas women have fewer weekly working hours and are more likely to have a highly educated spouse. In regions with a lower sex ratio, although women tend to have a decreased probability of getting married, they do not have significantly regressive gender views. Again, the evidence suggests that the erosion of women’s gender-role attitudes at the egalitarian level is highly correlated with gender inequality in the labor force. It is significantly driven by people living in regions with a high sex ratio.

4.6.3 Heterogeneity by GDP per capita

Finally, economic growth trends may affect many socioeconomic situations. I examine whether the outcomes are heterogeneous for regions with different levels of economic development when the surveys are conducted. Based on the average GDP per capita from 2010 to 2017, I divide the sample into two groups: people in regions
Table 10  Heterogeneous effect by GDP per capita

| Subsample: | Locations with high GDP per capita | Other locations |
|------------|-----------------------------------|----------------|
|            | Females (1) | Males (2) | Females (3) | Males (4) |
| I. Dependent variable: having a higher education degree | | | |
| Young $\times$ rich HE resources | 0.077*** | 0.100*** | 0.021 | 0.014 |
| Mean of dep. variable | 0.160 | 0.203 | 0.039 | 0.059 |
| Observations | 3468 | 3191 | 5355 | 4642 |
| II. Dependent variable: composite index of egalitarian gender-role attitudes | | | |
| Young $\times$ rich HE resources | $-0.096^*$ | $-0.002$ | $-0.102^*$ | 0.072 |
| Mean of dep. variable | 0.1524 | $-0.0634$ | 0.0069 | $-0.0812$ |
| Observations | 3467 | 3189 | 5352 | 4637 |
| III. Dependent variable: probability of working | | | |
| Young $\times$ rich HE resources | $-0.009$ | 0.056** | $-0.061^*$ | $-0.022$ |
| Mean of dep. variable | 0.759 | 0.941 | 0.656 | 0.875 |
| Observations | 3468 | 3191 | 5355 | 4642 |
| IV. Dependent variable: weekly working hours of labor market participants | | | |
| Young $\times$ rich HE resources | $-1.681$ | 0.869 | $-2.286$ | 0.331 |
| Mean of dep. variable | 46.85 | 50.01 | 49.12 | 53.62 |
| Observations | 2542 | 2932 | 3371 | 3962 |
| V. Dependent variable: weekly working hours gap between husband and wife among working couples | | | |
| Young $\times$ rich HE resources | 0.822 | 3.818*** | $-1.183$ | $-0.972$ |
| Mean of dep. variable | 2.879 | 3.050 | 5.663 | 3.076 |
| Observations | 2061 | 1799 | 2917 | 2329 |
| VI. Dependent variable: probability of marriage | | | |
| Young $\times$ rich HE resources | $-0.031$ | $-0.056^*$ | 0.029 | 0.053* |
| Mean of dep. variable | 0.871 | 0.816 | 0.942 | 0.869 |
| Observations | 3466 | 3189 | 5350 | 4639 |
| VII. Dependent variable: having a highly educated spouse among couples | | | |
| Young $\times$ rich HE resources | 0.073** | 0.034 | 0.012 | 0.015 |
| Mean of dep. variable | 0.181 | 0.160 | 0.045 | 0.043 |
| Observations | 3019 | 2603 | 5039 | 4033 |
Table 10 (continued)

| Subsample: | Locations with high GDP per capita | Other locations |
|------------|-----------------------------------|----------------|
|            | Females (1)                       | Males (2)      |
| Birth place + birth year | Yes                              | Yes            |
| Exogenous covariates | Yes                              | Yes            |
| Birth region × birth year | Yes                              | Yes            |

Columns (1) and (2) present estimates for regions with high GDP per capita, and columns (3) and (4) for other regions. In panel I, the dependent variable is an individual’s probability of having a higher education degree. In panel II, the dependent variable is a composite egalitarian index: the larger the value is, the more egalitarian the person is, and vice versa. In panel III, the dependent variable is an individual’s probability of working. In panel IV, the dependent variable is an individual’s self-reported weekly working hours including overtime hours. In panel V, the dependent variable is, among working couples, the gap in weekly working hours between the husband and wife. In panel VI, the dependent variable is an individual’s probability of being married. In panel VII, the dependent variable is, among couples, the probability of having a highly educated spouse. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. 

\* \( p < 0.1 \); \*\* \( p < 0.05 \); \*\*\* \( p < 0.01 \)

with high GDP per capita if the average GDP per capita ranks within the top tercile and people in other regions. The results are presented in Table 10. People in regions with high GDP per capita have higher educational attainment after the expansion. However, it is most likely that more educated people move to regions with high GDP per capita. It is observed that in both groups, the level of participation of women in the labor force is negatively impacted compared to men, as well as their egalitarian attitudes toward gender roles. The results suggest that the adverse impact on women’s egalitarian gender views is not correlated with contemporary economic development but is related to women’s disadvantaged status in the labor market.

5 Conclusions

In this paper, I explore the impact of higher education expansion on attitudes toward gender norms as well as the mechanisms involved by investigating the effect of this expansion on the labor market and the marriage market. China’s higher education expansion policy initiated in 1999 provides an empirical case to study the equilibrium effect of higher education expansion on gender norms and equity in the context of a
developing country with a conservative cultural background. Using a difference-in-differences strategy, the empirical analysis employs nationally representative survey data from CGSS datasets in the 2010, 2012, 2013, 2015, and 2017 waves to identify intention-to-treat effects of the expansion.

The results of this empirical analysis show that higher education expansion significantly increases the probability of attending university for both women and men. Nonetheless, the expansion tends to adversely affect women’s egalitarian gender ideology. Women revert to their family-focused role, and they tend to have more negative views of their labor force participation. No significant impact on men’s gender-role attitudes is observed.

The negative impact on egalitarian gender views may result from women’s disadvantaged status in the labor market relative to men after the expansion. Women’s labor force participation declines at both the extensive and intensive margins. Among dual-earner spouses, the gap in weekly working hours between husbands and wives increases for the male sample. The probability of having a highly educated spouse increases for the female sample. The results are significantly driven by married women and people living in regions with a high sex ratio. These findings suggest that the practical conditions that women face both at work and home following the expansion may encourage them to revert to traditional gender characteristics, making it more difficult for them to fulfill equal gender roles at both work and home.

Overall, the empirical strategy in this study identifies an equilibrium effect of higher education expansion. For instance, the empirical analysis cannot precisely distinguish between the labor supply and labor demand for labor market outcomes. The declines in female labor force participation could result from either the demand side, the supply side or both sides. A similar limitation applies to marriage market outcomes. Research with more comprehensive information can be conducted in the future to uncover more detailed mechanisms that will provide further insight and implications.

The findings from this paper suggest that the increasing access of women to higher education has not resulted in social and economic equality between women and men. A gender imbalance in the labor market and household can contaminate progressive gender norms and prevent women from achieving their full potential. As per Jayachandran (2021), labor market equality and egalitarian gender norms can create a virtuous cycle, whereas the opposite can cause a vicious cycle. In keeping with recent research, this work indicates as well that gender convergence is a consequence of evolving gender ideology norms (Kleven et al. 2020). Therefore, it is essential to consider the influence of gender norms when developing public policies to combat gender inequality.

**Appendix: Supplementary figure and table**
Fig. 7 Normalized university admissions quota in 1998 across the country. The figure plots the geographical distribution of the number of university slots per ten thousand high school graduates (university admissions quota) in 1998, which is used to create the treatment indicator $RHE$. The darker the color is, the greater the number of university slots per capita of the province/municipality. Calculations based on statistics from the National Bureau of Statistics of the People’s Republic of China.
Table 11  Impact of higher education expansion on other marriage market outcomes

| Marriage market outcomes | Females | Males |
|--------------------------|---------|-------|
|                         | (1)     | (2)   | (3)     | (4)     |

**I. Dependent variable: age at first marriage**

| Young × rich HE resources | 0.256* | 0.301** | −0.148 | −0.015 |
|---------------------------|--------|---------|--------|--------|
|                           | (0.140)| (0.153) | (0.156)| (0.166)|
| Mean of dep. variable     | 23.23  | 23.23  | 24.98  | 24.98  |
| Observations              | 8130   | 8130   | 6771   | 6771   |

**II. Dependent variable: ideal number of sons**

| Young × rich HE resources | −0.066** | −0.054* | 0.033  | 0.018  |
|---------------------------|----------|---------|--------|--------|
|                           | (0.027)  | (0.029) | (0.031)| (0.033)|
| Mean of dep. variable     | 0.95     | 0.95    | 0.99   | 0.99   |
| Observations              | 7148     | 7148    | 6172   | 6172   |

**III. Dependent variable: ideal number of daughters**

| Young × rich HE resources | −0.020  | −0.038  | 0.056** | 0.052* |
|---------------------------|---------|---------|---------|--------|
|                           | (0.023) | (0.024) | (0.028)| (0.030)|
| Mean of dep. variable     | 0.95    | 0.95    | 0.94   | 0.94   |
| Observations              | 7154    | 7154    | 6170   | 6170   |

Birth place + birth year: Yes

Birth-region × birth year: No

Exogenous covariates: Yes

Birth-region × birth year: No

In panel I, the dependent variable is an individual’s age at first marriage. In panel II, the dependent variable is an individual’s self-reported ideal number of sons, regardless of the policies in place. In panel III, the dependent variable is an individual’s self-reported ideal number of daughters, regardless of the policies in place. The set of exogenous covariates includes gender, ethnic group, whether the person was born in an urban area, the sex ratio in each province of each birth cohort, parent educational levels, parent party membership, and parent occupation information. Survey city fixed effects and survey year fixed effects are controlled. Robust standard errors in parentheses are clustered at the level of birth place-year. * \( p < 0.1 \); ** \( p < 0.05 \); *** \( p < 0.01 \)
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Declarations

Conflict of interest  The author declares no competing interests.

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