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Revisiting Horizontal Stratification in Higher Education: College Prestige Hierarchy and Educational Assortative Mating in China

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ABSTRACT Existing research on assortative mating has examined marriage between people with different levels of education, yet heterogeneity in educational assortative mating outcomes of college graduates has been mostly ignored. Using data from the 2010 Chinese Family Panel Study and log-multiplicative models, this study examines the changing structure and association of husbands' and wives' educational attainment between 1980 and 2010, a period in which Chinese higher education experienced rapid expansion and stratification. Results show that the graduates of first-tier institutions are less likely than graduates of lower-ranked colleges to marry someone without a college degree. Moreover, from 1980 to 2010, female first-tier-college graduates were increasingly more likely to marry people who graduated from similarly prestigious colleges, although there is insufficient evidence to draw the same conclusion about their male counterparts. This study thus demonstrates the extent of heterogeneity in educational assortative mating patterns among college graduates and the tendency for elite college graduates to marry within the educational elite.

KEYWORDS Educational assortative mating • Horizontal stratification in higher education • Higher education expansion • Gender gap in higher education • China

Introduction

Trends and variances in educational assortative mating, or "the patterns of educational sorting and matching between spouses' education" (Gullickson and Torche 2014:839), are important indicators of social openness and closeness in society (Blossfeld 2009; Schwartz 2013). A large body of research on educational assortative mating has examined intermarriage between people with different levels of education (e.g., Han 2010; Schwartz and Mare 2005; Smits and Park 2009). However, the potential impact of college hierarchy on educational assortative mating has been mostly ignored. Arum and colleagues (2008) were the first to examine the relationship between stratification within higher education and educational assortative mating, but their study does not reveal the educational mating patterns of graduates from higher education institutions of different tiers and, further, how these patterns have changed over time.

A close examination of college graduates' mating choices may be especially valuable in this age of massive global expansion of higher education and its growing stratification. The past century witnessed a global trend of higher education expansion

(Schofer and Meyer 2005). At the same time, higher education systems of many high- and middle-income countries have also become more stratified (Marginson 2016; Shavit et al. 2007). In this regard, scholars have pointed to the importance of horizontal stratification, or "the different types or quality of education received at a particular level" (Gerber and Cheung 2008:300). Existing research has documented the growing inequality in college quality during higher education expansion and indicated the implications of growing inequality for labor market outcomes (Davies and Zarifa 2012; Gerber and Cheung 2008): a diploma from a highly selective university may entail much brighter prospects than one from a less selective university (Brewer et al. 1999; Davis and Binder 2019; Triventi 2013; Witteveen and Attewell 2017). As economic prospects may be critical factors influencing people's marital choices (Qian 2017; Sweeney and Cancian 2004), the marriage outcomes of graduates from colleges of different tiers may also vary in socially relevant ways. Are elite college graduates inclined to marry someone who also attended an elite college, as opposed to a less selective institution? How would such patterns respond to change in the structure of higher education? These questions are yet to be answered.

The lack of research on educational assortative mating among college graduates could be attributed to two major challenges. Arum et al. (2008) rightly point out the first challenge of data availability: many social surveys do not include sufficient information on college characteristics. The second challenge comes from the complex nature of college prestige hierarchies. It is difficult to precisely measure and operationalize the concept of college prestige. One way is to use proxy measures of college selectivity, such as a composite score of expenditures per student, average freshmen college entrance examination score, or the prestige ranking of the college (Arum et al. 2008). Another commonly employed indicator is the Barron's selectivity score, which considers the academic performance of admitted students (Conwell and Quadlin 2021; Thompson 2019; Torche 2011). Dividing the colleges and universities into groups based on their respective scores would thus provide an approximate ranking.

This research addresses these challenges by examining the nuanced pattern of educational assortative mating in China around the year 2000, using data from the 2010 Chinese Family Panel Studies (CFPS). China provides an ideal setting to examine this nuanced educational mating pattern because of its officially hierarchized system of higher education. Since 1959, the government has implemented a series of higher education policies to classify universities and colleges on the basis of their prestige and selectivity. The classification of college selectivity, which is officially enacted by the government, is an ideal measure for research on college prestige hierarchy. In addition, the 2010 CFPS provides valuable information about the types of higher education institutions that the respondents graduated from (i.e., a first-tier, second-tier, or third-tier university), making a detailed examination of educational mating patterns possible. This research may shed light on the relationship between educational assortative mating and horizontal stratification in higher education. Furthermore, by revealing how mating patterns of elite-college graduates and other university graduates differ during the time of higher education expansion, this study may provide insight into the formation of elite classes. It may also have implications for higher education policy making, in the sense that it reveals an unintended outcome of expansion and stratification in higher education.

I first briefly describe the unique higher education system in China and discuss some differences between the Chinese and American higher education systems and what implications these differences have for patterns of educational assortative mating. Then, I review studies of educational assortative mating in China and draw on theories of social closure and cultural matching to derive my hypotheses. I use log-linear and log-multiplicative models to examine the patterns and shifts. I conclude with a discussion of limitations and implications of this research.

Background and Theoretical Framework

Hierarchy in the Chinese Higher Education System

In the context of this study, the "key university system" and the "gradation system" are the two most salient features of the higher education hierarchy in China. The key university system refers to the higher education system, which concentrates resources at a few top universities. The system originated in 1954 when the Ministry of Education first selected six universities as the National Key Universities (Ministry of Education 1993a). The list then expanded to 20 universities in 1959 and to 60 in 1960. In the 1980s, the State Council further expanded the list to around 100 universities. The term "National Key University" was then abolished during the higher education revolution in the 1990s.

The government then implemented the 211 Project in 1995 and the 985 Project in 1998. These two projects could be regarded as the continuation of the National Key University policy. Although the name of the policy changed, its nature did not. The main intention of the 211 Project was to concentrate resources at around 100 high-quality universities to make them internationally competitive (Ministry of Education 1993b). A small number of universities were then selected into the 985 Project, which intended to further develop universities with international recognition (Ministry of Education 1998). Under these two programs, funding and resources were poured into a small number of universities, which experienced rapid development in the 2000s. In the meantime, as the inequality among universities grew, the hierarchical nature of the higher education system also gradually intensified (Liu 2015; Ying 2011).

Another key feature of the Chinese higher education hierarchy is the gradation system, which refers to the three "batches" adopted in the college admission system between 1954 and the late 2010s (Yang et al. 2019). Under this system, all Chinese universities were divided into three batches during the admission process. Per the 1954 policy, the first-batch universities were the National Key Universities, the second-batch universities were other less elite universities, and the remaining universities were classified into the third batch. The first-batch universities enjoyed the priority of admitting students with higher scores in *gaokao*, the National College Entrance Exam. Because each student could be admitted into only one college, the second- and third-batch universities could only admit students who were not admitted into first-batch universities. Thus, students with the best academic performance would normally be admitted into the most selective universities, which are all in the first batch.

Nowadays, the first-batch universities include 985 and 211 Project universities, as well as some other high-quality universities; the second batch includes the remaining

public universities and a few private universities; and almost all third-batch institutions are private universities and independent colleges (Yang et al. 2019). With this unique admission mechanism, the Chinese higher education system implicitly hierarchized universities into three tiers. Students who graduated from the 985 and 211 Project universities are highly valued in the workforce. Indeed, research has found that students from elite schools may have better chances than those from less elite universities to work in a managerial position (Hu and Vargas 2015).

The Role of Socioeconomic Status in Higher Education: China as a Unique Case

Although the present study focuses on assortative mating in China (and uses data from only China), a comparison between the Chinese and American cases is helpful for readers who are more familiar with the American system of higher education. So far, Arum et al. (2008) is the only published research examining the educational mating outcomes of students attending college in different tiers with a focus on the United States. Their study reveals the distinct gender effect of elite college attendance on individual marriage outcomes in the United States since the 1970s. I expect two features of Chinese higher education to have implications for marriage outcomes. First, all of the high-quality universities in China are public, while many of the top U.S. institutions are private. Second, Chinese universities admit students based solely on their academic performance, while American universities (particularly, highly selective universities) place much more emphasis on nonacademic factors.

As mentioned, all first-batch universities in China are public. Private universities, which have much higher tuition than public institutions, may only admit students whose *gaokao* score is not high enough to get into public universities. On the contrary, the elite universities in the United States are mostly private universities, which typically have much higher tuition than public universities of similar prestige. The high tuition of the private elite institutions in the United States may act as a serious obstacle for students from poor families. Although top private institutions, such as Harvard University, are admitting more students from the lower classes with financial aid packages than they were in previous cohorts (see, e.g., Khan 2016), the economic barrier for students from the working class to get into elite U.S. universities still stands.

Moreover, the college admission system works differently in China and the United States. In China, the *gaokao* score is, by and large, the only criterion for college admission. In this sense, the Chinese higher education system is based on meritocracy captured exclusively through performance on standardized tests. Although students from higher socioeconomic status (SES) families may receive more tutoring and, thus, could be much more advantaged when taking standardized tests (Zhang and Xie 2016), the admission standard is the same for all students regardless of their socioeconomic background. Thus, as long as students from poor families have the same *gaokao* scores as their upper- and middle-class counterparts, their chance of getting into an elite university is the same.

In contrast, the admission process at elite U.S. universities may unfairly favor students from the upper classes. Nonacademic factors considered during the admission process are key channels for elite families to secure their children's entrance to an

elite university (Khan 2016). Using nationally representative data collected in 2002, Jerrim and colleagues (2015) found that the effect of parental education and father's social class on admission into high-quality colleges remains salient after controlling for students' own high school academic performances, and that this effect is especially prominent among private elite institutions. Moreover, controlling for high school academic performance, students in the United States whose parents attended selective universities or have higher SES still have higher odds of being admitted into selective universities (Ford and Thompson 2016; Grodsky 2007).

In both systems, students with higher SES have more advantages in the game of elite-college entrance. Social reproduction of class through higher education exists in both societies, although the mechanisms are different. Given the lower tuition of the elite public schools and the relatively meritocratic admission process, the graduates of Chinese elite universities might be more likely than their American counterparts to be high performers with fewer advantages in socioeconomic background. In other words, compared to the American higher education system, the Chinese higher education system, by design, provides a better chance for individuals from the lower class to achieve social mobility by receiving a high-quality college education.

That said, it should be noted that the two systems take divergent paths in admitting poor students. In recent decades, the demographics of Chinese and American elite universities have changed. Although the elite U.S. colleges still disproportionately admit students from the upper class, they have gradually started taking more low-SES students (Khan 2016; Lee 2013). In contrast, researchers have found that low-SES students in China have been less likely to attend elite universities, especially after 2000 (Luo et al. 2018).

The changing social class composition of elite universities' student bodies may have important implications for educational assortative mating. First, as indicated by Arum et al. (2008), the campus might be an important site for students to find their partners. Recent research has found that among married couples in which both partners attended college, about one third went to the same institution, a proportion that stayed stable from the 1970s to the 2010s (Ford 2020). As the student body becomes more diverse in terms of SES, the opportunity for upper- and middle-class students to meet a student from the lower class would also increase. The social demographics of elite college graduates who are single may also structure their marriage outcomes (Xie et al. 2015). As the pools diversified, the intermarriage between people from colleges of similar prestige but different social origin may become more prevalent. Thus, students in elite colleges may have greater chances of dating and then marrying someone from the same school but of a different social class. In addition, for people who do not find their partners in the same institution but are still inclined to marry someone from a similarly prestigious institution, their odds of marrying someone from a different social class also increase.

Theoretical Frameworks and Hypotheses

According to social closure theory, people belonging to the same social class or status may want to reinforce their advantages and, thus, feel reluctant to let others into their

inner circle (Weber 1978). The barriers to educational intermarriage have been found to be different on the higher and lower ends of the educational distribution (Smits and Park 2009; Torche 2010). Under the assumption of social closure theory, people on the higher end of the educational distribution may be more likely to marry within their status group to maintain their privilege. This assumption may especially ring true in East Asian societies, which have the tradition of valuing education (Raymo and Xie 2000). For example, Smits and Park (2009) have shown that educational homogamy (i.e., marriage between people of the same education level) is higher among college graduates in East Asian societies than in other countries.

Studies of educational assortative mating in China have mostly examined educational intermarriage between college graduates and those with lower educational attainment in the context of massive primary and secondary education expansion since 1949 (Han 2010; Qian and Qian 2014; Song 2009). They all point to an increase in the odds of educational homogamy since the 1980s (Han 2010; Hu and Qian 2016; Li 2011). Such results lend further support to the legitimacy of the hypothesis of growing social closure in China since 1980. In this sense, people graduating from the first-tier universities may be more willing to marry each other, or more broadly, they may be less likely than other college graduates to marry someone without a college degree.

Similar to the social closure theory, the cultural matching hypothesis also predicts educational homogamy (Kalmijn 1994). Although the literature on cultural matching is still in its infancy, studies on assortative mating conditioned by the origin of *hukou* (household registration status) in China show the importance of cultural preferences in mate selection in contemporary China: college graduates naturally express their willingness to find a partner with similar "world views" or "values" (Zhou 2019:578–579). Given significant variation in quality among colleges of different tiers, it is highly possible that students from colleges with different levels of prestige develop different qualities that may be attractive to or avoided by a specific group of people. Therefore, graduates of elite universities may develop mating preferences that are different from those who graduate from nonelite universities. Thus, the cultural matching hypothesis would predict different educational mating patterns for elite and nonelite university graduates.

In keeping with social closure theory and the cultural matching hypothesis, I derive the following hypotheses:

> *Hypothesis 1*: First-tier-university graduates are less likely than other university graduates to "marry down" in education.

Both social closure theory and the cultural matching hypothesis approach the question of educational assortative mating from the angle of personal preference. In addition to personal preference, the composition of the marriage market may also play a role in determining an individual's marital choice (Lichter et al. 2020; Schwartz 2013; Xie et al. 2015). Previous research has identified a trend of decreasing educational homogamy in East Asian societies in response to the mass educational expansion in the second half of the twentieth century (Smits and Park 2009). However, it remains unclear if graduates of first- and second-tier colleges are equally likely to intermarry across the education boundary.

In China, both higher education expansion and the 985 and 211 Projects were launched around 2000. Before 2000, the inequality among colleges was relatively

insignificant, and college entrance was a strong indicator of individual ability regardless of college prestige. After 2000, when more students were admitted into universities, the benefits of college attendance gradually became more heterogeneous. Thus, the life chances of people who graduate from universities with different levels of prestige might also be different. In the meantime, as colleges of different tiers increasingly diverge in quality, the boundaries between their graduates may emerge or become stronger. Moreover, as the proportion of students from the upper and middle class in the elite colleges grows, those upper- and middle-class elite-college attendees have more opportunity to meet and marry someone from a college with similar prestige level.

On the basis of changes in the Chinese higher education system, I hypothesize that:

> *Hypothesis 2*: Post-2000, college graduates from first-tier universities are increasingly more likely to marry people graduating from colleges with similar prestige.

It should also be noted that the globally observed reversal of the college gender gap is also present in China after the expansion of higher education (Esteve et al. 2016; Yeung 2013). In the 1980s, no more than 30% of Chinese college students were female, but the gender gap rapidly shrunk and then reversed in the twenty-first century (Yeung 2013; Zhang and Chen 2013). More importantly, the reversal of the gender gap is more salient in admission into elite colleges than nonelite colleges (Wu et al. 2020). Such a change in the gender composition of elite-college graduates might be highly relevant to their marriage outcomes. "The end of hypergamy" hypothesis posits that "the reversal of the gender gap in education is strongly associated with the end of hypergamy and increases in hypogamy" (Esteve et al. 2016:615). Here, educational hypergamy refers to marriages in which women marry *up* in education, and educational hypogamy refers to marriages in which women marry *down*. The end of hypergamy hypothesis thus provides an important perspective in understanding the association between social change and marital equality (De Hauw et al. 2017; Esteve et al. 2012; Esteve et al. 2016). However, this hypothesis does not specify what would happen during the transition period from the hypergamy-dominated pattern (i.e., most women marry up) to the hypogamy-dominated pattern (i.e., most women marry down). In societies with traditional gender roles, highly educated women are not valued in the marriage market (Qian and Qian 2014). Moreover, many women would rather remain single than marry down (Edin and Kefalas 2011; Lichter et al. 1995). As the gender gap in education gradually shrinks and women's education is valued in the marriage market, those highly educated women may have better odds of marrying someone with a similar level of education instead of staying single.

The reversed gender disparity could be partially attributed to the one-child policy, which was officially launched in 1978 (Lee 2012; Tsui and Rich 2002). The traditional Chinese multiple-children families tended to concentrate resources on their son(s) instead of their daughter(s): following the patrilocal tradition, many parents regard their son as the one to rely on in the future, and their daughter as the one who will eventually get married and serve only her parents-in-law (Hannum et al. 2009; Tsui and Rich 2002; Zhan and Montgomery 2003). In addition, traditionally, adult daughters tend to provide less financial support to their parents than adult sons. Research based on data in the 1990s finds that, in China, married sons provide more financial support to their parents than married daughters (Hermalin et al. 2003; Yang 1996).

Following the introduction of the one-child policy, as most families had only one child, the singular female child no longer faced the intrafamily competition for resources between siblings (Wu et al. 2014), which was much more common in earlier generations. Women in regions where the policy was more strictly implemented received more years of education than those in other regions where the policy was not as strongly enforced (Lu and Zhang 2016). More importantly, research has found no gender differences in terms of the financial resources that are invested in children (Chen and Jordan 2018; Lee 2012).

As a result of these societal changes, parents may gradually expect their daughters to be the primary caregiver (Raymo et al. 2015). Allendorf (2020) found that as the proportion of sonless families increases in India, mothers of only daughters have increasingly given up the traditional patriarchal idea of old-age support by sons and turned to their daughters for such care. In addition, research in China has found that urban adult daughters in contemporary China perform equally well with, or even surpass, the adult sons in providing financial support to their parents (Ding 2014; Xu 2015). As adult daughters are fulfilling more obligations to financially support their parents, parents of daughters also gradually hold higher expectations of their sons-in-law, whereas parents of sons still focus more on the daughter-in-law's personal traits than her economic standing (Eklund 2018). This change in parents' expectations may also contribute to changes in elite-college women's marital choices.

On the basis of the "end of hypergamy" hypothesis and parents' changing expectations for sons-in-law in the context of higher education expansion, I hypothesize that:

> *Hypothesis 3*: The increase in the odds of educational homogamy in the context of higher education expansion is higher for female first-tier-college graduates than for their male counterparts.

Methods

Data

I use the 2010 wave of the Chinese Family Panel Study to examine patterns and trends in educational assortative mating in China from 1980 to 2010. CFPS is a nationally representative longitudinal survey conducted by the Institute of Social Science Survey at Peking University (Xie and Hu 2014). The major advantage of this data set is that it includes information on each respondent's marital status, as well as details on their college attendance. Specifically, respondents who attended university in the past or during the survey reported if their college was first-tier, second-tier, or other. This detailed information on college hierarchy makes it possible for me to add more nuanced college categories into the educational distribution of the respondents.

In the 2010 total sample, 33,600 adults in 14,798 households were interviewed. I restrict my analytic sample to people currently in their first marriage who married after 1980. To achieve this, I exclude people who are married but are not in their first marriage during the survey ($n = 798$). I also exclude people who married before 1980 ($n = 16{,}196$) to avoid the sample bias caused by attrition among the early cohorts from the full sample, as well as divorced ($n = 20$) and widowed people ($n = 9$),

because information on their previous spouse is not collected in the survey. I further exclude cohabiting couples ($n=7$), as patterns of assortative mating may be different for cohabiting couples than for married couples (Hu and Qian 2019). Finally, I exclude individuals who completed their higher education at an overseas institution ($n=2$), those who reported their college type but have educational attainment lower than college ($n=6$), and never-married people ($n=14$). After the exclusions, the sample consists of 16,548 individuals.

Then, I construct the couple-level data of 9,754 couples. I use the family ID and spouse ID of each married individual to identify couple relationships. It should be noted that not all individuals in the survey had their spouse included in the data set. Among the 9,754 couple-level entries, 6,789 cases contain information for both partners of the married couple, and the other 2,965 cases contain information on only one marital partner. I use the respondent's self-reported level of education and college ranking. I use spouse-reported level of education when (1) respondent's self-reported level of education is missing or when (2) only one member of the married couple is in the data set. I drop couple-level cases if the educational level of either the husband or the wife is missing ($n=49$). I also drop respondents whose educational attainment is missing but is reported by their spouse as college or higher ($n=100$). These 149 cases are dropped because their college ranking is not available. My final analytic sample includes 9,605 couples.

Measurement

Marriage Cohort

I construct two marriage cohorts classified by the year of respondents' first marriage: 1 = 1980–2000 ($n=6,794$) and 2 = 2001–2010 ($n=2,811$). I set 2000 as the dividing line because the expansion of the higher education system in China started in 1999. This construction of marriage cohorts also allows me to capture potential changes in the value of different college diplomas in the marriage market, as the 211 Project was launched in 1994 and the 985 Project in 1998.

Education

CFPS's original options for higher education acquisition include National Key Universities (i.e., 985 and 211 Project universities); other first-tier universities; second-tier and third-tier universities; and other types of colleges, such as the Chinese Communist Party schools, military colleges, night schools, and self-taught higher education. I collapse them into three categories: first-tier universities (including both national key universities and ordinary key universities), second-tier universities, and all other higher education institutions. I do not have a separate category for third-tier colleges because there were no third-tier-college graduates in the analytic sample. I collapse all the other types of institutions because admission into them is much less competitive than for first- and second-tier universities.

Then, I categorize educational attainment into six groups: 1 = middle school and lower, 2 = high school, 3 = some college, 4 = other college, 5 = second-tier college, and 6 = first-tier college. These categories are similar to those used in prior studies of educational assortative mating (e.g., Han 2010; Mare 1991; Qian 2017). I do not incorporate the gradations of graduate school prestige, as that information is not collected by the survey. Ultimately, I combine people with postgraduate degrees and people with only college degrees into the same group because the number of couples with at least one postgraduate degree holder is very small ($n = 32$).

Analytic Strategy

I use log-linear models and multidimensional log-multiplicative row and column effect (RC(M)) models to capture the changes in patterns of educational assortative mating (Clogg 1982; Clogg and Shihadeh 1994). Previous researchers have adopted the log-linear model and log-multiplicative layer effect model to study trends in educational assortative mating (Mare 1991; Raymo and Xie 2000; Song 2009). The major advantage of a log-linear model is that it can examine the changing association of couples' educational attainment while also controlling for the marginal distribution of educational attainment (Schwartz and Mare 2005). Log-multiplicative layer effect models can examine changes in the association between couples' education in a more parsimonious manner, by assigning "a common association pattern and a table-specific parameter" (Xie 1992:380).

The major limitation of the log-multiplicative layer effect model is that it assumes the pattern of the educational categories in both genders to be the same across cohorts, and allows only the strength of the pattern to change (Fujihara and Uchikoshi 2019; Henz and Mills 2018). Because I attempt to measure the change in the structure of *and association between* couple's education categories, I adopted the RC(M) association model, as it not only can compare the association between two ordinal variables across tables, but also allows both the pattern and the strength of the association to change across tables (Clogg and Shihadeh 1994). Although the RC(M) association model is not widely used in assortative mating research, it has been shown to fit the setting well (Henz and Mills 2018; Torche 2010; Wang and Wong 2017; Zhou 2016). In this article, all the models are constructed on the three-way contingency table of husband's educational attainment H ($i = 1, \ldots, 6$) and wife's educational attainment W ($j = 1, \ldots, 6$), as well as marriage cohort C ($k = 1, 2$).

To begin with, I construct a conditional independence model as the baseline model:

$$\mathrm{Ln}\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC}, \quad (1)$$

where F_{ijk} stands for the expected number of couples in cohort k whose husband's level of education is i and wife's level of education is j. This model assumes that the educational levels of husband (λ_i^H) and wife (λ_j^W) are independent of each other but different across cohorts (λ_k^C, λ_{ik}^{HC}, and λ_{jk}^{WC}).

I use the RC(1) model, which allows for only one dimension of association ($M = 1$), to examine the mating pattern of people from different college categories and the association between couple's education (Hypothesis 1) and its change over

time (Hypotheses 2 and 3). To examine the association between couple's education, I construct the homogeneous model, simple heterogeneous model, and fully heterogeneous model:

$$\text{Ln}\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \lambda_{ij}^{HW}, \tag{2}$$

$$\text{Ln}\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \varphi_{ij} u_{ik} v_{jk}, \tag{3}$$

$$\text{Ln}\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \varphi_{ijk} u_{ik} v_{jk}, \tag{4}$$

where λ_{ij}^{HW} estimates the association between husbands' and wives' education, u_{ik} estimates the effect of husband's education, v_{jk} estimates the effect of wife's education, and the φ_{ij} and φ_{ijk} are interaction terms that represent the association between couple's educational attainment. The homogeneous model (Eq. (2)) examines the association between husbands' and wives' level of education, although the association is assumed to be constant across cohorts and the structure of both husbands' and wives' education is assumed to be the same across cohorts. The simple heterogeneous model (Eq. (3)) and the fully heterogeneous model (Eq. (4)) postulate that the association between couple's education varies across cohorts, and model (4) further allows differences between educational categories to vary over time.

I further fit the RC(2) model, which allows for two dimensions of association ($M=2$), to better fit the data (Clogg and Shihadeh 1994; Wong 2010):

$$\text{Ln}\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \varphi_{ijk1} u_{ik1} v_{jk1} + \varphi_{ijk2} u_{ik2} v_{jk2}, \tag{5}$$

where φ_{ijk1}, u_{ik1}, and v_{jk1} represent the intrinsic association, the row score, and the column score on the first dimension, respectively, and φ_{ijk2}, u_{ik2}, and v_{jk2} represent such parameters on the second dimension.

To justify the divergent mating pattern of the three college categories, I compare two sets of models (Wong 2010), both of which use the six-level categorization of educational attainment. However, I impose equality restrictions on the three college categories in the second set of models. Thus, the second set of models postulates that no differences in educational mating patterns exist between the three college categories. All the models were estimated using the LEM program (Vermunt 1997).

Results

Descriptive Findings

Table 1 presents the percentage distribution of husbands' and wives' educational attainment by cohort. This table reflects the expansion of higher education in China and the narrowing gender disparity in college attendance. Between the two marriage cohorts, both husbands and wives in the later cohort experienced a higher level of education: in the 1980–1999 marriage cohort, 1.9% of husbands and 1.3% of wives received a four-year college education, while in the 2000–2010 cohort, 4.8% of husbands and 4.3% of wives received a four-year college education. Thus, although the gender gap in higher education still exists in the later marriage cohort, the disparity

Table 1 Percentage distributions of husbands' and wives' educational attainment by cohort

Husbands' Educational Attainment	Wives' Educational Attainment						
	Less Than High School	High School	Some College	Other Types of College	Second-Tier College	First-Tier College	Total
1980–1999							
Less than high school	70.61	5.62	0.43	0.03	0.06	0.03	76.77
High school	10.80	5.50	0.53	0.06	0.06	0.06	17.02
Some college	1.38	1.25	1.30	0.06	0.15	0.19	4.33
Other types of college	0.12	0.16	0.18	0.12	0.04	0.04	0.66
Second-tier college	0.09	0.15	0.16	0.03	0.13	0.03	0.59
First-tier college	0.06	0.19	0.15	0.01	0.06	0.16	0.63
Total	83.06	12.88	2.74	0.31	0.50	0.52	100.00
n							6,794
2000–2010							
Less than high school	60.41	6.01	1.14	0.11	0.07	0.14	67.88
High school	9.75	5.62	2.56	0.07	0.28	0.21	18.50
Some college	1.81	2.74	2.74	0.36	0.36	0.85	8.86
Other types of college	0.07	0.43	0.46	0.21	0.18	0.04	1.39
Second-tier college	0.21	0.11	0.43	0.04	0.60	0.11	1.49
First-tier college	0.14	0.36	0.71	0.07	0.11	0.50	1.89
Total	72.39	15.26	8.04	0.85	1.60	1.85	100.00
n							2,811

has narrowed. The likelihood of married women graduating from a four-year college was much higher after 2000: in the first cohort, women's likelihood of receiving a four-year-college degree was 71% of men's, while in the second cohort, women's likelihood increased to 90% of men's.

More importantly, the breakdown of the three college categories shows different patterns of educational assortative mating for males and females. For example, for women married in the 1980–1999 cohort, the likelihood of marrying a man from a first-tier college was much higher if the woman was from a first-tier university (0.16 out of 0.52) than from a second-tier university (0.06 out of 0.50) or other type of college (0.01 out of 0.31). At the same time, for a woman married in this cohort, the likelihood of marrying a man with less than a high school degree was higher if she had graduated from "other" types of colleges (0.03 out of 0.31) than if she had a degree from a second-tier university (0.06 out of 0.50) or a first-tier university (0.03 out of 0.52). These two examples reveal the heterogeneity of educational mating patterns among college graduates: people graduating from elite universities are more likely to marry someone from a similarly prestigious university and are less likely to marry someone on the other end of the educational distribution.

Association Models

Table 2 presents the goodness-of-fit statistics of the fitted models: degrees of freedom, the likelihood ratio chi-square statistic (L^2), Bayesian information criterion (BIC) statistic, dissimilarity index, deviance, and p value. Model 1, the baseline conditional

Table 2 Goodness-of-fit results for log-linear and log-multiplicative models

Model	*df*	L^2	BIC	DI (%)	Deviance	*p*
1. Conditional Independence Model	50	1,942	1,483	7.86	1,942.47	.000
2. Homogamous RC(1) Model						
2a.	41	267	−108	3.26	267.41	.000
2b.	45	1,233	821	6.17	1,233.41	.000
3. Simple Heterogeneous RC(1) Model						
3a.	40	248	−118	3.33	247.41	.000
3b.	44	1,196	792	6.03	1,195.41	.000
4. Heterogeneous RC(1) Model						
4a.	32	283	−9	2.15	283.41	.000
4b.	40	1,149	782	5.78	1,147.41	.000
5. Heterogeneous RC(2) Model	18	26	−138	0.71	25.41	.125
6. Simple Heterogeneous RC(2) Model	34	91	−220	1.26	92.53	.000
7. RC(2) With Homogeneous Column Score	22	62	−139	0.99	62.11	.000
8. RC(2) With Homogeneous Row Score	22	28	−172	0.80	28.98	.196

Notes: L_2 = log-likelihood ratio chi-square statistic. BIC = Bayesian information criterion. DI = dissimilarity index.

independence model, fits the data poorly. All the remaining association models fit better than the baseline model, indicating that the association between husbands' and wives' education is significant.

Each pair of models nested under models 2, 3, and 4 compares the two ways of categorization of educational attainment. Models 2a, 3a, and 4a present results of the six-level categorization with the detailed information on college types. Meanwhile, models 2b, 3b, and 4b stand for the six-level categorization in which the three types of colleges are restricted to have the same score. In all the comparison pairs, the "a" version of the model fits better. For example, in terms of the heterogeneous RC(1) model, the BIC statistic for model 4a is negative, indicating better fit than the saturated model (Raftery 1995), while the BIC for model 4b is positive and much larger than that of model 4a. Model 4a also misclassifies fewer cases than model 4b (2.15% vs. 5.78%). The comparison between the four groups of models indicates that it may not be appropriate to combine the three categories of colleges into a single category, as people graduating from colleges with different prestige levels may have different educational mating patterns.

I then examine the change in the structure of husbands' and wives' educational attainments and their association across cohorts. Table 3 presents the results of the model comparison. Model 2a, the homogamous association model, postulates the association between husbands' and wives' education and fits better than the conditional independence model ($p < .001$), which assumes couples' educational attainment to be independent. Model 3a, the simple heterogeneous model, which allows changes in the association between couples' educational attainment, fits better than the homogamous association model by using just one more degree of freedom ($p < .001$). Thus, the changing association between couples' level of education is supported. Model 4a, the heterogeneous model, does not fit better than the simple heterogeneous model (3a). However, it should be noted that this comparison does not necessarily indicate

Table 3 Results of model comparisons

Models Used	*df*	Deviance	*p*
2a Versus 1	9	1,675.06	.000
3a Versus 2a	1	20.00	.000
3a Versus 4a	8	36.00	.000
5 Versus 3a	22	222.00	.000
5 Versus 6	16	67.12	.000
5 Versus 7	4	36.70	.000
5 Versus 8	4	3.57	.467

the constant structure of husbands' and wives' educational attainment, because model 3a measures association only at the first dimension. Models including higher dimension may fit better (Wong 2010).

Models 5 and 6 increase the dimensionality of the simple heterogeneous model and the heterogeneous model from 1 to 2. Although the BIC statistic of the simple heterogeneous RC(2) model is smaller than that of the heterogeneous model, the heterogeneous RC(2) model has a much smaller L^2 (26 vs. 91) and also misclassifies fewer cases (0.71% vs. 1.26%). Besides, among all the fitted models from model 1 to model 6, only model 5, the heterogeneous RC(2) model, is satisfactory ($L^2=26$, $df=18$, $p=.125$). Thus, the comparison between models 5 and 6 points to the changing structure at least in husbands' or wives' education.

Next, I carry out specification tests of the invariance of the structure of husbands' or wives' education across cohorts. I make this possible by further testing two models that impose limits on the row and column score based on model 5, the heterogeneous RC(2) model: model 7 imposes equal scores on the row scores on both dimensions, while model 8 imposes equal scores on the column scores on both dimensions. Empirically, these models test if the structure of husbands' or wives' educational attainment stays invariant across cohorts. According to Table 3, model 5 fits better than model 7, but not better than model 8. In addition, model 8 fits better than model 5 according to both the BIC (−172 vs. −138) and *p* value (.196 vs. .125). Thus, the row scores tend to be invariant across cohorts, indicating a significant change in wives' rather than husbands' structure of educational attainment over time. This result is consistent with the idea that women benefitted more than men from the expansion of higher education (Wu et al. 2020).

Table 4 presents the parameter estimates of model 8; φ_{ijk} represents the association of couples' educational attainment, u_{ik} represents husbands' educational attainment, and v_{jk} stands for wives' educational attainment. The row and column scores of both cohorts in the first dimension have a relatively clear rank order: lower educational categories tend to have lower scores, while the top education categories have higher scores, except for the "some college" category. The row and column scores in the second dimension could be read as "departures from the first dimension," or the "specific channels and barriers" in the marriage market that lead to the deviation from the dominating educational mating patterns (Wong 2010:50).

Table 4 Parameter estimates of model 8

Parameter		First Dimension		Second Dimension	
		First Cohort	Second Cohort	First Cohort	Second Cohort
φ_{ijk}		6.211	4.105	4.375	3.885
u_{ik}	Less than high school	–0.510	–0.510	–0.418	–0.418
	High school	–0.199	–0.199	0.546	0.546
	Some college	0.473	0.473	–0.180	–0.180
	Other types of college	–0.272	–0.272	–0.306	–0.306
	Second-tier college	–0.117	–0.117	0.589	0.589
	First-tier college	0.624	0.624	–0.233	–0.233
v_{jk}	Less than high school	–0.623	–0.661	–0.366	–0.109
	High school	0.104	0.187	0.505	0.331
	Some college	0.554	0.188	0.407	0.487
	Other types of college	–0.450	–0.420	–0.636	–0.709
	Second-tier college	0.159	0.168	–0.092	0.263
	First-tier college	0.257	0.537	0.182	–0.263

In terms of the intrinsic association between couples' level of education (φ_{ijk}), the value decreases from cohort 1 to cohort 2 on both dimensions. Thus, overall, education homogamy seems to decrease from 1980 to 2010. Put differently, people are decreasingly likely to marry someone with the same level of education.

Although the general trends of educational assortative mating are getting weaker, the distances between the two ends of the female educational distribution are expanding. For instance, in the first cohort, the distance on the first dimension between females attending first-tier colleges is 0.88 (0.257 – (–0.623)). Such distance increases to 1.20 (0.537 – (–0.661)) in the second cohort. The distances between the female first-tier-college graduates and graduates from other colleges also increase: the distance between first-tier and second-tier college expands from 0.10 (0.257 – 0.159) to 0.37 (0.537 – 0.168), and the distance from the first-tier college and other types of college expands from 0.71 (0.257 – (–0.450)) to 0.96 (0.537 – (–0.420)). These consistently increasing distances between first-tier colleges and other educational categories support Hypothesis 3 and partially support Hypothesis 2: female college graduates from first-tier universities are increasingly more likely to marry people from colleges with the same prestige, although there is insufficient evidence to come to the same conclusion for their male counterparts.

Based on the row and column scores on both dimensions, it is clear that for both males and females, the educational mating pattern of the first-tier-college graduates is different from that of graduates of other types of colleges. Per the distance between categories in both cohorts on the first dimension, in most cases, the distance between first-tier college and noncollege categories is greater than the distance between the second- and third-tier college and the noncollege categories. The wider distance indicates a stronger tendency for first-tier-college graduates than for graduates from less selective universities to not marry someone without a college degree (Hypothesis 1).

Discussion and Conclusion

This study examines an important but understudied topic of assortative mating patterns among graduates of colleges of different prestige levels. Although there is a growing body of literature on horizontal stratification in postsecondary education, most researchers investigate its implications only for labor market outcomes and the further influence on intergenerational mobility (Gerber and Cheung 2008). The pioneering work by Arum et al. (2008) is the only study so far examining the gender-varied effect of elite-college attendance on mate selection. This article builds on that work by examining the nuanced dynamics of educational assortative mating among college graduates in China from 1980 to 2010. Results show that first-tier-college graduates are less likely than those who graduated from less selective colleges to marry down in terms of level of education. In addition, from the 1980s to the 2000s, females from first-tier Chinese universities were increasingly less likely than others to marry outside of the circle of college graduates.

The importance of this research is twofold. First, this study provides a detailed picture of social change in China, in particular regarding marriage formation and higher education. Previous research has documented that educational homogamy among Shanghai couples increased in response to the expansion of higher education (Hu and Qian 2016), indicating an increasing level of social closure through the mechanism of marriage formation.

This study adds nuance to the understanding of the unexpected effect of higher education expansion and horizontal stratification in higher education: namely, the educated elites show the tendency to "tighten up." Further, this process of tightening up is gender-specific: female first-tier-college graduates are more likely than their male counterparts to marry homogamously in terms of college prestige. This finding contributes to the ongoing discussion of "the end of hypergamy" hypothesis, which posits that the reversal of the gender gap in education would lead to a decrease in hypergamy (i.e., women marrying up) and an increase in hypogamy (i.e., women marrying down) (Esteve et al. 2012; Esteve et al. 2016). This study shows that in the transition from a hypergamy-dominated society to a hypogamy-dominated society, homogamy among the female educated elite may be more prevalent. As Chinese society has become more gender-egalitarian in terms of educational attainment, highly educated women, who used to remain single rather than marry down, may now be valued in the marriage market and, thus, have a higher likelihood of finding a partner with the same level of education. This gender-specific change after 2000 could also be explained by the fact that people who married after 2000 are more likely to be from the single-child generation. As the daughter becomes the single child of the family, parents may hold a higher standard for the spouse of their daughter. Future research could test if this hypothesis holds, as the effect of changing sibling structure on spouse selection is still unclear.

Second, this research contributes to the literature on educational assortative mating and social stratification by examining a significant but overlooked population of college graduates. Previous research has mostly ignored heterogeneity within this group. As higher education continues to expand globally, stratification among college graduates also becomes more salient. By categorizing college graduates into three tiers, this study demonstrates the heterogeneity in educational mating patterns among this growing population. Admittedly, this research is partially limited by the

relatively small sample size of college graduates. For example, third-tier-college graduates are totally absent from my analytic sample. As mentioned earlier, the lack of research on this topic is partially attributable to the lack of detailed data regarding the college affiliation of both spouses. In this sense, longitudinal surveys that specifically target the population of college graduates are needed. Although current data could make it possible to examine the relationship between attendance at elite colleges and labor market outcomes, marriage outcomes should be no less important to investigate. Educationally homogamous marriage could be an important pathway for people to secure the inheritance of cultural privilege for their children. As indicated by previous research, children in the United States whose parents attended selective colleges may have better chances of being admitted into selective colleges (Ford and Thompson 2016). In addition, students may benefit from parents who graduated from elite colleges in terms of cultural capital and, thus, be more advantaged in the competition for college entrance and, later, employment.

Further, this study points to the need for more qualitative studies on assortative mating, and the scope of such studies should not necessarily be limited to college graduates. As college degrees are becoming more accessible and more common, the boundaries between different tiers of colleges may gradually emerge and grow more salient and influential. These dynamics may be highly influential in the formation of new educational elites. Binder and Abel (2019), for example, documented how students at Harvard and Stanford distinguish themselves from students at other elite colleges to justify their privilege in the higher education hierarchy. As the boundaries between colleges naturally ebb and flow, it will be important to see how college students make sense of their status and how these status boundaries emerge in the dating and marriage market.

This study is subject to a few limitations. First, because the analysis relies on log-linear and log-multiplicative models, this article is not able to consider the sex ratio of the marriage markets and, thus, could not address the potential influence of sex imbalance (Lichter and Qian 2019). Because of the one-child policy and son preference in China, the sex ratio at birth in China rose from 107.6 in 1982 to 117.8 in 2000 (Cai and Lavely 2003). This extremely high sex ratio leads to changes in the composition of the marriage market and, thus, may influence the patterns of educational assortative mating. Considering that the mean age at marriage in 2005 was 23.5 for females and 25.7 for males (Ji and Yeung 2014), the Chinese marriage market after 2005 may gradually be influenced by these sex-imbalanced generations. The issue of an imbalanced sex ratio has not been addressed by most of the research on education assortative mating in China (Han 2010; Hu and Qian 2016; Qian and Qian 2014). Future research examining educational assortative mating patterns in China after 2005 should pay special attention to this sex ratio imbalance.

Second, this article does not address the potential effect of family background in the mating process. Influential cultural factors in the mating process may include not only colleges of the same type, but also similar family backgrounds and social class (Streib 2015). The latter factors may confound the relationship between college prestige and mate selection. Future work should take family background into consideration, especially considering that the Chinese middle class has greatly expanded and that income inequality has increased since the 1990s (Xie and Zhou 2014; Yuan et al. 2011). In this context, family background may be increasingly important for cohorts born after 1990. ■

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