CSRDA
Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo
SUSTAINABLE DEVELOPMENT GOALS
CSRDA supports the Sustainable Development Goals

CSRDA Discussion Paper

Explaining Declining Educational Homogamy: The Role of Institutional Changes in Higher Education in Japan

No. 2

Date Aug. 2020

SDGs 5 GENDER EQUALITY, 10 REDUCED INEQUALITIES

Name Fumiya Uchikoshi

Explaining Declining Educational Homogamy:
The Role of Institutional Changes in Higher Education in Japan

Fumiya Uchikoshi, Princeton University

August 26, 2020

Abstract

Research on educational assortative mating has devoted much attention to educational expansion but has been less focused on a concurrent trend of importance – growing differentiation among higher education institutions. This study proposes that the bifurcation between high- and low-tier institutions in the context of high participation in tertiary education may help us understand the mixed evidence on educational homogamy trends across countries. I focus on Japan, which is characterized by a clear and widely acknowledged hierarchy of institutional selectivity, as an interesting case study. By applying log-linear and log-multiplicative models to data from the Japanese Panel Survey of Consumers and the Keio Household Panel Study, I find the following results. First, the odds of homogamy are higher among graduates of selective (national/public) universities than among graduates of nonselective (private) universities. Second, homogamy trends among graduates of selective and nonselective universities have diverged in recent years. I discuss these diverging trends, which have been obscured in earlier studies, provide new insights into the role of educational assortative mating in the creation of stratification and inequality.

Keywords

Marriage, Education, Assortative Mating, Japan

Fumiya Uchikoshi, Department of Sociology and Office of Population Research, Princeton University, Princeton, NJ 08540, uchikoshi@princeton.edu.

This research is supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number P2CHD047879. An earlier version of this paper was presented at the RC28 summer meeting held at Princeton University on August 15-19, 2019. The Japanese Panel Survey of Consumers and the Keio Household Panel Study were provided by the Panel Data Research Center at Keio University. I thank Jim Raymo, Christine Schwartz, Eric Grodsky, Leafia Zi Ye, Kelsey Wright, Noah Hirschl, Sawako Shirahase, Sho Fujihara, Ryota Mugiyama, Kohei Toyonaga and Akira Igarashi for their helpful comments and suggestions. All errors are the author's own.

1. Introduction

"Merely quantitative differences beyond a certain point pass into qualitative changes."
Karl Marx, *Capital*: *Volume One*

The question of who marries whom is of great interest to demographers and stratification researchers. Research on assortative mating suggests that an increase in educational homogamy at the top of educational may have potential impacts on economic inequality (Burtless 1999; Schwartz 2010) and intergenerational transmission of advantages (Breen and Andersen 2012; Breen and Salazar 2010; Esping-Andersen 2007; Torche 2010). Of particular theoretical interest to researchers has been how educational expansion affects educational homogamy trends (Blossfeld 2009; Kalmijn 1998; Schwartz 2013). Explanations vary, with some hypotheses predicting a positive influence of educational expansion (Blossfeld 2009; Blossfeld and Timm 2003; Kalmijn 1998; Mare 1991; Rauscher 2015) and others predicting the contrary (Smits 2003; Smits and Park 2009).

Empirical evidence on the impacts of educational expansion on educational homogamy is also inconsistent (Blossfeld 2009; Hout and DiPrete 2006). In absolute terms, as education expands and women come to outnumber men in higher education through educational expansion, educational hypergamy (women marrying up) is decreasing, while both homogamy and hypogamy (women marrying down) are increasing in many countries (Esteve et al. 2012, 2016; van Bavel et al. 2018).[1] However, after controlling for compositional differences in educational attainment across time frames, evidence of relative trends in educational homogamy varies

[1] In the study of educational assortative mating, higher education is typically a single category that lumps all types of four-year (and higher) tertiary education together. The current study follows this classification.

across countries.[2] In the United States, for example, educational homogamy has increased among the most educated (Schwartz and Mare 2005), while the opposite is true in East Asian and several European countries (Andrade and Thomsen 2018; Bouchet-Valat 2014; Katrňák and Manea 2020; Smits and Park 2009).

This paper argues that those studies have missed one important detail of the institutional context, that is, the growth in institutional heterogeneity. Sociological studies of educational stratification have argued that the *quantitative* change in higher education has transformed the *qualitative* aspects of higher education. Specifically, education expansion is accompanied by differentiation or, in other words, a growth of institutional heterogeneity through the proliferation of lower-tier institutions (Arum et al. 2007). The impacts of the increase in the number of graduates of lower-tier institutions in higher education could be driven by two mechanisms. On the one hand, graduates of lower-tier institutions may be more likely to marry noncollege graduates than are members of the most selective group, who have no opportunity to "marry up" and thus are more likely to marry graduates of equally selective educational institutions (Arum et al. 2008). Thus, if no adjustment is made for the changing composition of the pool of graduates in terms of their institutions' selectivity over time, the increase in the number of graduates of lower-tier institutions may decrease the odds of educational homogamy among college graduates (*compositional* process). On the other hand, if the increase in the share of lower-tier institutions is accompanied by a relative decline in the value of credentials for this group, then recent cohorts of these graduates of less prestigious universities are increasingly likely to marry noncollege graduates, which also contributes to an overall decline in educational homogamy (*diverging* process).

[2] Using simple categorical measures of education, studies on educational assortative mating have two ways of measuring educational pairing: one is the overall prevalence of different types of pairings, while the other is the relative likelihood of different pairings net of marginal distributions. The current study focuses on the second type of measure.

This study is motivated by the concern that ignoring the growth of within-group variation in higher education may prevent the accurate evaluation of educational assortative mating trends. Although previous studies mentioned this growth as a likely explanation of current educational homogamy trends (Arum et al. 2008; Arum and Roska 2014; Hersch 2013; Schwartz and Mare 2005), they did not examine this possibility by explicitly modeling the implications of the growing differentiation in higher education for trends in educational assortative mating. A focus on the growing heterogeneity among university graduates in terms of the selectivity of their institutions could be a fundamental contextual factor that helps us to understand the mixed evidence on the trends in educational homogamy across countries.

The current study examines Japan as an interesting case of potentially broader relevance to other societies because of its clear and widely acknowledged selectivity-based hierarchy of higher education institutions, which allows us to examine several testable hypotheses. Japan is one of the countries where educational homogamy has declined continuously since the 1950s (Fujihara and Uchikoshi 2019; Fukuda, Yoda, and Mogi 2019; Miwa 2007). Increased postsecondary educational attainment in Japan has been promoted through the growth of private institutions, including upgrades of private junior colleges, which are seen as lower in the hierarchy of selectivity (Fujihara and Ishida 2016; Ishida 2007). If this increasing share of private universities has reduced the relative value of tertiary education in the marriage market in Japan, graduates of these institutions may be increasingly likely to marry nongraduates, as one recent study speculated might be the case (Fukuda, Raymo, and Yoda 2019).

Thus, the current study addresses two questions. First, I ask whether the strength of homogamy among university graduates differs depending on the prestige and selectivity of the institution they attended.[3] I hypothesize that educational homogamy is stronger for the most

[3] Arum and Roska (2014) defined college selectivity in the U.S. based on the SAT percentile scores of college entrants. The university hierarchy in Japan also reflects the difficulty of

selective group and less pronounced for the other, less selective groups. Second, after confirming the previously documented decline in homogamy among university graduates, I examine the extent to which the declining trend reflects a combination of the compositional shift (i.e., more people in the highly educated category), especially among graduates of lower-tier institutions, and an increasing likelihood of members of this growing group marrying less-educated persons. To this end, I operationalize selectivity by grouping university graduates into two categories: those who graduated from national/public universities and those who graduated from private universities. The latter group is further divided into those with STEM majors and those with non-STEM majors, in anticipation of the fact that the STEM/non-STEM binary is a good proxy for measuring institutional selectivity, especially in the Japanese context, as I discuss below.

By comparing the trends in homogamy among university graduates produced by conventional models with the results from models that distinguish between different types of universities, this study suggests that the mechanism behind educational assortative mating trends in Japan may also operate in other contexts where educational expansion is characterized by stratification in higher education through the growth of lower-tier institutions (Roksa et al. 2007). This study thereby contributes to updating the general implications of educational assortative mating for stratification research. As an increasing number of individuals enter higher education in many countries, simply looking at the vertical aspects of educational attainment obscures a potentially important source of inequality in contemporary societies; thus researchers are also interested in examining horizontal stratification (Gerber and Cheung 2008). To the extent that differing marriage patterns among college graduates may explain stratification trends overall, the inequality implications would be different if the rise (or decline) in homogamy is

---

entrance examinations (Ishida 2007), but institutions that require higher entrance examination scores are often historically prestigious ones. Therefore, selectivity measures based on entrance examinations and institutional prestige are highly correlated, and I use the two types of measures interchangeably.

driven by changes in marriages among college graduates with more resources than if it is driven by changes in marriages among those with fewer resources.

2. Background

The role of expansion and differentiation in higher education institutions

As Blossfeld and Timm (2003) summarized and recent work by Rauscher (2015) also emphasized, studies have revealed that changes in educational assortative mating depend on how institutional contexts influence preferences and the opportunity structure in the marriage market, two components influencing *who marries whom* (Kalmijn 1998). Among the possible institutional mechanisms that may explain the mixed findings on trends in educational assortative mating, educational expansion is particularly relevant. While the theoretical expectations of prior studies are varied, with some predicting a positive influence and others a negative influence of educational expansion on assortative mating, they have all assumed that increased access to higher education occurs uniformly. The limited focus on the quantitative increase in the number of highly educated individuals (which I call *expansion*) may obscure another important mechanism that influences the pattern of educational assortative mating, that is, the growth of variation within higher education (which I call institutional *differentiation*) (Arum et al. 2007).

Structural theory (Blau and Schwartz 1984) explicitly assumes that educational expansion increases educational homogamy. According to this theory, "as group size increases, the probable rate of outgroup relations decreases" (Blau and Schwartz 1984: 31): that is, the relative group size *per se* is seen as determinant of the possibility of meeting spouses in the same or different social groups. Specifically, this theory predicts that expansion of higher education increases educational homogamy, especially among the highly educated, because such expansion increases the possibility of meeting equally educated spouses at the ages when marriage is most likely to occur (Blossfeld 2009; Mare 1991); Hu and Qian (2016) offered evidence in support of this theory by examining the case of urban China.

Other hypotheses focused on preferences rather than the opportunity structure of the marriage market also predict that educational expansion leads to increased homogamy. The status attainment hypothesis, for example, predicts that socioeconomic development brings about a change from ascriptive to universalistic achievement criteria, whereby social origins are replaced by educational attainment as the main determinant of one's future socioeconomic status (Blossfeld and Timm 2003; Kalmijn 1998; Treiman 1970). Individuals who achieve the highest possible socioeconomic status tend to take education level into account when selecting their partners (Smits et al. 1998). Thus, this hypothesis predicts that the level of educational homogamy increases as individuals increasingly value education in the marriage market because of educational expansion. A similar argument was provided by Schwartz and Mare (2005), who posited that men's and women's preferences for partners have become more symmetric over time as women's access to both higher education and the labor market have increased, resulting in a positive association between education and earning potential among women (Oppenheimer 1988). This hypothesis has been supported with data from countries where women's access to both education and the labor market improved in the 20th century (Han 2010; Ravazzini et al. 2017; Wong 2003).

Smits (2003) and Smits and Park (2009) predict, in contrast to the findings of these studies, an opposite consequence of educational expansion. According to what they call the *exclusivity* hypothesis, educational homogamy among college graduates is stronger when their group size is smaller. The rationale for this prediction comes from the theory of status closure or status-group credentialism (Brown 2000; Collins 1979), which posits that elite small groups are aware of their advantages. This awareness may increase these groups' motivation to maintain the social boundary and exclude outgroups (Parkin 1971). If group size increases, however, the relative value of higher education decreases, and barriers to mating with members of elite groups should also decrease. Therefore, this hypothesis predicts that educational expansion promotes intermarriage between educational elites and others. The decline in educational assortative mating in Japan (Fujihara and Uchikoshi 2019; Fukuda, Yoda, and Mogi 2019; Miwa 2007) fits

with this theoretical expectation. Importantly, Japan is not the only country that has seen a decline in educational homogamy. Rather, similar trends are observed in other countries, including France (Bouchet-Valat 2014), Denmark (Andrade and Thomsen 2018), and Eastern European (Katrňák and Manea 2020) and East Asian (Smits and Park 2009) countries.

The exclusivity hypothesis better aligns with the perspective in this study on the cooccurrence of expansion and differentiation in the sense that this hypothesis predicts that a *quantitative* increase in group size is accompanied by *qualitative* changes in the value of higher education in the marriage market; however, even this hypothesis does not consider the likely heterogeneity among university graduates. The distinction between *expansion* and *differentiation* provides important insights, especially when the increase in the number of people with higher education is promoted through the growth of lower-tier institutions in terms of institutional prestige and selectivity, as previous studies have argued to be the case (Arum et al. 2007: 5).[4] This assumption is reasonable to the extent that these lower-tier institutions are often established as a compromise between popular demand for higher education from below and a reluctant response on the part of elites (Brint and Karabel 1989). Although they only indirectly address the topic, studies by Arum and his associates on the role of college selectivity in the marriage market in the United States argued that college graduates tend to marry spouses from postsecondary institutions with similar academic selectivity (Arum et al. 2008) and that graduates of prestigious schools are more likely than graduates of less prestigious schools to marry spouses with a college degree (Arum and Roska 2014). These results suggest that graduates of prestigious institutions

[4] Arum et al. (2007: 5) distinguish between lower- versus higher-tier postsecondary education based on "prestige, resources, and selectivity of both faculty and students". A notable example of a context characterized by high differentiation is American postsecondary education, which consists of a mix of research universities, second-tier universities, two-year community colleges, and for-profit colleges.

are more likely to seek college graduates of similarly ranked institutions to maintain social boundaries, which is consistent with the exclusivity hypothesis.[5]

Arguably, the distinction between educational expansion and differentiation within higher education is not new in social stratification research. In particular, the *effectively maintained inequality* (EMI) hypothesis provides relevant insights into my research question. This hypothesis was proposed by Lucas (2001) as a theoretical response to the *maximally maintained inequality* (MMI) hypothesis, which argues that educational inequality between two groups is persistent until access to a given level of education among the advantaged group reaches a saturation point through educational expansion (Raftery and Hout 1993). In contrast to the MMI hypothesis, the EMI hypothesis posits that educational inequality is maintained even when vertical inequality in educational attainment decreases through improved access to higher education because privileged groups seek qualitative advantages within a given level of education to maintain their positions.[6] The EMI hypothesis suggests that to the extent that the importance of prestige within higher education is constant or increases in tandem with the increase in the number of lower-tier private institutions in Japan, the strength of homogamy

[5] Related to this finding, other studies pointed out that female graduates of elite institutions are more likely to marry male spouses whose jobs require a BA or higher (Hersch 2013: 483-484) and that there has been growth in intermarriage between people with some college (13-15 years of education) and high school graduates (12 years of education) in the United States (Schwartz and Mare 2005: 640).

[6] Attempts to link the MMI or EMI hypothesis to educational assortative mating are not new. Andrade and Thomsen (2018: 4-5), for instance, mentioned an impact of differentiation in higher education on patterns of educational assortative mating, citing Raftery and Hout (1993) and Lucas (2001), but their focus was more on horizontal differentiation, i.e., diversification of fields of study, while my main focus in this paper is on the vertical aspect of differentiation (years or level of education).

among graduates of prestigious universities should remain at the same level or increase, while graduates of private universities should be increasingly likely to marry nongraduates.

The Japanese context

An overview of the higher education system

Japanese universities are characterized by their position within a clear and widely acknowledged hierarchy of institutional selectivity (Yonezawa et al. 2002).[7] National/public universities are often perceived to be more prestigious, more selective, and of better quality, while private universities (with a few notable, widely recognized exceptions) are generally thought to be in a lower tier (Ishida 1998; Ono 2008). Importantly, an increase in the number of private institutions has meant a larger share of graduates of these less prestigious universities within the pool of college graduates.

Figure 1 illustrates two stages of educational expansion and upgrades of junior colleges into four-year universities, which contributed to the growing institutional selectivity. This figure presents trends in (1) male and female entrance rates to four-year universities (including national, public, and private) and (2) the proportion of students enrolled in private universities by gender. During the first stage of private university expansion, from the late 1950s to the late 1970s, the proportion of students enrolled in private universities continuously increased for both men and women.[8] This expansion was driven by newly established private institutions, which are mostly

[7] According to Times Higher Education's Japan University Rankings 2019 (https://japanuniversityrankings.jp/), nine out of the top 10, 35 of the top 50, and 63 of the top 100 universities are national or public institutions. Since national or public universities account for only 32.9% of the total number of universities in 2018, the overrepresentation of these universities in the ranking supports my claim that national or public universities are perceived to be more prestigious.

[8] Men's enrollment rate has increased more rapidly than women's. According to Ishida (2007), the first stage of expansion was caused by demographics (an increase in the population of 18-

located in the lower ranks of the hierarchy of selectivity (Ishida 2007).[9] The absolute and relative increases in the representation of students from these lower-tier private universities thus drove the growth in heterogeneity among university students. This trend continued during the second stage of expansion, which was also implemented through the establishment of new private universities. As Figure 1 shows, although the proportion of students enrolled in private institutions slightly decreased during this period, it has been stable since 1995. As in the first stage of expansion, the private universities that contributed to the expansion of higher education are still considered less prestigious in the hierarchy of selectivity (Ishida 2007).

[Figure 1 is about here]

The upgrade of junior colleges into private universities is another mechanism through which heterogeneity across universities in Japan has grown. According to data from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), junior colleges are mostly established by private institutions (84% as of 1995) and are frequently characterized by a high concentration of female students – who made up almost 90% of the students enrolled in junior colleges from the 1980s (MEXT 2019). These junior colleges are also gendered in terms of the subjects that they offer – many of their (female) students majored in non-STEM fields such as humanities, home economics, and education during this period (Fujiwara-Fanselow 1995; MEXT 2019). As women's opportunities to enter occupational careers increased, female students began to aspire to study at four-year universities (Edwards and Pasquale 2003). Suffering from a

year-olds) and economic circumstances (heightened demand for skilled human resources to deploy new technologies).

[9] Indeed, the old private universities that existed before the first expansion are perceived to be more prestigious than the new private universities. According to the university ranking mentioned in the last footnote, among the 15 private universities ranked in the top 50, 10 were established before the first stage of expansion.

shortage of female applicants, many junior colleges decided to upgrade into four-year universities, and the number of junior colleges thus decreased almost by half, from 596 to 337, while that of private four-year universities increased from 415 to 604 between 1995 and 2017 (MEXT 2019). Importantly, these upgraded institutions are located within the lower ranks of the hierarchy because they have been less selective in recruiting students and mostly continue to offer non-STEM majors, suggesting that private institutions that predominantly offer non-STEM majors have become increasingly heterogeneous in terms of school selectivity.

Trends in educational assortative mating

Much evidence suggests that educational homogamy has declined in Japan (Fujihara and Uchikoshi 2019; Fukuda, Yoda, and Mogi 2019; Miwa 2007; Raymo and Xie 2000). The overall odds of homogamy, for example, decreased by approximately 25% between the 1950-1954 and the 1975-1979 birth cohorts (Fujihara and Uchikoshi 2019). Unfortunately, similar to previous studies that examined other countries, the studies on Japanese educational homogamy also treated university degrees and their granting institutions as homogeneous, which limits our understanding of the plausible impacts of the growing heterogeneity in higher education on educational assortative mating. Importantly, however, a few studies suggested that a closer look at the growth in heterogeneity within higher education provides important insights into the decline in educational assortative mating in Japan (Fukuda, Yoda, and Mogi 2019; Fukuda, Raymo, and Yoda 2019). In their analysis of trends in educational assortative mating among couples married between 1990 and 2013, Fukuda, Raymo, and Yoda (2019) found an increase in hypogamy among university-educated women and interpreted this result to suggest that “the social and economic boundaries between lower-ranked universities and technical colleges may be declining among younger cohorts” (Fukuda, Raymo and Yoda 2019: 29).

3. Research questions and hypotheses

While the importance of horizontal stratification in higher education has been emphasized in the social stratification literature, consideration of how this factor impacts educational assortative mating has been limited. By linking the growing institutional heterogeneity at the top of educational distribution to the core of the stratification analytical framework, this study updates our understanding of the educational assortative mating trend. This bridging of horizontal stratification and assortative mating, two determinants of social stratification in contemporary societies, also provides important insights into our overarching questions about social stratification.

A focus on institutional differentiation in higher education provides several testable hypotheses to explain declining educational homogamy in some high-income countries, including Japan. First, relying on the exclusivity hypothesis, I expect to see a qualitative difference in the strength of homogamy among university graduates in line with the boundaries represented by the prestige and selectivity of their institutions. Specifically, net of cohort change, I expect educational homogamy to become stronger for the most selective group but to be less pronounced among less selective groups. Second, I expect that if educational homogamy among the highly educated has declined, as prior studies revealed, this is explained by the increase in the number of graduates of less selective institutions and their growing tendency to marry nongraduates.

On the basis of these theoretical expectations, I propose the following hypotheses. First, I test whether the findings on declining educational assortative mating in Japan from previous studies are supported in this dataset as well. Previous studies did not take into account the heterogeneity of university graduates' institutional selectivity. Thus, as prior studies revealed, I also expect the association of educational attainment between husbands and wives to decline over the cohorts including university graduates when I do not distinguish between university graduates based on their institutional selectivity. This step is simply to replicate earlier findings and set up my main analyses.

H1: Conditional on the composition of the pool of graduates in terms of educational attainment and cohorts, the association of educational attainment between spouses decreases over cohorts (declining association hypothesis).

Second, I expect the strength of homogamy among university graduates to vary by levels of selectivity, net of compositional differences in the husband's and wife's education and marriage cohorts. If Hypothesis 2 is supported, this would imply that educational homogamy among university graduates has declined because of the compositional change in the pool of graduates in terms of their universities' selectivity, with a larger proportion of graduates of less selective universities in recent years.

H2: Conditional on the composition of the pool of graduates in terms of educational attainment and cohorts, the odds of homogamy are strongest for national and public university graduates, lower for graduates attending a private school that offers STEM majors and lowest for those attending a private school that offers non-STEM majors (exclusivity hypothesis).

The rationale for classifying university graduates into these groups is as follows. First, there is a social boundary between national/public universities and private universities, as I argued above. Second, in addition to this boundary, I also posit that private universities that disproportionately offer non-STEM majors are perceived in a different light from private universities that also offer STEM majors because private universities with STEM majors, such as engineering or medicine, are often more selective. In contrast, private universities that offer non-STEM majors, such as those in the humanities, social sciences, or education, are less selective, and their tuition is lower than that of STEM institutions.[10] Moreover, as I discussed, the recent

[10] Although studies that clearly show the divide between STEM and non-STEM institutions in private sector universities in Japan are limited, studies based on cross-national comparisons of

upgrades of junior colleges, where female students have been dominant and have primarily selected non-STEM majors, to four-year universities enable me to argue that the distinction between STEM and non-STEM majors among private university graduates is reasonable.[11]

Finally, I test whether distinguishing between university graduates based on their institutional selectivity explains the decline in educational assortative mating in Japan. In particular, I test whether the direction of change in assortative mating differs by university prestige and selectivity.

European countries argued that growing access to higher education is associated with a decline in mean ability among non-STEM students (Reimer et al. 2008). Additionally, the relative returns to education were found to have increased for those choosing STEM majors (engineering and hard sciences) in Spain (Ortiz and Rodriguez-Menés 2016). Most importantly, studies on horizontal stratification argued that STEM majors bring higher occupational returns than other majors (Gerber and Cheung 2008); the EMI hypothesis suggests that STEM majors are more advantaged than non-STEM majors and thus should be perceived as more prestigious.

[11] The same hierarchy between STEM and non-STEM majors is generally applicable within national and public universities, but the smaller number of the respondents who graduated from these institutions does not allow us to categorize them on this basis. Additionally, it might be problematic to use STEM majors as an entirely separate category, given that the proportion of STEM majors is thought to differ greatly between men and women. However, in contrast to this intuition, the gender gap in STEM majors is not as pronounced in Japan, especially among private university graduates. Appendix Figure 1 shows the trends in the proportions of STEM and non-STEM students by gender. Although the proportion of female students with STEM majors from national/public universities is small, representing less than 5% during the 1970s, for example, the proportion of private STEM majors was approximately 10% in that period. Importantly, during the 2000s, the proportion increased dramatically among women, going from 12% to 21% among private university graduates. This indicates that women increasingly major in STEM fields, and this is especially the case within private institutions.

H3: Conditional on the composition of the pool of graduates in terms of educational attainment and cohorts, the association of educational attainment between spouses decreases over cohorts among private university graduates, while the association does not decrease among national/public university graduates (institutional differentiation hypothesis).

4. Data and method

Data

This study used two related panel surveys: the Japanese Panel Survey of Consumers (JPSC) and the Keio Household Panel Study (KHPS). One reason for the lack of consideration of institutional differentiation in previous literature is data limitations. Most surveys do not ask respondents about the institutional characteristics of the universities from which they graduated. Even when such questions are asked, these surveys do not ask about the characteristics of the spouse's college (Arum et al. 2008: 110; but see Andrade and Thomsen 2018 for a recent exception). By contrast, the JPSC and KHPS collect information about the types of schools from which both respondents and their spouses graduated.

The 1993 JPSC was the first nationally representative longitudinal survey in Japan to target young women (aged 24 to 34). Later waves added additional cohorts (women aged 24-27 in 1997, aged 24-29 in 2003, aged 24-28 in 2008, and aged 24-28 in 2013), and the survey continues to be conducted annually. The KHPS is administered by Keio University and has questions similar to those on the JPSC. The first wave of the KHPS was in 2004; respondents in the first wave were from a nationally representative sample of 4,000 households. A total of 1,400 households were added in 2007 and 2012.

Variables

I use five categories for the husband's and wife's educational attainment: 1 = *high school or less* (*koutou gakko*; Level 3 of the International Standardized Classification of Education [ISCED]), including junior high school (*chugakko*; Level 2 of the ISCED), 2 = *junior college, college of*

technology, or professional training college (*tanki daigaku, koutou senmon gakko, and senmon gakko*; Level 5 of the ISCED, hereafter junior college), 3 = *private university with humanities and non-STEM majors (shiritsu daigaku bunkei*; Level 6 of the ISCED), 4 = *private university with STEM major (shiritsu daigaku rikei*; Level 6 of the ISCED), and 5 = *national or public university* (*kokkoritsu daigaku*; Level 6 of the ISCED).

The distinction between STEM and non-STEM is critical, as it functions as a proxy for school selectivity. Although it is true that this distinction is drawn based on the information about respondents and their spouses' undergraduate majors,[12] it also reflects the selectivity of the schools that offer these majors. In this context, it is important to reiterate that many less selective private four-year universities that upgraded from junior colleges during the 1990s have disproportionately offered non-STEM majors. Therefore, this study assumes that the additional penalty in the marriage market for non-STEM graduates after the postuniversity expansion comes from attending a less prestigious private school that tends to offer non-STEM majors.

Given my focus on exclusivity and institutional differentiation, this study does not consider educational attainment beyond an undergraduate university degree. In my sample of university graduates, some respondents also obtained Master's or PhD degrees (1.5%). Although the study of such educational attainment is important, I use only these respondents' undergraduate degree in my analysis. Since the proportion of people with graduate degrees in Japan is small, including this category produces many zero cells, which makes the log-linear models difficult to estimate. For respondents' education, I use the information at the time of the first interview. For spouses' education, I use the information at the time of the first interview if respondents were already married. If not, I use the information provided after they married.

[12] The categories are science, engineering, agriculture, medicine or dentistry, pharmacology, humanities, social science, education, home economics, and other. I aggregate the first five as STEM majors and the other five as non-STEM majors.

After I omit cases with missing educational information, 7,086 couples remain (2,563 cases for the JPSC and 4,523 cases for the KHPS).[13] The year of marriage ranges from 1954 to 2015 in this sample. For the purpose of this study on the impact of expansion and institutional differentiation in higher education, to avoid confounding due to selective attrition via divorce, which is more likely to occur among heterogamous couples (Tzeng 1992), I limit the sample to respondents who married from 1970 to 2014, resulting in the removal of 12% of the observations.[14] I then divide the sample into 15-year marriage cohorts (1970-1984, 1985-1999, and 2000-2014). The smaller sample size does not allow me to examine the research question using smaller cohort bins, but dividing the sample into three marriage cohorts is enough to capture the impacts of expansion and institutional differentiation on educational assortative mating patterns. In particular, the division between the late 1990s and early 2000s is critical to this study, as a number of junior colleges upgraded into four-year private universities in this period as discussed above, likely contributing to the growth in heterogeneity among four-year universities.

Method

The current study is interested in educational homogamy net of marginal distributions rather than the descriptive trends. This means that I control for compositional changes in educational attainment between men and women. I then examine changes in the odds ratio of homogamy conditional on educational attainment distributions. To capture these odds ratios and their changes, I apply log-linear and log-multiplicative models to three-way tables of the husband's

[13] Thirty-one cases are omitted because their or their spouses' education was based on the old, pre-WWII educational system. Additionally, 286 cases are omitted because either their or their spouses' education is missing.

[14] Unfortunately, these surveys do not distinguish first from later marriages. As the prevalence of remarried couples has increase in Japan (Ministry of Health Labour and Welfare 2018), the inability to distinguish them from the first-married population may induce biased results.

educational attainment $H(i = 1, \dots, 5)$, the wife's educational attainment $W(j = 1, \dots, 5)$, and the respondent's marriage cohort $C(k = 1, \dots, 3)$.

The baseline model is the conditional independence model, which assumes the independence of wives' and husbands' educational achievement:

$$\ln F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC}$$

(Model 0: Conditional independence)

where F_{ijk} is the expected frequency of the (i, j, k) cell, consisting of husbands with education i and wives with education j who married in cohort k. I set this model as the baseline and expand upon it by adding other parameters. Each value for education and cohort corresponds to the categories that I defined previously. For example, F_{543} indicates the frequency of couples in which the husbands are national/public university graduates, the wives are private university graduates with STEM majors, and the marriage occurred in a year in the period 2000-2014.

Based on this model, I examine various extensions to test my hypotheses. First, I estimate the following three models (Models 1a to 1c) to test the first hypothesis, which states that educational homogamy decreased across educational levels if it is assumed that homogamy among university graduates does not vary based on their institution's selectivity. Model 1a represents the quasi-independence model of homogamy:

$$\ln F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \delta_{ij}^{HW}, \text{where } \delta_{ij}^{HW} \text{ follows matrix 1.}$$

(Model 1a: Homogamy)

This model estimates the likelihood of homogamy that is consistent across education levels. The model also treats marriage between all university graduates equally regardless of the selectivity of their institutions by using design matrix 1, shown in Appendix Table 1.[15]

Next, I examine whether the degree of educational assortative mating varies by marriage cohort. To investigate the trends in educational assortative mating, I apply the model based on Schwartz and Mare (2005). Model 1b is written as follows:

$$\ln F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \lambda_{ij}^{HW} + \delta_{ijk}^{HWC}, \text{where } \delta_{ijk}^{HWC} \text{ follows matrix 1.}$$

(Model 1b: Changing homogamy)

I also apply the log-multiplicative layer effects models (Xie 1992), which allows me to estimate changes in the strength of the associations over time while assuming that the overall patterns are constant. The log-multiplicative layer effects model for homogamy is expressed as follows:

$$\ln F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \beta_k^C \delta_{ij}^{HW}, \text{where } \delta_{ij}^{HW} \text{ follows matrix 1.}$$

(Model 1c: Homogamy, Log-multiplicative)

Here, δ_{ij}^{HW} indicates the homogamous association between wives' and husbands' educational achievement and β_k^C is the log-multiplicative parameter. This model produces a parsimonious estimation of changes in the strength of the association with flexibility in specifying the

[15] Although all of my focus is on homogamy among college graduates, I explicitly include noncollege graduates because otherwise (1) I would be unable to compare my results with those from prior literature that included noncollege graduates and (2) I would be unable to examine whether the decrease in educational homogamy is due to compositional shifts in the pool of graduates related to changes in higher education since models that include only college graduates by definition end up controlling the marginal distribution.

association (Powers and Xie 2008; Xie 1992). The β parameter is set to 1, with the oldest cohort as the reference, and I evaluate changes in the association in terms of the percent change in this parameter relative to the value for the reference cohort.

Next, to capture different patterns of educational homogamy, I estimate Models 2a to 2d to test Hypothesis 2, which posits that there is a gradient in the odds of homogamy based on institutional selectivity. Model 2a, on the one hand, assumes distinct diagonal parameters among university graduates but treats off-diagonal cells among graduates equally (see matrix 2 in Appendix Table 1). Model 2b, on the other hand, captures the strength of the association for each cell on the main diagonal in comparison to that for the off-diagonal cells (see matrix 3 in Appendix Table 1). While these models, including Model 1a, examine homogamy *within* educational groups, Model 2c reflects the permeability of barriers to marriage *across* educational types between spouses. The equation is defined as follows:

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

$$\text{where } \gamma_{ij}^{HW} = \sum_{q=j}^{i-1} \gamma_q \text{ for } i > j, \ \gamma_{ij}^{HW} = \sum_{q=i}^{j-1} \gamma_q \text{ for } i < j, \text{ and } \gamma_{ij}^{HW} = 0 \text{ for } i = j.$$

(Model 2c: Crossing)

For example, the odds ratios of a husband with a national/public university education marrying a wife with a private university education and a STEM major are expressed as $\gamma_{54}^{HW} = \gamma_4$. This parameter is additive, and thus the odds ratio of husbands with a national/public university education crossing barriers and marrying wives with a junior college education is $\gamma_{52}^{HW} = \gamma_2 + \gamma_3 + \gamma_4$.

Last, I test Hypothesis 3 to examine changes in the strength of the associations over time, focusing on heterogeneity within higher education in terms of institutional selectivity. To examine this, I apply Models 3a to 3c. All of these models are either changing homogamy or crossing models based on the models used to test Hypothesis 2. For example, Model 3a is expressed as follows:

$$ln\, F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \lambda_{ij}^{HW} + \delta_{ijk}^{HWC}, \text{where } \delta_{ijk}^{HWC} \text{ follows matrix 2.}$$

(Model 3a: Changing homogamy)

5. Results

Descriptive results

Figure 2 shows the distributions of educational attainment for married men and women separately using the JPSC and KHPS. Both men and women in recent cohorts are more likely to enter four-year universities than those in previous cohorts, although this trend stalls somewhat among the 1970 to 1979 birth cohorts for men.[16] Despite the general rise in access to education among women, gender differences in educational attainment persist among younger cohorts. In terms of heterogeneity by university selectivity, the proportion of national/public university graduates remains largely the same across cohorts, while the proportion of private institution graduates, especially in non-STEM fields, increases. This is consistent with the fact that women's access to higher education has been promoted through an increase in the number of private institutions, including schools upgraded from junior colleges.

[Figure 2 is about here]

Figure 3 presents changes in the observed proportions of educational homogamy, female hypergamy, and female hypogamy on the left and the expected proportions on the right.[17] Within the observed rates, 48% of marriages in the 1970-1984 cohort are homogamous, and homogamy still characterizes more than 37% of the latest cohort. In contrast, both educational

[16] Although not shown, the trends among the unmarried population are comparable.

[17] The expected rates are calculated under the assumption that the husband's and wife's education levels are independent of each other. This provides results equivalent to those calculated by Model 1.

hypergamy and educational hypogamy slightly increase from the oldest cohort to the latest cohort. The expected rates (right) show trends similar to those in the observed rates. The rate of homogamy decreases, while the trend increases for hypergamy and hypogamy. This result suggests that the observed trends are largely due to changes in the marginal distributions of men's and women's educational attainment. One interesting finding is that expected educational homogamy decreases even further than the observed rate. Intuitively, it is plausible that educational expansion could lead to an increase in educational homogamy as the distributions of men's and women's education become more similar. However, the figure shows that this is not the case in Japan, which is not surprising in light of the previous studies that I cited above. Additionally, although the trends are the same between the observed and expected rates, the results suggest that much of the observed trend is explained by changes in the composition of men's and women's educational attainment.

[Figure 3 is about here]

Log-linear and log-multiplicative models

To investigate the relative association between wives' and husbands' educational attainment, I estimated log-linear and log-multiplicative layer effects models. Table 1 provides the goodness-of-fit statistics for the models: the log-likelihood ratio chi-squared statistic (G^2), the degrees of freedom (df), the index of dissimilarity (ID), and the Bayesian information criterion (BIC).[18] The *ID* is the proportion of misclassified cases in a given model. Thus, the smaller the *ID*, the better is the model fit. The *BIC* adds a penalty for the number of parameters related to G^2 in a given model, so the more negative the *BIC*, the better is the model fit. One advantage of referring

[18] The *ID* is defined as $\sum|F_{ijk} - f_{ijk}|/2n$, where f_{ijk} denotes the observed frequencies of the (i, j, k) cell. The *BIC* is defined as $G^2 - \log n \times \text{df}$.

to the *BIC* is that for a fully saturated model, this criterion should be 0 (Raftery 1995). Thus, it is expected that models with a *BIC* lower than 0 are preferred over models with a positive *BIC*.

Model 0 (conditional independence) shows that 18.8% of cases are misclassified in this model, which suggests a poorer fit, as expected. To test Hypothesis 1, Model 1a adds homogamy parameters, which improve the model fit compared with that of Model 0. Model 1b adds parameters to estimate changes in each of the educational assortative mating types articulated in Model 1a. The *BIC* in this model is not lower than that of Model 1a, while the chi-squared test of the G^2 statistic between Model 1a and Model 1b shows that the null hypothesis is rejected at the 5% level of statistical significance (G^2= 8.1, df=2), indicating that the degree of educational homogamy changes over time.

[Table 1 is about here]

Panel (a) of Figure 4 presents changes in each of the homogamy scenarios for Model 1b. The results indicate that homogamy is increasingly less likely to occur over time for cohorts of all educational attainment levels than for the reference cohort. This result is consistent with those of previous studies that argued that educational homogamy has consistently declined in Japan (Fujihara and Uchikoshi 2019; Fukuda, Yoda, and Mogi 2019; Miwa 2007; Raymo and Xie 2000). To examine the trend in educational assortative mating using a more parsimonious model, I also apply a log-multiplicative model (Model 1c). The model fit statistics indicate that the *BIC* is close to that of the changing homogamy model. The log-multiplicative parameters β_k^C estimated in Model 1c show that the association between the husband's and wife's educational attainment in terms of the log-odds ratios declines by 21% over the three cohorts.

[Figure 4 is about here]

Next, Models 2a to 2c are estimated to test Hypothesis 2. Among the homogamy models (2a and 2b), Model 2a, which uses matrix 2, where I define homogamous marriages as the association in each cell on the main diagonal, is the best fitting. This result suggests that the association between husbands' and wives' educational attainment is heterogeneous in terms of their institutions' levels of selectivity, and the off-diagonal associations among university graduates are distinguishable from those of other marriages. Model 1c, which adds crossing parameters, also displays an improved fit. Although both the *BIC* and the *ID* in this model are slightly worse than those in Model 1a, the *BIC* (-231.6, results not shown) is smaller than that of the saturated model.[19] Therefore, the crossing model is also sufficient to capture patterns of assortative mating parsimoniously.

For descriptive purposes, Figure 5 presents the parameters estimated by Model 2a and Model 2c shown in Table 1. For Model 2a, the parameters of the diagonal cells that represent types of university education (private non-STEM, private STEM, and national/public) tend to be larger (2.00, 2.31, 3.04) than those representing those who did not graduate from university, i.e., high school graduates (1.43) and junior college graduates (-0.52). Substantively, for example, the odds ratio of homogamy among national/public university graduates is 21.0 (=exp(3.04)), implying that these university graduates are 21 times more likely than others to marry spouses with the same type of education. Additionally, if this parameter is read as the strength of homogamy, homogamy is strongest among national/public university graduates (the 95% confidence interval ranges from 2.69 to 3.39), weaker among graduates of private universities

[19] This model, which allows for a saturated association between wives' and husbands' educational achievement (ψ_{ij}^{HW}), provides us with a reference for selecting the best-fitting models, as models with better fit statistics than that of the saturated model are able to capture the association more parsimoniously. The equation for the saturated model is as follows: $\ln F_{ijk} = \lambda + \lambda_i^H + \lambda_j^W + \lambda_k^C + \lambda_{ik}^{HC} + \lambda_{jk}^{WC} + \psi_{ij}^{HW}$

with STEM (from 1.96 to 2.66) and weakest among graduates of private universities without STEM (from 1.75 to 2.24). Thus, the strength of homogamy among university graduates differs based on their institution's selectivity under the assumption that the parameters are the same across cohorts, which supports the exclusivity hypothesis.

According to Model 2c, as expected, marrying across educational attainment statuses is less likely to occur than marrying within the same educational level. Interestingly, however, the crossing parameter is relatively higher for marriages between private non-STEM university graduates and private STEM university graduates than for other marriages across adjacent levels of educational attainment. Since larger crossing parameters refer to higher odds of intermarriage, this result suggests that the difficulty of crossing the education boundary is lower for these private university graduates and that they are more likely to intermarry than other pairs of adjacent education groups.

[Figure 5 is about here]

Last, to test Hypothesis 3, I examine Models 3a-3c, which add parameters to estimate changes in assortative mating among graduates of each of the educational types. The *BIC* is lower than 0 across the models but poorer than that of Model 2a or Model 2c, which suggests that there is no cohort change in assortative mating; thus, the results should be interpreted with caution due to the relatively worse fit, although the chi-squared tests of the G^2 statistic between the hierarchical models (Models 2a and 3a, 2b and 3b, and 2c and 3c) reveal that the null hypothesis that these models are the same is rejected at the 1% level of statistical significance. These results, similar to those of my evaluation of Hypothesis 1, suggest that educational

homogamy has declined overall but that distinguishing between university graduates by institutional selectivity provides a more nuanced picture of these trends.[20]

Panels (B) and (C) of Figure 4 present changes in the homogamy (3b) and crossing parameters (3c), the *BIC*s of which are relatively smaller than that of Model 3a. These models assume that the strength of educational homogamy differs by cohort. In panel (B), in line with this study's interest in educational homogamy among university graduates, I limit the visualization to the three university-educated groups. The results of Model 3b, which distinguishes between universities by selectivity, present a different picture than the results of Model 1b. Specifically, while national/public university graduates are increasingly likely to marry similarly educated spouses, private university graduates with both STEM and non-STEM degrees are less likely to marry homogenously in recent cohorts. To pinpoint where the increase in educational homogamy among prestigious university graduates and the decrease among private university graduates occur, panel (C) of Figure 4 presents changes in the crossing parameters for adjacent categories. Positive coefficients on the cohort interaction mean more intermarriage in recent cohorts, while negative coefficients indicate less intermarriage. The results show that the difficulty of crossing educational attainment boundaries between private STEM and national/public university graduates increases by 40.4% across the three cohorts. In contrast, crossing boundaries between other adjacent education types declines by 20.0% (for non-STEM and STEM graduates) and 7.4% (for junior college and non-STEM graduates).

6. Discussion

[20] Although the results are not shown in Table 1, I also apply log-multiplicative models to test Hypothesis 3. Even among these models, the *BIC* is worse than that in the hierarchical models (Models 2a to 2c), while the chi-squared test of the G^2 statistic between the hierarchical models rejects the null hypothesis.

This paper investigated the patterns of educational assortative mating in Japan over time, focusing on the role of *expansion* and *institutional differentiation* in higher education. As expected, in general, educational homogamy has decreased, but the evidence for the declining association hypothesis (H1) is weakly supported. The *BIC* model fit statistics indicate that models assuming no cohort change in educational assortative mating are the best fitting, while another criterion (the chi-squared test of the G^2 statistic) supports the log-multiplicative layer effects model, which estimates that the association between husbands' and wives' educational attainment decreased by approximately 20% over the three cohorts, defined by the respondent's year of marriage. Despite using different categorizations and birth cohorts instead of marriage cohorts, prior work with the same model provided a similar estimate of a 25% change in homogamy among women born from 1950-1954 and those born from 1975-1979 (Fujihara and Uchikoshi 2019).

This weak support for a decline in homogamy, which is in contrast to the findings of past studies on assortative mating in Japan, is related to this study's original contribution; that is, the ability to discern patterns of educational assortative mating is dependent on how educational categories are measured in the context of rapid educational expansion. First, the results using a finer categorization of university graduates based on school selectivity and prestige demonstrate that the strength of educational homogamy differs according to the level of institutional selectivity, with a larger likelihood of homogamy among national/public university graduates than among other private university graduates and lower odds of homogamy among private university non-STEM graduates than among STEM graduates. These findings support the exclusivity hypothesis (H2). Importantly, possibly reflecting their schools' selectivity, graduates of a national/public university are more likely to marry homogamously than graduates of a private school. This result adds to our understanding of the heterogeneity in school selectivity-based assortative mating patterns that were obscured in earlier studies.

Second, in addition to the initial difference in the strength of homogamy across these groups, there has been a diverging trend. Specifically, national/public university graduates have

increased their tendency to marry similarly educated spouses, while the opposite is true for private university graduates, supporting the institutional differentiation hypothesis (H3). Because they did not account for the increasing differentiation within higher education, previous studies on trends in educational assortative mating were not able to identify these diverging trends in homogamy among university graduates; these divergent patterns in turn contribute to general trends in quite different ways. To summarize, these results suggest that a relative increase in the number of private university graduates contributes to a decline in educational homogamy through these graduates' increased representation in the pool of university graduates and growing likelihood of intermarriage in recent years.

However, I acknowledge a number of limitations. First, since this study used cross-sectional information about spouse pairing patterns, a potential bias was not addressed. In particular, given that older cohorts are more likely to appear to marry homogamously than younger cohorts in cross-sectional data as a result of selective attrition via divorce (Tzeng 1992), the current study may have overestimated the decline in educational assortative mating. Second, the relatively small sample size makes the contingency table sparse, especially for marriages between university graduates and nongraduates. To ensure the consistency and reliability of these estimates, future research should reanalyze the results with using a larger survey dataset. Third, the classification of prestige among university graduates in this analysis is crude, so future studies could provide an improved picture by using a finer prestige classification, such as one based on school name, rather than the simple national/public–private distinction.

Despite these limitations, the finding of diverging trends in homogamy among university graduates provides new insights into the role of educational assortative mating in the creation of stratification and inequality. As a potential determinant of increasing economic inequality, educational assortative mating has drawn enormous attention (Breen and Andersen 2012; Breen and Salazar 2010; Esping-Andersen 2007; Schwartz 2010; Torche 2010), although evidence for its actual influence on inequality is mixed (Schwartz 2013). This mixed evidence might be due to an inappropriate categorization of educational attainment. For example,

educational homogamy may increase for a particular subgroup (e.g., selective university graduates), while the opposite might be true for other subgroups (e.g., nonselective university graduates). If this is the case, these groups likely impact growing income inequality differently. Therefore, my results suggest that close attention should be paid to the important and growing heterogeneity of institutional characteristics that has been obscured in earlier studies to understand the impact of educational assortative mating on income inequality.

Last, the findings in this study could also extend to comparative contexts. Facilitation of higher educational expansion through institutional differentiation has also occurred, for example, in the United States, where the expansion has been characterized by stratifying processes in higher education through a proliferation of lower-tier institutions (Roksa et al. 2007). In particular, there was an increase in the number of for-profit universities from the early 1990s until 2010 (National Center for Education Statistics 2019). Studies have argued that these colleges target disadvantaged and minority students (Deming et al. 2013), who then end up with heavy student loan debt (Deming et al. 2012) and almost no economic benefits (Cellini and Turner 2019). The results from this study imply that the proliferation of these for-profit colleges may have attenuated the increase in educational homogamy among college graduates (Schwartz and Mare 2005). In other words, if for-profit college graduates are distinguished from other college graduates, the former may show a different trend, with more intermarriage, but more homogamy among other college graduates. Moreover, a growth in institutional differentiation via various mechanisms has also been observed in East Asian societies (Hannum et al. 2019), including China (Li et al. 2012), South Korea (Park 2007) and Taiwan (Lo 2014). Thus, future research should also examine whether the growth in institutional heterogeneity within higher education is associated with changes in educational assortative mating in these countries. Analyzing how spouse pairing patterns are influenced by educational expansion and differentiation would provide new insights into how higher education creates stratification and inequality.

References

Andrade, Stefan B., and Jens-Peter Thomsen. 2019. “Educational Assortative Mating: A Micro-educational Approach.” *The British Journal of Sociology* 70(4):1245–75.

Arum, Richard, Adam Gamoran, and Yossi Shavit. 2007. “More Inclusion than Diversion: Expansion, Differentiation, and Market Structure in Higher Education.” Pp. 1–35 in *Stratification in Higher Education: A Comparative Study*, edited by Y. Shavit, R. Arum, and A. Gamoran. Stanford: Stanford University Press.

Arum, Richard, Josipa Roksa, and Michelle J. Budig. 2008. “The Romance of College Attendance: Higher Education Stratification and Mate Selection.” *Research in Social Stratification and Mobility* 26(2):107–21.

Arum, Richard, and Josipa Roska. 2014. *Aspiring Adults Adrift: Tentative Transitions of College Graduates*. University of Chicago Press.

Blossfeld, Hans-Peter. 2009. “Educational Assortative Marriage in Comparative Perspective.” *Annual Review of Sociology* 35(1):513–30.

Blossfeld, Hans-Peter, and A. Timm. 2003. *Who Marries Whom?* Springer Science & Business Media.

Bouchet-Valat, Milan. 2014. “Les Évolutions de l’homogamie de Diplôme, de Classe et d’origine Sociales En France (1969-2011) : Ouverture d’ensemble, Repli Des Élites.” *Revue Française de Sociologie* 55(3):459.

Breen, R., and L. Salazar. 2010. “Has Increased Women’s Educational Attainment Led to Greater Earnings Inequality in the United Kingdom? A Multivariate Decomposition Analysis.” *European Sociological Review* 26(2):143–57.

Breen, Richard, and Signe Hald Andersen. 2012. “Educational Assortative Mating and Income Inequality in Denmark.” *Demography* 49(3):867–87.

Brint, Steven, and Jerome Karabel. 1989. *Diverted Dream : Community Colleges and the Promise of Educational Opportunity in America, 1900-1985*. Oxford University Press.

Burtless, G. 1999. “Effects of Growing Wage Disparities and Changing Family Composition on the US Income Distribution.” *European Economic Review* 43:853–65.

Cellini, Stephanie Riegg, and Nicholas Turner. 2019. “Gainfully Employed?: Assessing the Employment and Earnings of For-Profit College Students Using Administrative Data.” *Journal of Human Resources* 54(2):342–70.

Deming, David, Claudia Goldin, and Lawrence Katz. 2013. “For-Profit Colleges.” *The Future of Children* 23(1):137–63.

Deming, David J., Claudia Goldin, and Lawrence F. Katz. 2012. “The For-Profit Postsecondary School Sector: Nimble Critters or Agile Predators?” *Journal of Economic Perspectives* 26(1):139–64.

DiPrete, Thomas A., and Claudia Buchmann. 2013. *The Rise of Women: The Growing Gender Gap in Education and What It Means for American Schools*. Russell Sage Foundation.

Edwards, Linda N., and Margaret K. Pasquale. 2003. “Women’s Higher Education in Japan: Family Background, Economic Factors, and the Equal Employment Opportunity.” *Journal of the Japanese and International Economies* 17(1):1–32.

Esping-Andersen, G. 2007. “Sociological Explanations of Changing Income Distributions.” *American Behavioral Scientist* 50(5):639–58.

Esteve, Albert, Joan Garcia-Roman, and Inaki Permanyer. 2012a. “The Gender-Gap Reversal in Education and Its Effect on Union Formation: The End of Hypergamy?” *Population and Development Review* 38(3):535–46.

Esteve, Albert, Joan Garcia-Roman, and Inaki Permanyer. 2012b. “The Gender-Gap Reversal in Education and Its Effect on Union Formation: The End of Hypergamy?” *Population and Development Review* {38}({3}):{535-}.

Esteve, Albert, Christine R. Schwartz, J. Van Bavel, Inaki Permanyer, Martin Klesment, and Joan Garcia-Roman. 2016. “The End of Hypergamy: Global Trends and Implications.” *Population and Development Review* 42(4):615–625.

Fujihara, Sho, and Hiroshi Ishida. 2016. “The Absolute and Relative Values of Education and The Inequality of Educational Opportunity: Trends in Access to Education in Postwar Japan.” *Research in Social Stratification and Mobility* 43:25–37.

Fujihara, Sho, and Fumiya Uchikoshi. 2019. “Declining Association with Persistent Gender Asymmetric Structure: Patterns and Trends in Educational Assortative Marriage in Japan, 1950–1979.” *Research in Social Stratification and Mobility* 60:66–77.

Fujimura-Fanselow, Kumiko. 1995. “College Women Today: Options and Dilemmas.” Pp. 125–154 in *Japanese Women: New Feminist Perspectives on the Past, Present, and Future*, edited by K. Fujimura-Fanselow and A. Kameda. New York: The Feminist Press.

Fukuda, Setsuya, James M. Raymo, and Shohei Yoda. 2020. “Revisiting the Educational Gradient in Marriage in Japan.” *Journal of Marriage and Family* 82(4):1378–96.

Fukuda, Setsuya, Shohei Yoda, and Ryohei Mogi. 2019. “Educational Assortative Mating in Japan: Evidence from the 1980-2010 Census.” *National Institute of Population and Social Security Research Working Paper Series: 29* 1–30.

Gerber, Theodore P., and Sin Yi Cheung. 2008. “Horizontal Stratification in Postsecondary Education: Forms, Explanations, and Implications.” *Annual Review of Sociology* 34(1):299–318.

Han, Hongyun. 2010. “Trends in Educational Assortative Marriage in China from 1970 to 2000.” *Demographic Research* 22:733–70.

Hannum, Emily, Hiroshi Ishida, Hyunjoon Park, and Tony Tam. 2019. “Education in East Asian Societies: Postwar Expansion and the Evolution of Inequality.” *Annual Review of Sociology* 45(1):625–47.

Hersch, Joni. 2013. “Opting out among Women with Elite Education.” *Review of Economics of the Household* 11(4):469–506.

Hout, Michael, and Thomas A. DiPrete. 2006. “What We Have Learned: RC28’s Contributions to Knowledge about Social Stratification.” *Research in Social Stratification and Mobility* 24(1):1–20.

Ishida, Hiroshi. 1998. “Educational Credentials and Labour-Market Entry Outcomes in Japan.” Pp. 287–309 in *From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations*, edited by Y. Shavit and W. Muller. Clarendon Press.

Ishida, Hiroshi. 2007. “Japan: Educational Expansion and Inequality in Access to Higher Education.” Pp. 63–86 in *Stratification in Higher Education: A Comparative Study*, edited by Y. Shavit, R. Arum, and A. Gamoran. Stanford: Stanford University Press.

Kalmijn, Matthijs. 1998. “Intermarriage and Homogamy: Causes, Patterns, Trends.” *Annual Review of Sociology* 395–421.

Katrňák, Tomáš, and Beatrice Chromková Manea. 2020. “Change in Prevalence or Preference? Trends in Educational Homogamy in Six European Countries in a Time of Educational Expansion.” *Social Science Research* (Online first).

Li, Hongbin, Lingsheng Meng, Xinzheng Shi, and Binzhen Wu. 2012. “Does Attending Elite Colleges Pay in China?” *Journal of Comparative Economics* 40(1):78–88.

Lo, William Yat Wai. 2014. *University Rankings: Implications for Higher Education in Taiwan*. Singapore: Springer.

Lucas, Samuel R. 2001. “Effectively Maintained Inequality: Education Transitions, Track Mobility, and Social Background Effects.” *American Journal of Sociology* 106(6):1642–90.

Mare, Robert D. 1991. “Five Decades of Educational Assortative Mating.” *American Sociological Review* 56(1):15–32.

Ministry of Education, Culture Sports, Science and Technology. 2019. *Statistical Abstract*.

Ministry of Health Labour and Welfare. 2018. *Vital Statistics in Japan: Trends up to 2016*. Tokyo: Ministry of Health Labour and Welfare. (In Japanese).

Miwa, S. 2007. “Long-Term Trends in Status Homogamy.” Pp. 140–60 in *Deciphering Stratification and Inequality*, edited by Y. Sato. Trans Pacific Press.

National Center for Education Statistics. 2019. *The Condition of Education 2019*.

Oppenheimer, Valerie Kincade. 1988. “A Theory of Marriage Timing.” *American Journal of Sociology* 94(3):563–91.

Ortiz, Luis, and Jorge Rodriguez-Menés. 2016. “The Positional Value of Education and Its Effect on General and Technical Fields of Education: Educational Expansion and

Occupational Returns to Education in Spain." *European Sociological Review* 32(2):216–37.

Park, Hyunjoon. 2007. "South Korea: Educational Expansion and Inequality of Opportunity for Higher Education." Pp. 87–112 in *Stratification in Higher Education: A Comparative Study*, edited by Y. Shavit, R. Arum, and A. Gamoran. Stanford: Stanford University Press.

Parkin, Frank. 1971. *Class Inequality and Political Order*. University of California Press.

Powers, Daniel A., and Yu Xie. 2008. *Statistical Methods for Categorical Data Analysis*. 2nd Edition. Emerald Group Publishing.

Raftery, Adrian E. 1995. "Bayesian Model Selection in Social Research." *Sociological Methodology* 25:111–63.

Raftery, Adrian E., and Michael Hout. 1993. "Maximally Maintained Inequality: Expansion, Reform, and Opportunity in Irish Education, 1921-75." *Sociology of Education* 66(1):41–62.

Rauscher, Emily. 2015. "Effects of Early U.S. Compulsory Schooling Laws on Educational Assortative Mating: The Importance of Context." *Demography* 52(4):1219–42.

Ravazzini, Laura, Ursina Kuhn, and Christian Suter. 2017. "Do Opposites Attract? Educational Assortative Mating and Dynamics of Wage Homogamy in Switzerland, 1992–2014." *Swiss Journal of Sociology* 43(3):567–86.

Raymo, J. M., and Y. Xie. 2000. "Temporal and Regional Variation in the Strength of Educational Homogamy." *American Sociological Review* 65(5):773–81.

Reimer, David, Clemens Noelke, and Aleksander Kucel. 2008. "Labor Market Effects of Field of Study in Comparative Perspective: An Analysis of 22 European Countries." *International Journal of Comparative Sociology* 49(4–5):233–56.

Roksa, Josipa, Eric Grodsky, Richard Arum, and Adam Gamoran. 2007. “United States: Changes in Higher Education and Social Stratification.” Pp. 165–91 in *Stratification in Higher Education: A Comparative Study*, edited by Y. Shavit, R. Arum, and A. Gamoran. Stanford: Stanford University Press.

Schwartz, Christine R. 2010. “Earnings Inequality and the Changing Association between Spouses’ Earnings.” *American Journal of Sociology* 115(5):1524–57.

Schwartz, Christine R. 2013. “Trends and Variation in Assortative Mating: Causes and Consequences.” *Annual Review of Sociology* 39(1):451–70.

Schwartz, Christine R., and Robert D. Mare. 2005. “Trends in Educational Assortative Marriage from 1940 to 2003.” *Demography* 42(4):621–46.

Smits, J., W. Ultee, and J. Lammers. 1998. “Educational Homogamy in 65 Countries: An Explanation of Differences in Openness Using Country-Level Explanatory Variables.” *American Sociological Review* 63(2):264–85.

Smits, Jeroen. 2003. “Social Closure among The Higher Educated: Trends in Educational Homogamy in 55 Countries.” *Social Science Research* 32(2):251–77.

Smits, Jeroen, and Hyunjoon Park. 2009. “Five Decades of Educational Assortative Mating in 10 East Asian Societies.” *Social Forces* 88(1):227–55.

Torche, Florencia. 2010. “Educational Assortative Mating and Economic Inequality: A Comparative Analysis of Three Latin American Countries.” *Demography* 47(2):481–502.

Treiman, D. J. 1970. “Industrialization and Social Stratification.” *Sociological Inquiry* 40(2):207–34.

UNESCO Institute for Statistics. 2012. *International Standard Classification of Education ISCED 2011*. UNESCO Institute for Statistics.

Van Bavel, Jan, Christine R. Schwartz, and Albert Esteve. 2018. “The Reversal of the Gender Gap in Education and Its Consequences for Family Life.” *Annual Review of Sociology* 44(1):341–60.

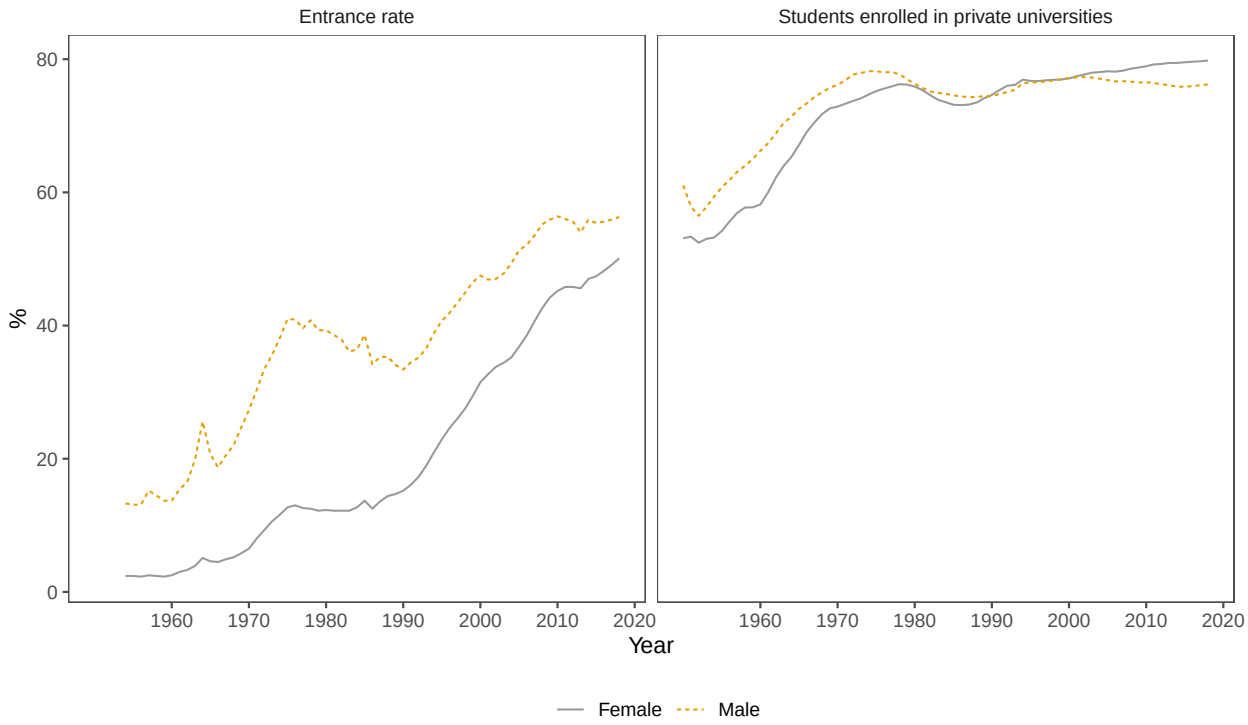
Wong, Raymond Sin-Kwok. 2003. “To See or Not To See: Another Look at Research on Temporal Trends and Cross-National Differences in Educational Homogamy.” *Taiwanese Journal of Sociology* 31:45–88.

Xie, Yu. 1992. “The Log-Multiplicative Layer Effect Model for Comparing Mobility Tables.” *American Sociological Review* 57(3):380–95.

Yonezawa, Akiyoshi, Izumi Nakatsui, and Tetsuo Kobayashi. 2002. “University Rankings in Japan.” *Higher Education in Europe* 27:373–82.

Table 1 Goodness-of-fit statistics for the models and log-multiplicative layer coefficients

Models			Goodness of fit of models			
			G^2	df	*ID*	*BIC*
0	[HC WC]	Conditional independence	1490.4	48	18.8%	1071.0
Models for Hypothesis 1 (using homogamy matrix 1)						
1a	[HC WC δ^{HW}]	Homogamy	192.9	45	4.4%	-200.3
1b	[HC WC HW δ^{HWC}]	Changing homogamy	35.3	26	1.7%	-191.9
1c	[HC WC $\delta^{HW}\beta^{C}$]	Homogamy, LM	184.8	43	3.9%	-190.9
Models for Hypothesis 2						
2a	[HC WC δ^{HW}]	Homogamy (matrix 2)	71.8	42	3.1%	-295.2
2b	[HC WC δ^{HW}]	Homogamy (matrix 3)	310.5	43	6.2%	-65.2
2c	[HC WC γ^{HW}]	Crossing	137.4	44	4.9%	-247.1
Models for Hypothesis 3						
3a	[HC WC HW δ^{HWC}]	Changing homogamy (matrix 2)	21.9	20	1.0%	-152.8
3b	[HC WC HW δ^{HWC}]	Changing homogamy (matrix 3)	23.5	22	1.1%	-168.7
3c	[HC WC HW γ^{HWC}]	Changing crossing	29.8	24	1.6%	-179.9



Source: School Basic Survey, Ministry of Education, Culture, Sports, Science and Technology

Note: Entrance rate is calculated by total number of enrolled students out of high school graduates

Figure 1 Trends in university enrollment in Japan

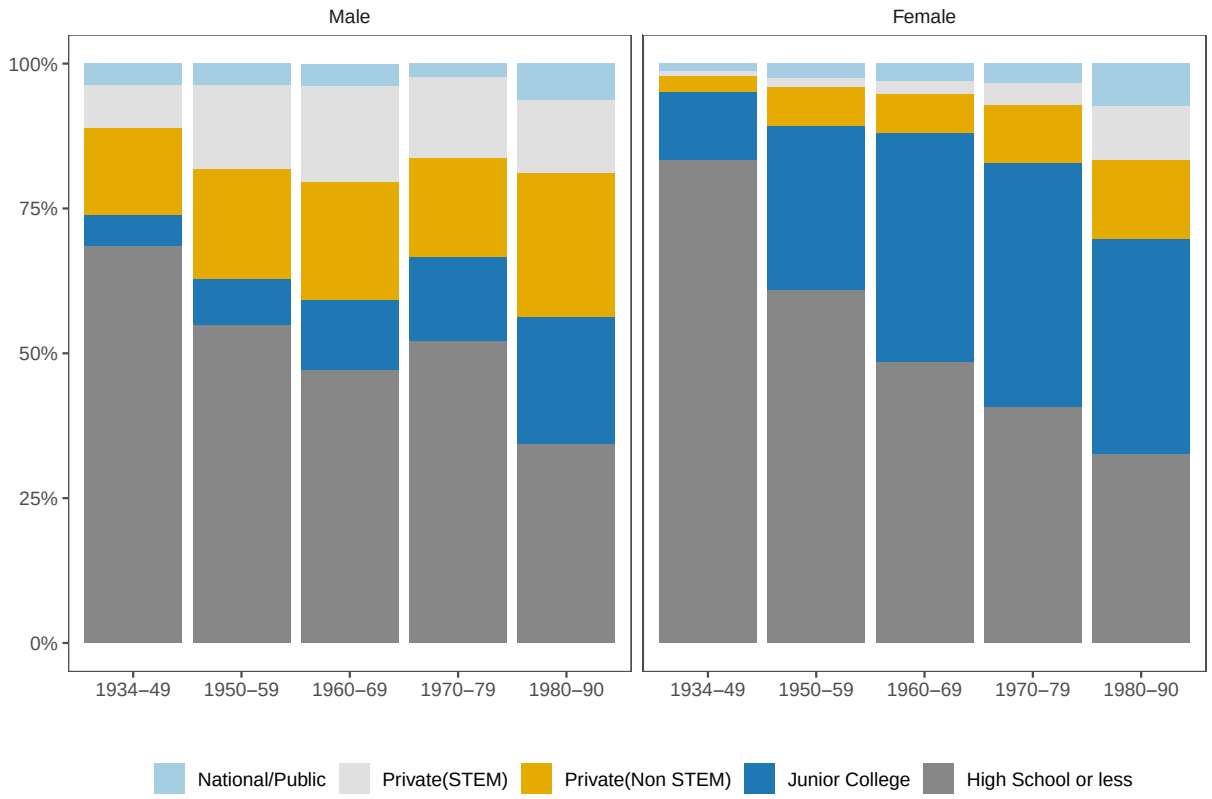


Figure 2 Respondents' educational attainment by gender and birth cohort (excluding nonmarried respondents)

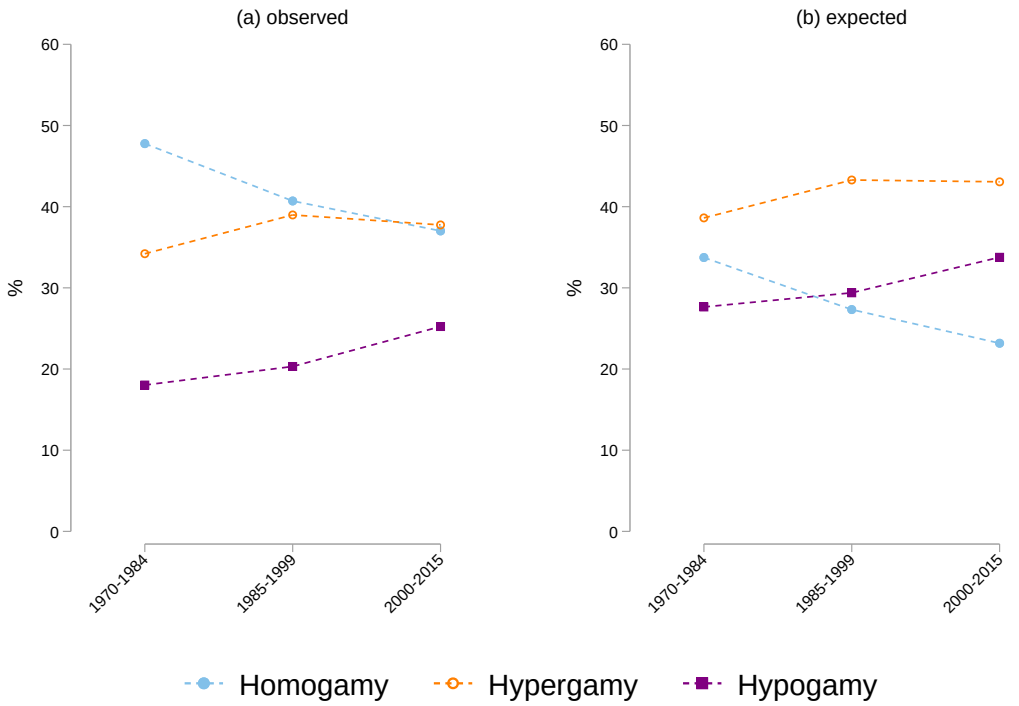


Figure 3 Observed and expected distributions of homogamy, hypergamy, and hypogamy by marriage cohort

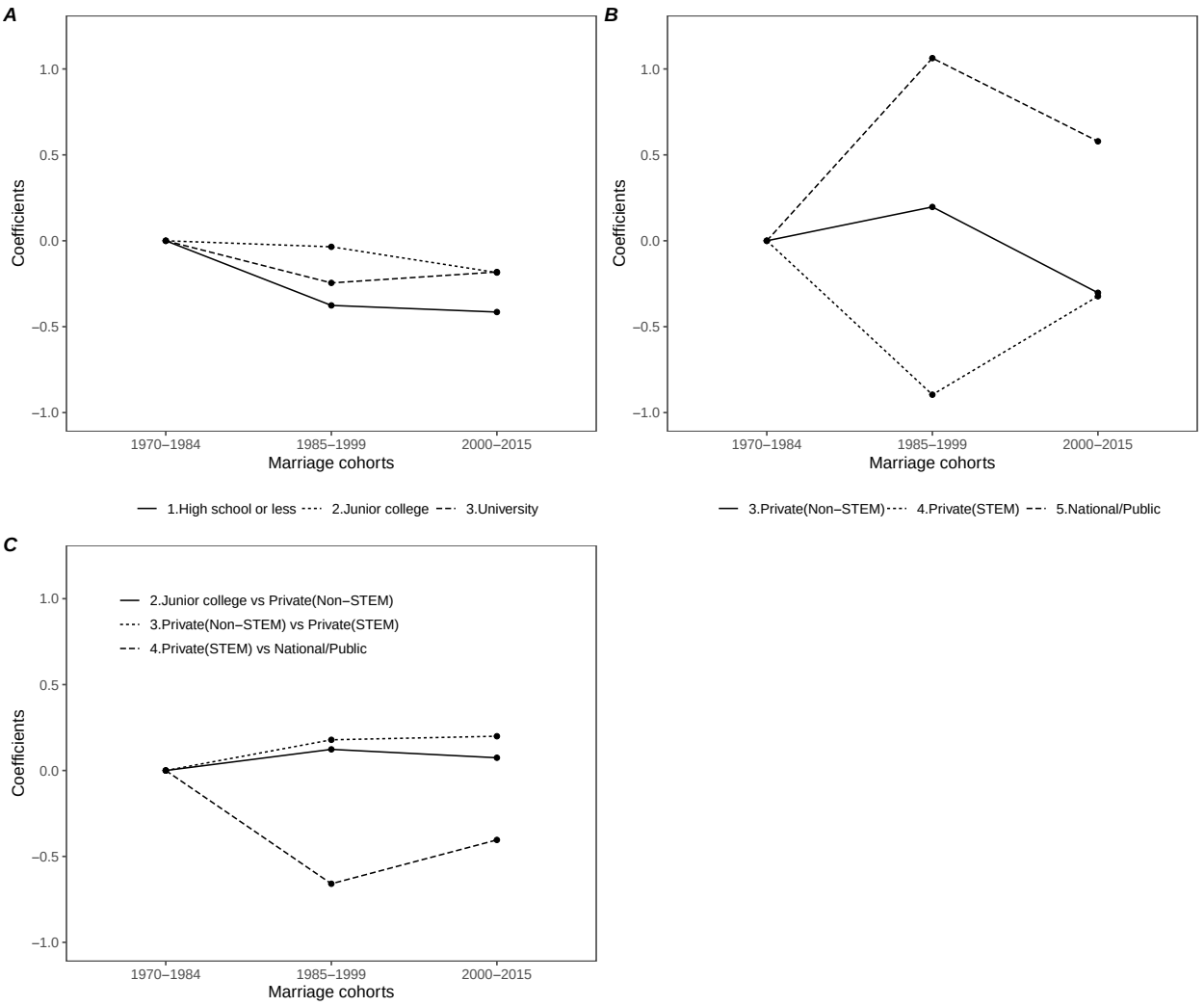


Figure 4 Changes in the homogamy and crossing parameters by marriage cohort as estimated by Model 1b, Model 3b, and Model 3c

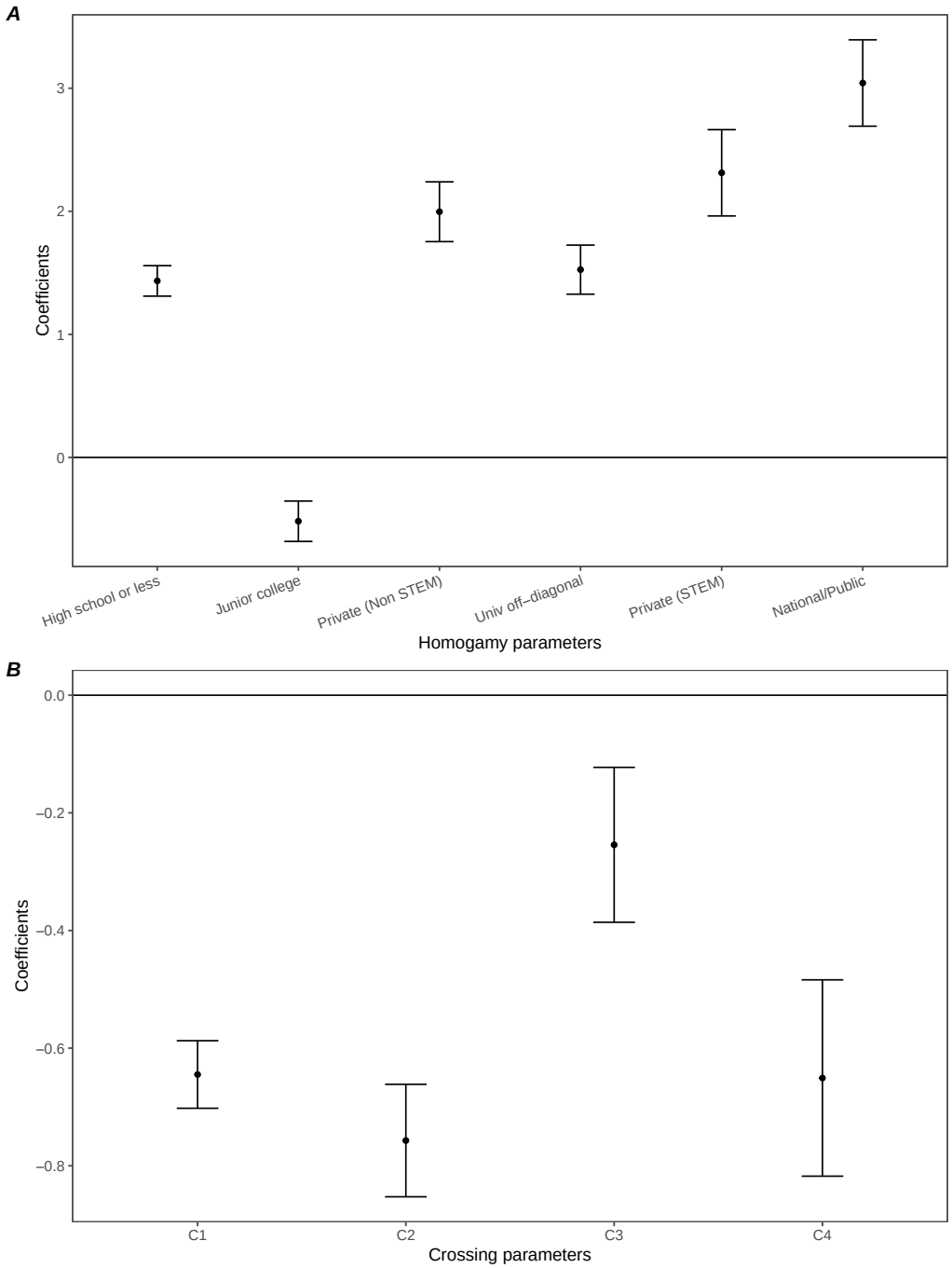


Figure 5 Parameters of association between husbands' and wives' educational attainment (A: estimated by Model 2a; B: estimated by Model 2c)

Note: Error bars indicate the 95% confidence intervals. C1: high school or less/junior college, C2: junior college/private non-STEM, C3: private non-STEM/private STEM, C4: private STEM/national or public

Appendix

Table 1 Design matrix

Matrix 1

	1	2	3	4	5
1	1	0	0	0	0
2	0	2	0	0	0
3	0	0	3	3	3
4	0	0	3	3	3
5	0	0	3	3	3

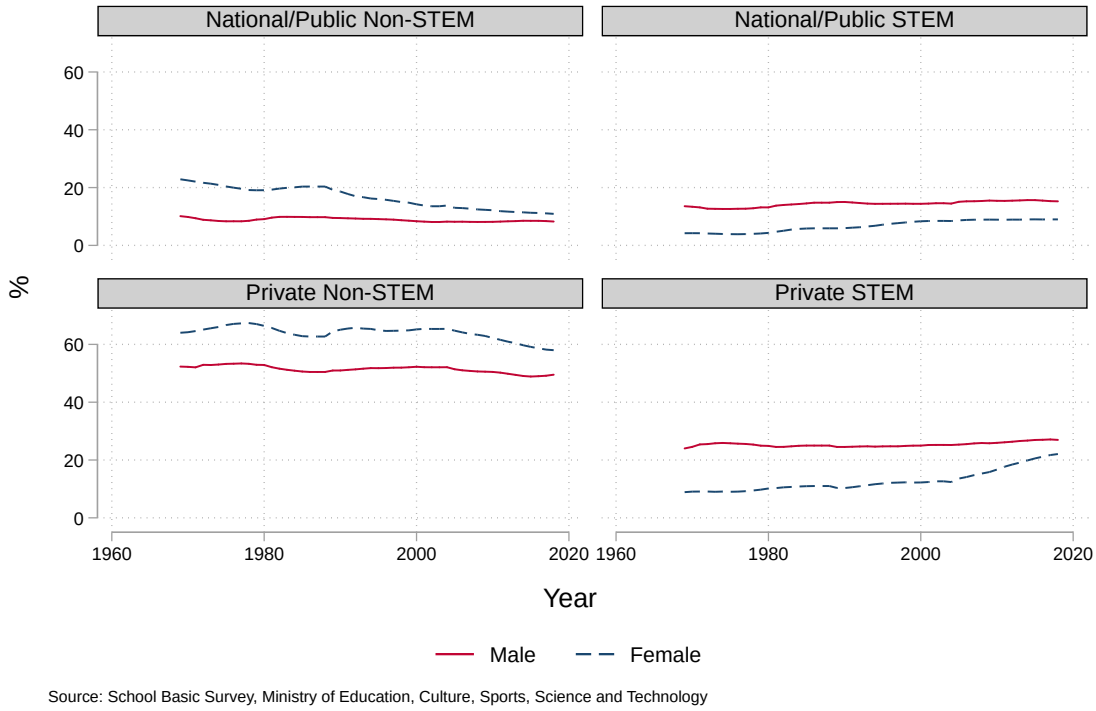
Matrix 2

	1	2	3	4	5
1	1	0	0	0	0
2	0	2	0	0	0
3	0	0	3	4	4
4	0	0	4	5	4
5	0	0	4	4	6

Matrix 3

	1	2	3	4	5
1	1	0	0	0	0
2	0	2	0	0	0
3	0	0	3	0	0
4	0	0	0	4	0
5	0	0	0	0	5

Note: Row and column numbers correspond to the following educational attainment levels: 1= high school or less; 2 = junior college, college of technology, or professional training college; 3 = private university with non-STEM majors; 4 = private university with STEM majors; 5 = national and public universities



Source: School Basic Survey, Ministry of Education, Culture, Sports, Science and Technology

Figure 1 Trends in the number of STEM/non-STEM students by gender and institution