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Can Educational Expansion and Delayed Family Formation Explain Occupational Gender Desegregation?
Evidence from harmonized census occupation data in Japan, 1980–2020[1]

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Abstract

The increasing educational attainment of women and the associated delay in marriage have been proposed as demographic factors contributing to a reduction in occupational gender segregation, but few studies have directly examined the extent to which these compositional changes have in fact contributed to this decline. This study examines how much change has taken place in occupational gender segregation among Japanese employees since 1980, the extent to which compositional shifts in educational attainment and marital status have contributed to this change, and whether such patterns differ by age group. Using harmonized Population Census data from Japan covering 164 occupational titles from 1980 to 2020, we find that occupational gender segregation measured using the dissimilarity index declined by approximately 11% over four decades from 54.9 to 49.0. This decrease was concentrated since 2000 and is most pronounced among younger workers. Decomposition analyses further indicate that, among changes in demographic composition, increases in educational attainment, in particular the rising proportion of university-educated women, made the largest contribution. This effect was broadly uniform across all age groups. In contrast, compositional shifts in marital status contributed only marginally. A greater impact on desegregation came from changes that are not attributable to demographic composition (i.e., structural changes), which first emerged among younger workers before subsequently extending to middle-aged workers.

Keywords: Occupational gender segregation, educational expansion, family formation, decomposition analysis
JEL classification: J16, J24, J12, J21

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Introduction

Occupational gender segregation is a key source of gender wage inequality in affluent societies (England 1992; Petersen and Morgan 1995; Tam 1997; Tomaskovic-Devey and Skaggs 2002; Levanon et al. 2009). Previous empirical efforts have explored certain sources of declining occupational segregation, noting the role of the expansion of women's education. In most countries where access to higher education has expanded, women's postsecondary attendance and completion rates have caught up and even surpassed those of men (DiPrete and Buchmann 2013; Esteve et al. 2012, 2016; Van Bavel 2012). Women's longer years of education could therefore contribute to occupational desegregation (Campbell and Horowitz 2016). Consistent with this expectation, studies have documented the decline in occupational gender segregation (Blau et al. 2013; England 2010; England et al. 2020; Mandel and Birgier 2016) as well as the fact that the decline is more pronounced among the college-educated (Blau et al. 2013). Yet, substantial segregation remains and the pace has slowed in recent decades (Blau et al. 2013; England et al. 2020; England 2010; Blau et al. 2013; Mandel and Birgier 2016).

Why has occupational gender desegregation stalled despite an educational expansion that could be expected to help equalize men's and women's career trajectories? A handful of studies find that family formation can reinforce gender inequality by penalizing mothers' careers and rewarding fathers' earnings, as well as by prompting women's career interruptions through husband-related relocations (Budig and England 2001; Cooke 2008; Killewald and Gough 2013). These findings collectively suggest that career interruption due to family formation shapes women's careers, damping education's equalizing role in occupational gender segregation. It thus follows that changes in family dynamics—particularly delaying the timing of marriage and childbearing—may also play an important role in the shaping of occupational gender segregation, especially where women switch occupations in response to career interruptions. Supporting this view, Killewald and Cricco (2025) find that declining fertility in the United States has contributed to a narrowing of the gender wage gap, given that mothers often lower wages than non-mothers. Despite these compelling expectations, surprisingly little research has examined the ways that changing family dynamics can influence occupational segregation.

Building on these lines of research, this study provides updated insights into the stalled trend in occupational gender segregation, investigating how women's expanded access to higher education and changing family dynamics shape occupational outcomes. To this end, we focus on

Japan as an illustrative case. A central feature of the Japanese labor market is its strongly age-graded occupational career structure. Workers typically enter lower-skilled positions and advance along firm-specific career ladders (Busemeyer 2009; Estévez-Abe et al. 2001), and promotion to managerial positions generally occurs ten to thirty years after initial firm entry following graduation (Ishida et al. 2002). Women have historically been more likely to exit employment upon marriage and childbirth and re-enter the labor market in middle age, after their children have grown up (Yu 2009). As a result, occupational distributions—and, consequently, occupational gender segregation—vary substantially across age groups (Brinton and Ngo 1993; Charles and Grusky 2004; Shirahase and Ishida 1994). This age pattern has an important analytical advantage for the examination of how demographic changes shape occupational gender segregation over the life course.

Population Census data from 1980 to 2020 that harmonize occupation data show that occupational gender segregation declined by approximately 11% over this period, with the reduction particularly pronounced after 2000 and among younger workers. Segregation declined by 23% among workers aged 20–29, compared with only modest declines among older age groups. Decomposition analyses indicate that educational upgrading—especially women's increased access to four-year university education—was the primary demographic contributor to desegregation, and changes in marital status played a much smaller role. At the same time, the contribution of structural change varied across age groups, suggesting that desegregation first emerged among younger workers and later extended to older cohorts.

This study makes three key contributions to research on occupational gender segregation. First, by distinguishing changes in the demographic composition from changes in the associations between demographic or other characteristics and occupational outcomes, we provide new insights into the mechanisms that have been shaping desegregation beyond simply documenting overall trends. Second, focusing on age-specific patterns, our analysis clarifies the sources of desegregation: educational expansion was the primary demographic driver, while changes in marital status contributed only marginally, and structural change was initially concentrated in younger workers. Finally, the Japanese case highlights the value of incorporating age stratification into comparative research on occupational segregation, particularly in societies that are experiencing rapid aging of their workforces.

Background

Stalled decline in occupational gender segregation amid educational expansion

The scholarship on occupational gender segregation emphasizes the transformative role of women's improved access to education in shaping how men and women are distributed across occupational careers. Studies have found that occupations that have typically been held by college-educated individuals, such as professional occupations, tend to be more gender-integrated, whereas occupations requiring less education tend to be more gender-segregated, particularly in recent years (Blau et al. 2013). One explanation is that the human capital acquired through additional years of education has become more important in hiring decisions than ascribed characteristics such as gender. Exposure to education may also foster more egalitarian views of the gender division of labor (Campbell and Horowitz 2016). Thus, women's improved access to education, particularly to higher education, may reshape men and women's occupational distribution by channeling college-educated individuals into professional occupations. This expectation is supported, at least by evidence from the United States, where declining occupational segregation has been particularly pronounced among college-educated individuals (Blau et al. 2013).

Despite the expectation that the equalization, or even reversal, of the gender gap in educational attainment should bring men's and women's career trajectories closer together, the decline in occupational gender segregation has stalled in several countries (Blau et al. 2013; England 2010; Mandel and Birgier 2016; England et al. 2020). One explanation for this is the persistence of gender essentialism, or tacit beliefs about fundamental differences between men and women that are deeply embedded in social structures (England 2010; Ridgeway and Correll 2004). For example, extensive research has shown that gender beliefs attribute different capabilities to men and women, where women are often stereotyped as social, nurturing, or expressive and men as analytical (Ridgeway and Correll 2004), resulting in persistent occupational segregation (Levanon and Grusky 2016). Scholars argue that persistent gender essentialism produces gender-asymmetric change in which progress toward gender equality in one domain (e.g.,, higher education attendance and completion) does not necessarily lead to convergence in another (e.g., occupational integration) (Ridgeway 2011).

Life-course perspective and role of changing timing of family formation

Gender-essentialist beliefs and stereotypes that associate particular occupations with men or women are undeniably important for occupational gender segregation, these cultural explanations often overlook the role of the life course. Occupational trajectories evolve over the life course: where some individuals experience upward mobility due to their accumulation of human capital (Kalleberg and Mouw 2018), while others move downward or exit the labor market as they accommodate family or caregiving demands (Cha 2013; Roth 2006).

With respect to occupational segregation, even if college education helps men and women enter gender-integrated occupations, career interruptions—which are experienced more frequently by women—may erode education's equalizing roles. As the "revolving doors" thesis suggests (Jacobs 1989), even when women do enter male-dominated fields, they often leave them later on, and this pattern maintains occupational segregation. Studies also show that childbearing is negatively associated with women's wages and occupational status (Abendroth et al. 2014; Budig and England 2001; Gangl and Ziefle 2009; Yu and Hara 2021), whereas fatherhood is associated with a wage premium for men (Killewald 2013; Gowen 2023; Yu and Hara 2021). Marriage can also interrupt women's careers when they relocate to accommodate their husbands' jobs (Cooke 2008). Similarly, study of the gender "leaky pipeline" shows that women are more likely than their male counterparts to leave academic careers (Xie and Shauman 2003), indicating that gender differences in career interruptions form an important mechanism for the stalled integration of men and women in the labor market. These studies suggest that trends in occupational gender segregation are partly shaped by shifts in gender differences in terms of how family formation affects career continuity.

The demographic perspective also indicates that the relationship between educational attainment and occupational gender segregation may vary across age groups. For those at younger ages, for whom family-formation events such as marriage and childbearing are less common, education may play a stronger role in the reduction of occupational segregation. At later ages, when more men and women have experienced family formation, women's educational attainment may not translate into employment in professional occupations. A life-course perspective helps clarify the complex relationships among occupational distribution, educational attainment, and family formation by incorporating age-patterned career trajectories. The following section explains why Japan's case is suitable and illustrative one for examining these relationships.

Japanese context

Despite significant improvements in women's access to higher education and career opportunities, gender inequality in Japan remains persistent and pervasive, in particular in terms of wages and earnings (Chang and England 2011; Hara 2018; Kim and Shirahase 2014; Kumlin 2007; Takenoshita 2020; Yamaguchi 2019). Japan's gender wage gap is partially but not entirely attributable its occupational segregation: economically lucrative occupations and those with lower gender wage gaps (such as managerial, administrative, and highly skilled professional jobs), are still numerically dominated by men (Yamaguchi 2019). This male dominance persists despite educational convergence, largely because Japan's skill regime is characterized by low inter-firm mobility and a heavy reliance on within-firm on-the-job training (Dore and Sako 1998; Estévez-Abe et al. 2001). These institutional features disadvantage women who exit the labor market (Estévez-Abe 2011).

Previous studies link the persistent gender inequality found in Japan's labor market to the age-dependent nature of occupational placement. Under Japan's firm-internal labor-market system, workers typically advance in their careers up firm-specific career ladders, resulting in a greater share of relatively older workers in managerial and administrative occupations than in the United States (Brinton and Ngo 1993; Charles and Grusky 2004). Given the well-established pattern of women interrupting their careers in response to family events, this age-graded employment structure is closely linked to gender inequality in the labor market. Recent evidence, however, indicates that Japanese women—particularly college-educated women—are increasingly continuing to be employed after childbearing (Mugiyama 2024). This trend is supported by multiple policy efforts to promote women's labor force participation, including the expansion of parental leave, the creation of public childcare centers, the provision of shorter working hours to accommodate childcare, and the enactment of Act on Promotion of Women's Participation and Advancement in the Workplace, all in response to labor shortages that are caused by population decline. Given the age-patterned employment trajectories, the impact of these policies on workers' job placement is expected to become apparent among younger workers before it does among older workers.

Hypotheses

This context and background lead us to expect that compositional differences in educational attainment between men and women primarily matter for segregation at the early career stage. Once women experience a career interruption after marrying or having children, they are likely to be sorted into gender-segregated jobs, regardless of their level of education. This study specifically tests the following hypothesis:

Hypothesis 1a: Women's expanded access to higher education contributes to occupational desegregation across all age groups.
Hypothesis 1b: The contribution of higher education is largest among younger workers.

At the same time, Japanese men and women are increasingly delaying marriage and childbirth. While marriage was once nearly universal, and most individuals married in their twenties, the average age at first marriage has skyrocketed over the last decades. For men, the mean age at first marriage increased from 27.0 in 1975 to 31.1 in 2023, and for women, it increased from 24.7 to 29.7 over the same period (National Institute of Population and Social Security Research 2025). As nonmarital childbearing remains almost negligible (Raymo et al. 2015), childbirth has also been delayed, with the average age of first birth increased from 25.6 to 30.7. We hypothesize that this delay in marriage and childbearing increases the share of women who benefit from higher education in the labor market. In particular, we test the following hypothesis.

Hypothesis 2: Delayed family formation partially accounts for the decline in occupational gender segregation.

Methods

Data

We use restricted individual-level data from the Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications) for the years 1980, 1990, 2000, 2010, and 2020. This census, conducted every five years on October 1, covers all residents of Japan. The detailed (three-digit) occupational codes are available for 20% (in 1980) or 10% (in 1990–2020)

of the sample in each census year, and this allows us to identify a detailed nationwide trend in gender occupational segregation.

Our analytical sample includes employed male and female workers aged 20–59, excluding the self-employed and family workers. We excluded those younger than 20 years old, as graduates of junior college or university are not observed in this age range. We also excluded those aged 60 years and older, as most companies in Japan set the mandatory retirement age at 60. Re-employment is possible for those who wish to continue working, but for those who do so, their position at work often changes to a less prestigious one. Since the 1980s, the mandatory retirement age has gradually been raised to 60, and re-employment after age 60 was rare until the 2000s. To enhance comparability across periods, we decided to restrict the sample to those aged younger than 60 years. We also excluded those currently enrolled in school as their employment is not similarly interpreted as those finished school. We also excluded those who did not provide valid responses to variables we use (i.e., occupation, educational attainment, and marital status).

Variables

We use a three-digit, the most detailed classification of occupational titles to capture occupational trends. While the occupational classification in the Population Census is based on the Japanese Standard Occupational Classification, minor changes have been introduced each year, and a significant revision was made in 2010. To ensure comparability over time, we constructed a harmonized classification scheme, using the Population Census crosswalk lists for consecutive census years. The resulting occupational classifications contain 164 occupational titles.[1]

We also use age, educational attainment, and marital status as predictors for occupational segregation. Ages are grouped into 10-year blocks: 20–29, 30–39, 40–49, and 50–59 years. Educational attainment is defined using the last educational institution the respondents were enrolled. We separated these into four categories: junior high (corresponding to compulsory/lower secondary education), high school (upper secondary education), junior college

[1] The original number of occupational classifications was 284 in 1980, 293 in 1990, 292 in 2000, and 231 in both 2010 and 2020.

(lower tertiary education), and university (bachelor or higher). Finally, marital status has four values: never-married, married, widowed, or divorced.

Analytical strategy

We calculate occupational gender segregation by using Duncan's dissimilarity index (Duncan and Duncan 1955). Suppose the number of female (male) workers in occupation j in time t is defined as F_{jt} (M_{jt}), then the dissimilarity index, or D-index, can be expressed as a sum of absolute difference between the proportion of female workers in a given occupation (F_{jt} / F_t) and that of male workers (M_{jt} / M_t).

$$D_t = 100 \times \frac{1}{2} \times \sum_j \left| \frac{F_{jt}}{F_t} - \frac{M_{jt}}{M_t} \right| \quad (1)$$

Studies have developed margin-free alternatives to the D-index, such as a log-linear index (Weeden 1998) or the mutual information index (Elbers 2023), which are designed to be invariant to changes in the relative sizes of occupations and instead to capture the association between gender and the occupation net of occupational structure. Our substantive interest, however, lies in the realized gender gap in the occupational distributions itself, that is, the extent to which men and women actually work in different occupations, rather than in this association net of occupational structure. Because the gender wage gap and other forms of gender inequality among employed individuals are tied to the differential placement of men and women across occupations differing in pay, the D-index is a more theoretically relevant measure for the questions that we ask.

To measure the contribution of education, age, and marital status composition to the overall changes in the D-index, we decompose the change between periods developing Fossett's (2017) difference-of-means method and the Kitagawa–Oaxaca–Blinder (KOB) decomposition method (Fossett 2017; Zheng and Weeden 2023; Kröger and Hartmann 2021). An individual's segregation score at period t, denoted Y_{it}, is defined based on whether they are in a male-dominated occupation. Here, male-dominated occupations are those where the male proportion is

greater than the proportion in the entire workforce in the given period.[2] A score of 1 is assigned if the proportion of men in their occupation (p_{ijt}) is at or above the average proportion of men in the total workforce (P_t):

$$Y_{it} = \begin{cases} f(p_{ijt}) = 1 & \text{if } p_{ijt} \geq P_t \\ 0 & \text{if } p_{ijt} < P_t \end{cases} \quad (2)$$

Given an individual score, the D-index can be recovered by averaging Y_{it} for male workers ($E(Y_t^m)$) and female workers $E(Y_t^f)$, taking the difference, and multiplying it by 100 (Fossett 2017; Zheng and Weeden 2023):

$$\left[E(Y_t^m) - E(Y_t^f)\right] = \frac{D_t}{100} \quad (3)$$

Using this framework, we decompose changes in mean segregation score for male and female workers between two periods (period 1 and 2) using the threefold interventionist KOB decomposition (Kröger and Hartmann 2021). First, we estimate the models that predict employment in male-dominated occupation by the vector of independent variables for men and women at period t and obtain the estimates:

$$E(Y_t^g) = E(X_t^g)\beta_t^g, \quad t \in [1,2], g \in [m,f], \quad (4)$$

where X_t^g represents the vector of independent variables for men or women at period t and β_t^g represents the vector of estimated coefficients, showing the extent to which independent variables are associated with employment in male-dominated occupation; positive values here

[2] When analyzing occupational gender segregation using age group, male-dominated occupations are defined as those for which the male proportion exceeds that of the entire workforce for a given period and age group. These definitions mean that which occupations are classified as male-dominated may vary across periods and age groups. We therefore interpret the concept of male-dominated occupation here as an instrumental device for the decomposition of the dissimilarity index rather than as a substantive category.

indicate the higher probability of employment in male-dominated occupation as defined in Equation (2). The gender gap in coefficient, $\beta_t^m - \beta_t^f$, represents the contribution of each independent variable to segregation via men's over-representation in male-dominated occupations and/or women's underrepresentation in male-dominated occupations.

Finally, the change of the segregation score for male workers is decomposed as follows:

$$
\begin{aligned}
&\frac{D_2}{100} - \frac{D_1}{100} \\
&= \left[E(Y_2^m) - E\left(Y_2^f\right)\right] - \left[E(Y_1^m) - E\left(Y_1^f\right)\right] \\
&= \left[E(Y_2^m) - E(Y_1^m)\right] - \left[E\left(Y_2^f\right) - E\left(Y_1^f\right)\right] \\
&= \left[E(X_2^m)\beta_2^m - E(X_1^m)\beta_1^m\right] - \left[E\left(X_2^f\right)\beta_2^f - E(X_1^m)\beta_1^f\right] \\
&= \left[\left[E(X_2^m) - E(X_1^m)\right]\beta_1^m - \left[E\left(X_2^f\right) - E\left(X_1^f\right)\right]\beta_1^f\right] \\
&\quad + \left[E(X_1^m)(\beta_2^m - \beta_1^m) - E\left(X_1^f\right)(\beta_2^f - \beta_1^f)\right] \\
&\qquad + \left[E(X_2^m) - E(X_1^m)\right](\beta_2^m - \beta_1^m) - \left[E\left(X_2^f\right) - E\left(X_1^f\right)\right](\beta_2^f - \beta_1^f) \qquad (5)
\end{aligned}
$$

The first term on the right-hand side, or the endowments component, represents the contribution from changes in terms of the demographic characteristics of male and female workers given the initial differences in coefficients. The second term, or the coefficient component, represents the contribution from changes in the group coefficients across periods, given the initial differences in within-gender demographic compositions characteristics. The third term, the interaction component, accounts for the joint contribution of endowments and coefficients components. Due to the difficulty of the interpretation, we do not focus on the interaction component.

Results

Overall trends in segregation and the decomposition

Figure 1 presents the changes in the dissimilarity index from 1980 to 2020. This index shows a clear decline, particularly after 2000. In 1980, it stood at 54.9, indicating that 54.9% of either male or female workers would need to switch to the opposite gender's occupation to equalize the male/female distribution. By 2020, the index had decreased to 49.0 (a decline of about 10.7% from 1980), and most of this decline took place after 1990. This trend aligns with the narrowing

gender wage gap that has been observed in Japan since the late 1990s (OECD 2025). Descriptively, the desegregation proceeded among “administrative and managerial,” “craft and related trades,” and “plant and machine operators, and assemblers” occupations, as their share of this employment has declined over time (see Figure A1 and A2 in the Appendix). Conversely, segregation is becoming more concentrated in “professional and technical” occupations and “sales and service” occupations, reflecting their increased representation.

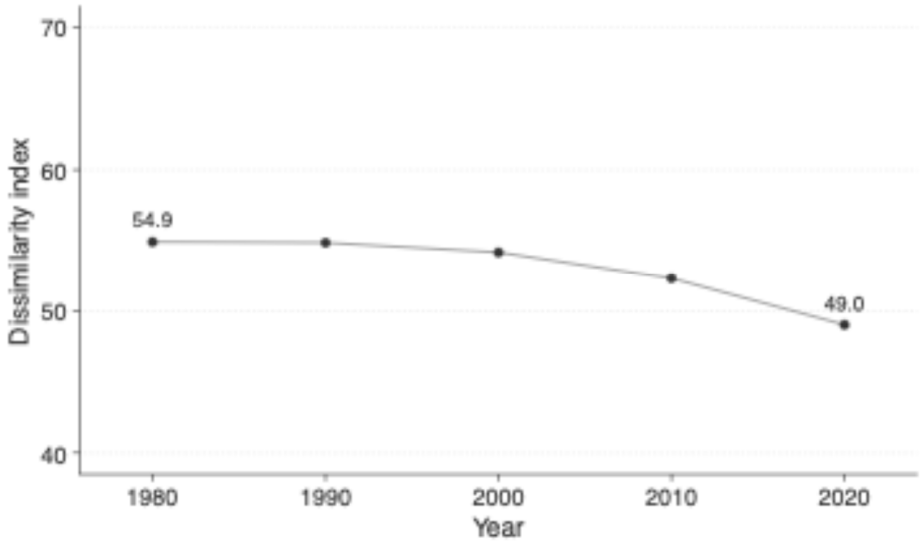


Figure 1. Trends in occupational gender segregation in Japan, 1980–2020.

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).

Together with the decline in occupational gender segregation, the demographic profile of the employed workforce has changed considerably. Table 1 presents the changing composition of employed men and women by age, educational attainment, and marital status from 1980 to 2020. Over the course of this period, the workforce, both men and women, has aged and become more highly educated. Furthermore, trends in marital status have diverged by gender. Among men, the proportions of both the never-married and the divorced increased. Among women, by contrast, only the proportion of divorced individuals increased, while the share of married individuals declined only slightly (from 62.8% to 59.0%). Given the well-established evidence of growing non-marriage for both genders in Japan (Raymo et al. 2015), this pattern suggests a relative

increase in married women's labor force participation. These compositional changes likely contribute to the observed trends in occupational gender segregation.

Table 1. Descriptive statistics for men and women in selected years

	1980		2000		2020	
	Men	Women	Men	Women	Men	Women
Age group						
20–29	0.269	0.330	0.227	0.268	0.180	0.179
30–39	0.319	0.256	0.251	0.217	0.239	0.224
40–49	0.245	0.256	0.259	0.271	0.305	0.312
50–59	0.168	0.158	0.263	0.244	0.276	0.285
Educational attainment						
Junior high	0.308	0.339	0.140	0.129	0.050	0.033
High school	0.474	0.495	0.508	0.530	0.442	0.413
Junior college	0.045	0.121	0.085	0.241	0.126	0.308
University	0.173	0.044	0.267	0.101	0.381	0.247
Marital status						
Never-married	0.239	0.285	0.296	0.300	0.364	0.311
Married	0.744	0.628	0.671	0.612	0.591	0.590
Widowed	0.005	0.048	0.006	0.025	0.003	0.012
Divorced	0.011	0.039	0.028	0.062	0.042	0.088
N	4,803,717	2,485,813	3,225,190	2,292,068	2,055,247	1,761,356

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).
Notes. Proportions are reported. Values of 1990 and 2010 are omitted.

Table 2 indicates the extent to which each independent variable is associated with the degree of segregation, based on the linear probability models that predicted employment in male-dominated occupations. The "Men – Women" columns report the gender gaps in terms of coefficients, where negative values indicate that the variable is associated with lower occupational segregation in terms of increasing women's entry into male-dominated occupations and/or men's entry into female-dominated occupations. In 1980, the primary source of desegregation is educational attainment. University-educated men are less likely to be employed in male-dominated occupations, while university-educated women are more likely to be employed in male-dominated occupations. For this reason, higher educational attainment is strongly associated with occupational desegregation. Another notable finding here is that older age is associated with lower segregation in 1980. This may reflect selection into employment: women employed at older ages in this earliest period may be a more selective group, having overcome employment discrimination and possessing greater skills.

In later years, the contribution of educational attainment to the degree of segregation continues to be large: university-educated men are less likely to be employed in male-dominated occupations, but university-educated women are more likely to be. However, the association between women's university education and employment in male-dominated occupations has decreased over time. This decreasing association likely reflects the replacement of high-school-educated clerical workers with college-educated ones (Sakaguchi 2018), as well as changes in the distribution of fields of study in female university graduates (Uchikoshi et al. 2020). Unlike educational attainment, in later years, age is not strongly associated with occupational segregation. Finally, marital status is weakly associated with segregation, mainly via ever-married men's greater representation in male-dominated occupations.

Table 2. Estimated coefficients of linear probability models predicting male-dominated occupation

	1980			2000			2020		
	Men − Women	Men	Women	Men − Women	Men	Women	Men − Women	Men	Women
Age group (ref: 20–29)									
30–39	−2.4	0.5	2.8	0.3	2.3	1.9	−1.1	−3.0	−1.9
40–49	−4.7	3.0	7.7	0.2	1.4	1.2	−1.3	−2.8	−1.4
50–59	−8.0	2.7	10.7	−0.2	2.2	2.4	−1.7	−3.9	−2.2
Education (ref: Junior high)									
High school	−4.7	−13.1	−8.5	−7.5	−12.4	−4.8	−2.7	−5.6	−3.0
Junior college	−11.3	−18.8	−7.4	−10.5	−18.1	−7.6	−7.0	−16.7	−9.7
University	−31.2	−19.6	11.6	−28.2	−19.3	8.9	−21.7	−19.7	2.0
Marital status (ref: Never-married)									
Married	−2.2	1.0	3.2	3.8	4.1	0.3	6.8	4.0	−2.8
Widowed	−0.8	0.7	1.5	3.5	5.1	1.5	6.2	3.9	−2.3
Divorced	4.1	1.8	−2.2	5.3	6.0	0.8	5.1	3.6	−1.5
Constant	65.1	77.6	12.6	60.8	76.3	15.5	54.2	76.5	22.3

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).

Notes. The estimated coefficients (times 100) on the probability of entering a male-dominated occupation. The "Men − Women" columns represent the gap in coefficients for men and those for women; the negative coefficients indicate that the variable is associated with the reduction in dissimilarity index. Male-dominated occupation is defined based on Equation (2), which represents occupations where the male proportion is greater than the proportion in the entire workforce.

Figure 2 presents the KOB decomposition results using Equation (5). Between 1980 and 2000, when segregation decreased only slightly (a 0.7-point decline), endowment components, i.e., compositional shifts in demographic characteristics, contribute substantially to desegregation, with a 3.1-point decline. Among these factors, the expansion of access to higher education has a primary role in explaining the trend. The aging of the workforce also contributes to the decline, mainly due to the shrinking share of the younger age groups, which exhibits particularly high levels of segregation at the beginning of the period. In contrast, changes in the population composition by marital status do not play a meaningful role in explaining the overall trend. The coefficient components, i.e., the changing associations between individual characteristics and occupational segregation, contribute to a 1.9-point increase in the dissimilarity index. This offsets the contribution of the endowment components and results in a modest overall shift in segregation.

From 2000 to 2020, occupational desegregation proceeded more rapidly than in the earlier period, showing a 5.2-point decline in the dissimilarity index. The endowment components, educational upgrading in particular, contribute substantially to a 3.5-point decline in the dissimilarity index. Other compositional shifts in terms of demographic characteristics show little impact on declines in occupational segregation. Furthermore, unlike the previous period, the coefficient components also contribute to desegregation, accounting for a 2.3-point decline in the dissimilarity index. Among the coefficient components, the intercept accounts for the largest share of desegregation, indicating that factors that are not incorporated in our models drive desegregation in the later period. These results suggest that both compositional shifts in the demographic characteristics of the male and female workforces and other unexplained structural shifts both matter in explaining trends in occupational gender segregation.

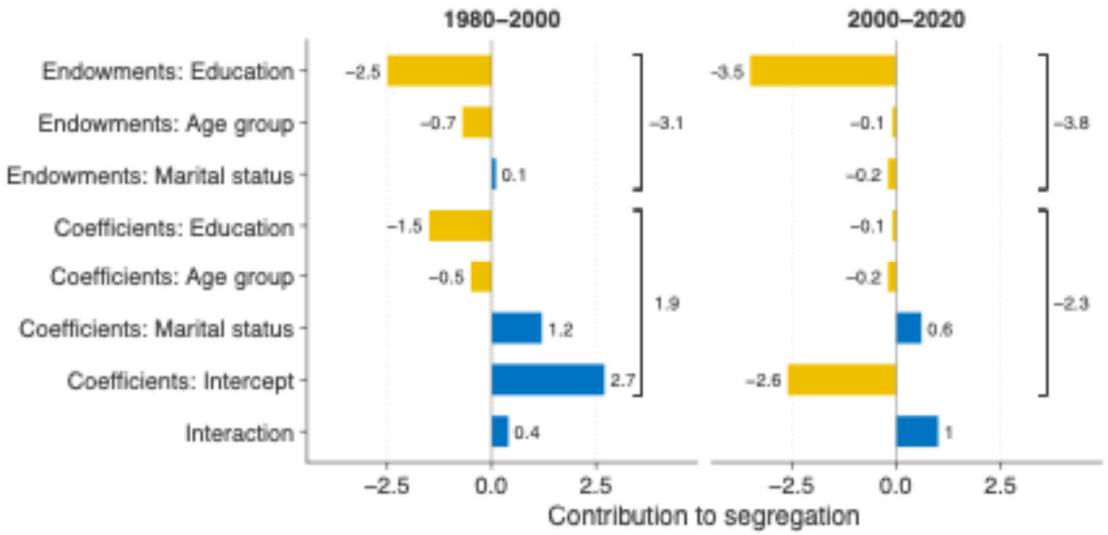


Figure 2. Decomposition of changes in occupational gender segregation (dissimilarity index) from 1980 to 2000 and from 2000 to 2020

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).
Notes. The definition of each component is presented in Equation (5).

Overall, the results indicate that educational expansion contributed to occupational desegregation over time, which is consistent with Hypothesis 1a. As expected, university-educated women were more likely to be employed in male-dominated occupations than their less-educated counterparts. In addition, university-educated men were less likely to be employed in male-dominated occupations than their less-educated counterparts. These relationships, taken together with the trend of university expansion, suggest that educational upgrading has substantially contributed to desegregation over time.

Age-specific trends in segregation and the decomposition

Figure 3 presents occupational segregation by age group. The results show that trends in desegregation vary considerably across age groups, with greater declines in segregation among younger populations. For those aged 20–29 years, the dissimilarity index was initially 61.9, the highest among all four age groups, followed by a sharp decline to 47.7 in 2020, amounting to a 23% decline. For those aged 30–39 years, it decreased from 55.0 to 47.7. Meanwhile, older age groups showed more modest changes. For the 40- to 49-year-old and 50- to 59-year-old age groups, segregation increased after 1980 before later declining, remaining at levels similar to

those of the initial period. These differential trends suggest that occupational desegregation proceeded through different underlying sources across age groups.

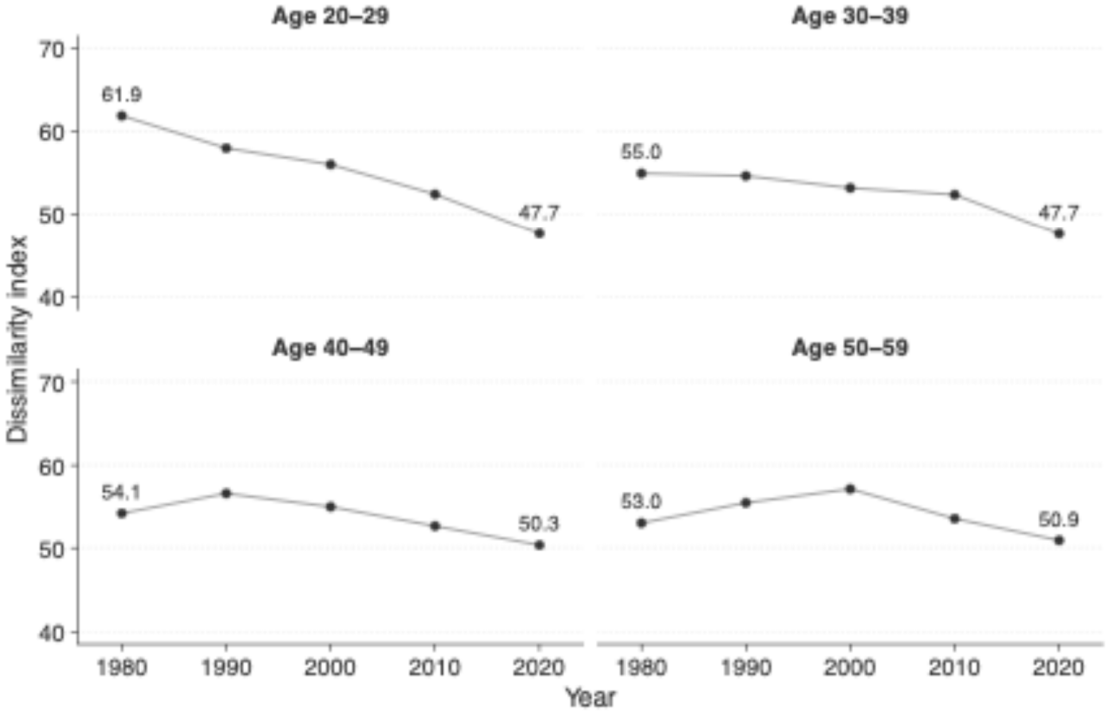


Figure 3. Trends in occupational gender segregation by age group.

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).
Notes. The D-index is calculated using the age-group subsamples, so the sum of the values across age groups does not equal the overall D-index that is shown in Figure 1.

Notable changes here include the sharp decline in clerical occupations among workers aged 20–29 years. In earlier periods, young female workers were heavily concentrated in clerical occupations, and they constituted a significant portion of overall segregation in young workers. The share of clerical workers has shown a rapidly decrease in recent years, and the number of sales and service workers has increased (see Figure A1 and A2 in the Appendix).

Table 3 presents the distributions of individuals' educational attainment and marital status according to age group across years. As with Table 1, all of the age groups experienced educational expansion and an increase in the never-married population. For the 20- to 29-year-old age group in 1980, for example, 21.2% of male employees held a university degree, while only 7.6% of female employees did. By 2020, the proportion of university graduates had reached

similar levels for both men and women (37.2% vs. 38.0%). Among older age groups, the proportion of female university graduates had not yet reached that of men, reflecting cohort differences in educational attainment.

Table 3. Descriptive statistics for men and women in selected years

	1980		2000		2020	
	Men	Women	Men	Women	Men	Women
Age 20–29						
Educational attainment						
Junior high	0.179	0.105	0.079	0.044	0.034	0.025
High school	0.554	0.575	0.526	0.431	0.466	0.329
Junior college	0.055	0.244	0.152	0.373	0.128	0.266
University	0.212	0.076	0.242	0.152	0.372	0.380
Marital status						
Never-married	0.692	0.694	0.738	0.789	0.816	0.788
Married	0.304	0.294	0.254	0.191	0.177	0.195
Widowed	0.000	0.001	0.000	0.001	0.000	0.000
Divorced	0.003	0.011	0.008	0.019	0.007	0.016
N	1,290,086	820,477	730,870	614,026	370,091	315,636
Age 30–39						
Educational attainment						
Junior high	0.288	0.339	0.069	0.049	0.047	0.037
High school	0.473	0.522	0.506	0.545	0.381	0.337
Junior college	0.033	0.091	0.101	0.283	0.134	0.286
University	0.206	0.049	0.323	0.123	0.438	0.341
Marital status						
Never-married	0.140	0.126	0.308	0.270	0.391	0.335
Married	0.845	0.809	0.667	0.653	0.581	0.595
Widowed	0.002	0.017	0.001	0.005	0.001	0.002
Divorced	0.013	0.048	0.025	0.072	0.027	0.068
N	1,532,530	635,613	807,946	498,394	491,528	394,238
Age 40–49						
Educational attainment						
Junior high	0.418	0.526	0.131	0.118	0.055	0.032
High school	0.407	0.411	0.507	0.591	0.439	0.409
Junior college	0.026	0.042	0.060	0.206	0.143	0.353
University	0.149	0.021	0.302	0.085	0.363	0.206
Marital status						
Never-married	0.028	0.055	0.137	0.067	0.245	0.189
Married	0.948	0.833	0.821	0.833	0.703	0.695
Widowed	0.007	0.062	0.005	0.022	0.003	0.008
Divorced	0.017	0.050	0.036	0.077	0.049	0.107
N	1,174,908	636,795	836,798	620,154	626,897	549,778
Age 50–59						

Educational attainment						
Junior high	0.394	0.527	0.269	0.304	0.059	0.034
High school	0.445	0.422	0.496	0.556	0.483	0.529
Junior college	0.078	0.042	0.035	0.096	0.101	0.303
University	0.082	0.008	0.200	0.043	0.358	0.134
Marital status						
Never-married	0.011	0.060	0.059	0.046	0.177	0.126
Married	0.956	0.701	0.885	0.795	0.747	0.718
Widowed	0.019	0.174	0.016	0.074	0.008	0.030
Divorced	0.014	0.066	0.040	0.085	0.068	0.126
N	806,193	392,928	849,576	559,494	566,731	501,704

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).
Notes. Proportions are reported. Values of 1990 and 2010 are omitted.

Table 4 shows the gender gap in terms of coefficients of regression models predicting employment in male-dominated occupations for each year, separated by age group. For all age groups, higher educational attainment, university education in particular, is associated with lower occupational segregation, suggesting that educational expansion has contributed to desegregation. Meanwhile, the strength of this association has particularly weakened among the younger age groups. For the 20- to 29-year-old age group, for example, a university degree is associated with a 39.0-point reduction in occupational segregation in 1980, compared with 17.5 points in 2020. A similar decline in the association is also apparent among workers in the 30- to 39-year-old age group. These results may reflect increasing segregation by field of study within universities or growing heterogeneity in occupational choices among university graduates.

Table 4. Gender gap in coefficients (men − women) of linear probability models predicting male-dominated occupation, separated by age

	Age 20–29			**Age 30–39**		
	1980	2000	2020	1980	2000	2020
Education (ref: Junior high)						
High school	−8.4	−7.6	0.5	−7.2	−7.7	0.9
Junior college	−14.0	−1.4	−3.2	−12.8	−9.7	−6.2
University	−39.0	−25.6	−17.5	−36.5	−29.6	−17.7
Marital status (ref: Never-married)						
Married	−1.8	7.1	7.4	−2.9	3.6	7.9
Widowed	1.7	−6.2	−12.6	−0.4	4.7	5.4
Divorced	−1.2	4.1	9.6	3.2	3.6	5.7
Constant	69.4	59.2	49.9	64.4	61.3	49.5
	Age 40–49			**Age 50–59**		

	1980	2000	2020	1980	2000	2020
Education (ref: Junior high)						
High school	−3.6	−9.4	−2.5	−1.8	−6.5	−5.9
Junior college	−16.1	−11.2	−6.2	−12.0	−2.0	−8.1
University	−29.4	−29.7	−21.5	−23.3	−28.8	−27.9
Marital status (ref: Never-married)						
Married	−3.3	2.5	6.7	−2.6	1.4	4.7
Widowed	−0.8	2.7	5.9	−0.3	1.0	4.6
Divorced	4.1	3.5	4.1	6.7	4.8	3.9
Constant	59.9	64.4	52.7	54.9	62.4	57.5

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).
Notes. The gap in estimated coefficients (times 100) for men and those for women on the probability of entering a male-dominated occupation (corresponding to the rows of "Men – Women" in Table 2). Male-dominated occupation is defined by age group and years based on Equation (2), which represents occupations in which the male proportion is greater than the proportion in the employed workforce.

Figure 4 indicates the age-specific results of KOB decomposition. The endowment components contribute similarly to desegregation across all age groups in both periods. In 2000–2020, for example, the endowment components (the sum of education and marital status) account for between −3.0 and −4.1 points across the four age groups. Within the endowment components, educational upgrading consistently accounts for the majority of this contribution, regardless of age group, ranging from −2.6 to −3.9 points over the same period. These findings indicate that the impact of the expansion of education on desegregation was not concentrated among younger workers, which is inconsistent with Hypothesis 1b. The endowment component of compositional change in marital status contributes little to desegregation in either period: while it is modestly negative in 2000–2020 across most age groups (ranging from −0.1 to −0.4 points), the magnitude is far smaller than that of educational attainment. Thus, the finding is also not consistent with Hypothesis 2, which posits that delayed marriage has contributed to desegregation in younger workers.

The magnitude of the coefficient components, by contrast, varies considerably across age groups and periods. Among younger workers in 1980–2000, the coefficient component is negative and large (−5.8 points for the 20- to 29-year-old group, as the sum of education, marital status, and intercept), suggesting that structural changes altered the relationship between individual characteristics and occupational placement in ways favoring desegregation at the early career stage. These structural changes proceeded further in the later period, as evidenced by the

overall contribution of the coefficient component, reaching −5.4 points for the 20- to 29-year-old age group and −2.5 points for the 30- to 39-year-old age group. Among the older groups in 1980–2000, however, the coefficient component is positive and of comparable magnitude (5.2 points for the 40- to 49-year-old group and 5.4 points for the 50- to 59-year-old group), offsetting the contribution of the compositional shifts. This pattern likely reflects the growing number of women who are re-entering the employed workforce following childbirth, who tended to be sorted into female-dominated occupations instead of those they had previously held. In 2000–2020, the coefficient component became negative across all age groups, suggesting that structural factors that promote desegregation may have had their influence beyond the early career stage.

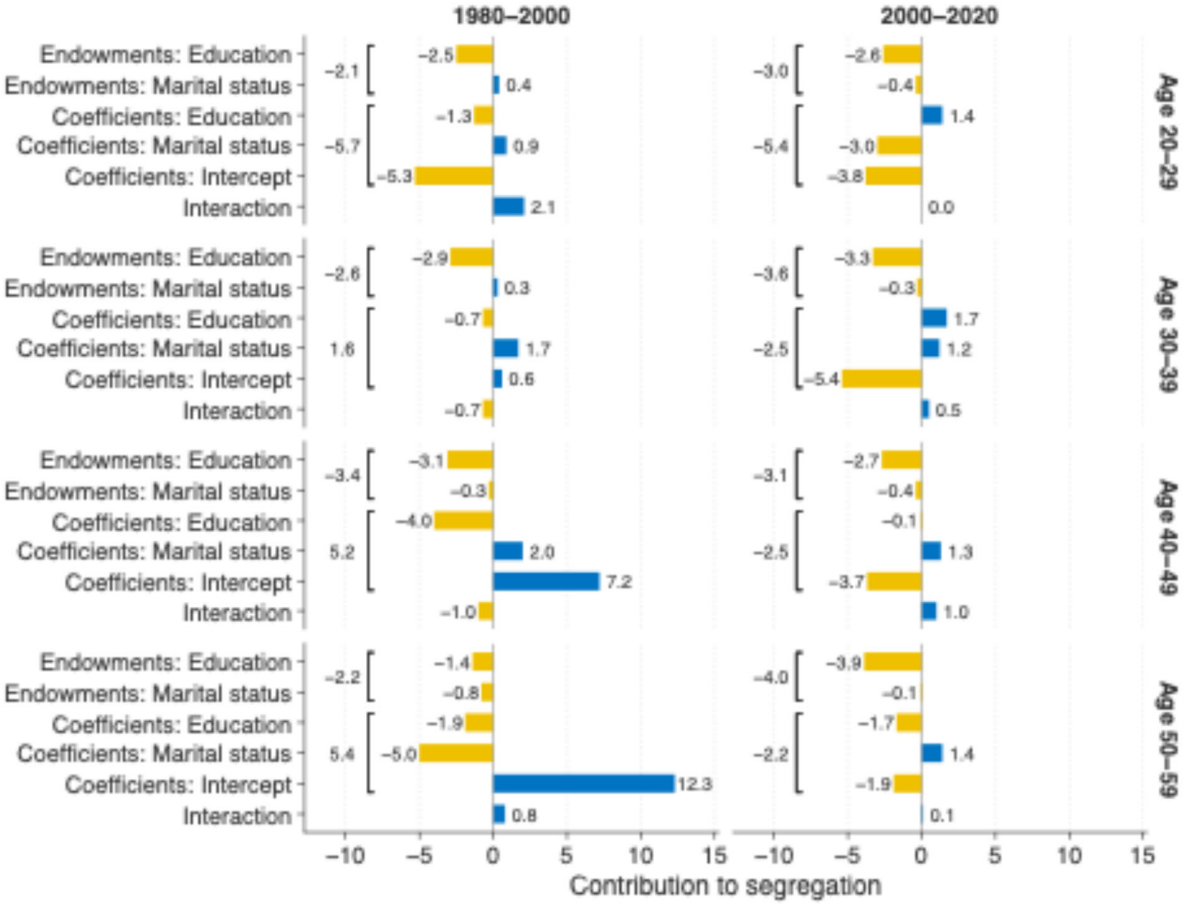


Figure 4. Decomposition of changes in occupational gender segregation (dissimilarity index) in each age group, from 1980 to 2000 and from 2000 to 2020

Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).

Notes. The definition of each component is shown in Equation (5).

Discussion

This study examined four decades of occupational gender segregation in Japan and the extent to which demographic compositional shifts in the employed population account for segregation changes. Drawing on the Population Census from 1980 to 2020 with a harmonized occupational classification, we found that occupational gender segregation had decreased, particularly since 2000, with the dissimilarity index in 2020 being approximately 11% lower than in 1980 (i.e., 54.9 to 49.0). Furthermore, this trend varied across age groups. Desegregation has been most pronounced among younger workers: for those aged 20–29 years, the dissimilarity index fell by 23% over the four decades (from 61.9 to 47.7), whereas older age groups, such as the 40- to 49-year-old and 50- to 59-year-old groups, exhibited only modest declines.

The decomposition results revealed that demographic compositional shifts in age, educational attainment, and marital status consistently contributed to desegregation across the entire study period. Among these factors, educational upgrading, which particularly increased access to four-year university education among women, plays the most salient role. Our results showed that university-educated men are less likely to enter male-dominated occupations than their less educated counterparts, while university-educated women are more likely to do so; both patterns promoted desegregation. Furthermore, educational upgrading contributed to desegregation in a broadly similar way across all age groups, instead of being concentrated among younger workers, a finding consistent with Hypothesis 1a (overall contribution) but inconsistent with Hypothesis 1b (larger impact for younger workers). This finding aligns with evidence obtained from other contexts suggesting that women's educational expansion contributes to occupational desegregation (Blau et al. 2013; England 2010; England et al. 2020; Jacobsen 1997; Mandel and Birgier 2016). Our contribution is to directly gauge the magnitude of this impact with a decomposition technique.

We also found that the association between women's university education and employment in a male-dominated occupation weakened over time, particularly among younger workers. This suggests that increasing horizontal gender segregation with respect to field of study (Uchikoshi et al. 2020) or growing heterogeneity in occupational choices among university graduates partially offset the desegregating impacts of the educational expansion. Because the

Population Census does not include information on fields of study, we cannot test this horizontal segregation channel directly in our data. Nevertheless, this pattern is consistent with broader arguments concerning the evolution of gender-essentialist educational and occupational preferences under industrialization in high-income countries (Charles and Bradley 2009), and it warrants attention in future research.

Meanwhile, the contribution to desegregation of composition changes with respect to marital status was far smaller than that of educational upgrading throughout the entire period, a finding inconsistent with Hypothesis 2. One possible explanation rests on the concurrent increase in married women's labor force participation. Despite the rising proportion of the never-married population, the share of never-married women only slightly increased in the employed workforce, as the increasing presence of married women in employment offset the potential desegregating impact of delayed marriage. This group includes both women who remained continuously employed following marriage, in a pattern that has become increasingly common since the 2010s (National Institute of Population and Social Security Research 2023), and those who re-entered the labor market after career interruptions associated with childbirth. While the former may have contributed to desegregation, the latter tended to be concentrated in female-dominated occupations. These two counteracting trends seen in married women likely complicated the contribution of changing marital status composition to segregation patterns. This pattern of change is broadly consistent with the "revolving doors" thesis (Jacobs 1989), which holds that women's movement into and out of male-dominated occupations over the life course need not produce any shift in aggregate segregation. The offsetting contributions of continuous employment, for some married women, and, for others, of re-entry into female-dominated occupations after a career interruption may limit the net contribution of changes in marital status composition to aggregate desegregation, a pattern that warrants further investigation.

The age-specific results of decomposition further revealed that the contribution of coefficient components, that is, structural changes that are not attributable to demographic compositional changes, varied considerably by age group. Among younger workers in 1980–2000, the coefficient component contributed to desegregation; this suggests that policy changes such as the Equal Employment Opportunity Law (enacted in 1986) altered hiring patterns into male-dominated occupations primarily for new labor market entrants. Among middle-aged workers in the same period, however, the coefficient component exhibited the opposite pattern,

contributing to increased segregation. This likely reflects the growing representation of women who are re-entering the labor market following childbirth, who tended to be sorted into female-dominated occupations. In 2000–2020, the coefficient component became negative across all age groups, suggesting that structural factors promoting desegregation extended beyond early career stages, although the magnitude remained larger among the youngest workers. These age-differentiated patterns would reflect Japan's age-segmented labor market, in which structural changes in gender inequality spread first among new entrants and later diffused to older workers over time through cohort replacement.

Taken together, our findings highlight the importance of distinguishing demographic contributions from structural changes in explaining trends in occupational gender segregation, a central concern in demographic research on segregation (Blau et al. 2013; Tomaskovic-Devey et al. 2006; Zheng and Weeden 2023). Our results show that educational expansion was indeed the primary demographic driver for desegregation, whereas changes in marital status composition showed only a marginal contribution. At the same time, age-varying desegregation trends and the differential contribution of structural change across age groups underscore that the pace and sources of desegregation are shaped by the institutional characteristics of labor markets. Comparative research on how age stratification moderates segregation is a promising direction for future inquiry, given that many societies are experiencing rapid demographic compositional changes in their workforce.

Future research should examine how changes in selection into employment shape trends in occupational gender segregation, as rising female labor force participation transforms the composition of the female workforce. It should also investigate how changing associations between demographic characteristics and occupational representation can influence decomposition results. Such analyses would clarify how evolving family dynamics, including delayed marriage and childbearing, shape the translation of women's human capital into occupational outcomes and, ultimately, patterns of gender segregation.

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Appendix

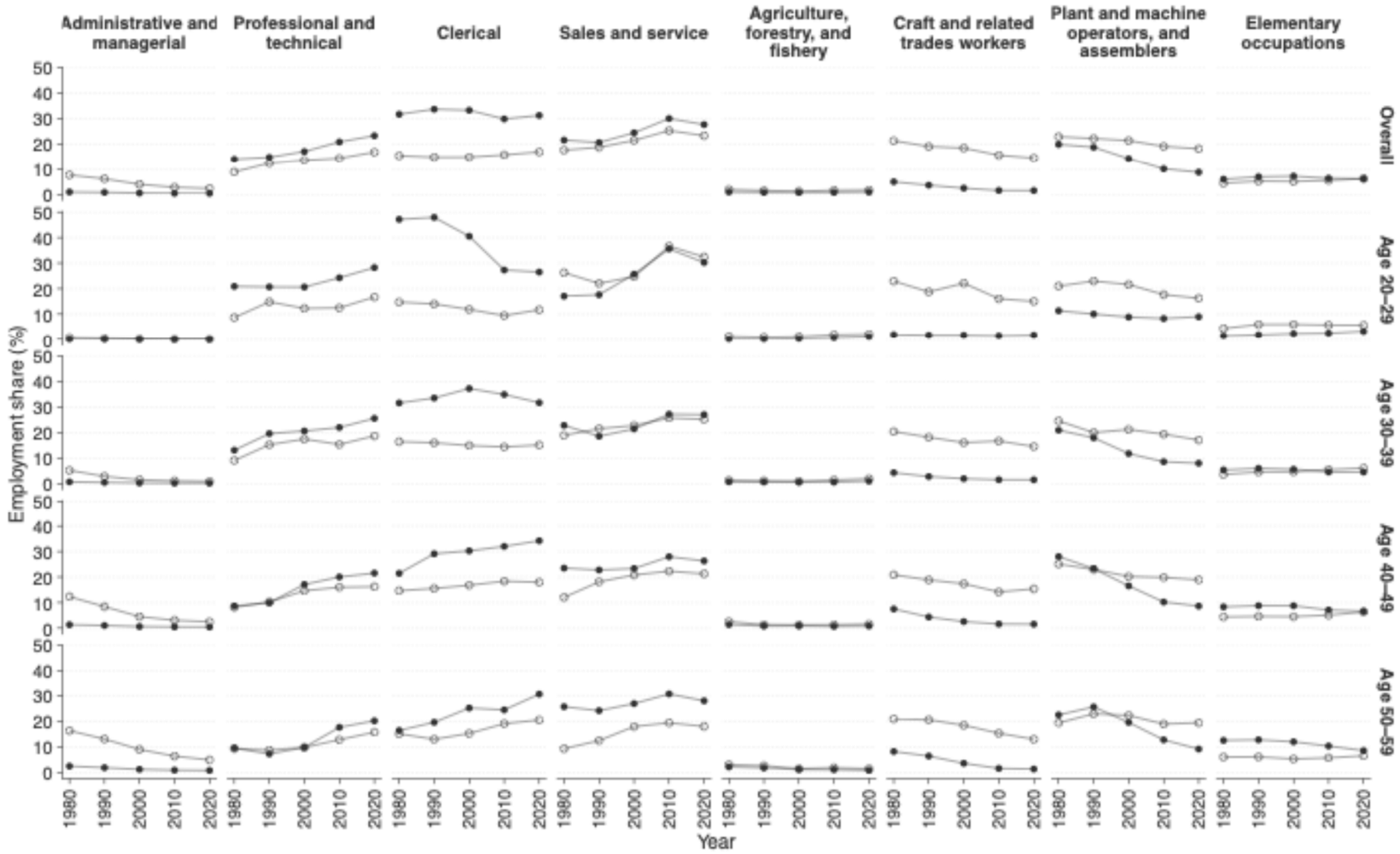


Figure A1. Employment share across major occupational categories for women and men.
Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications).

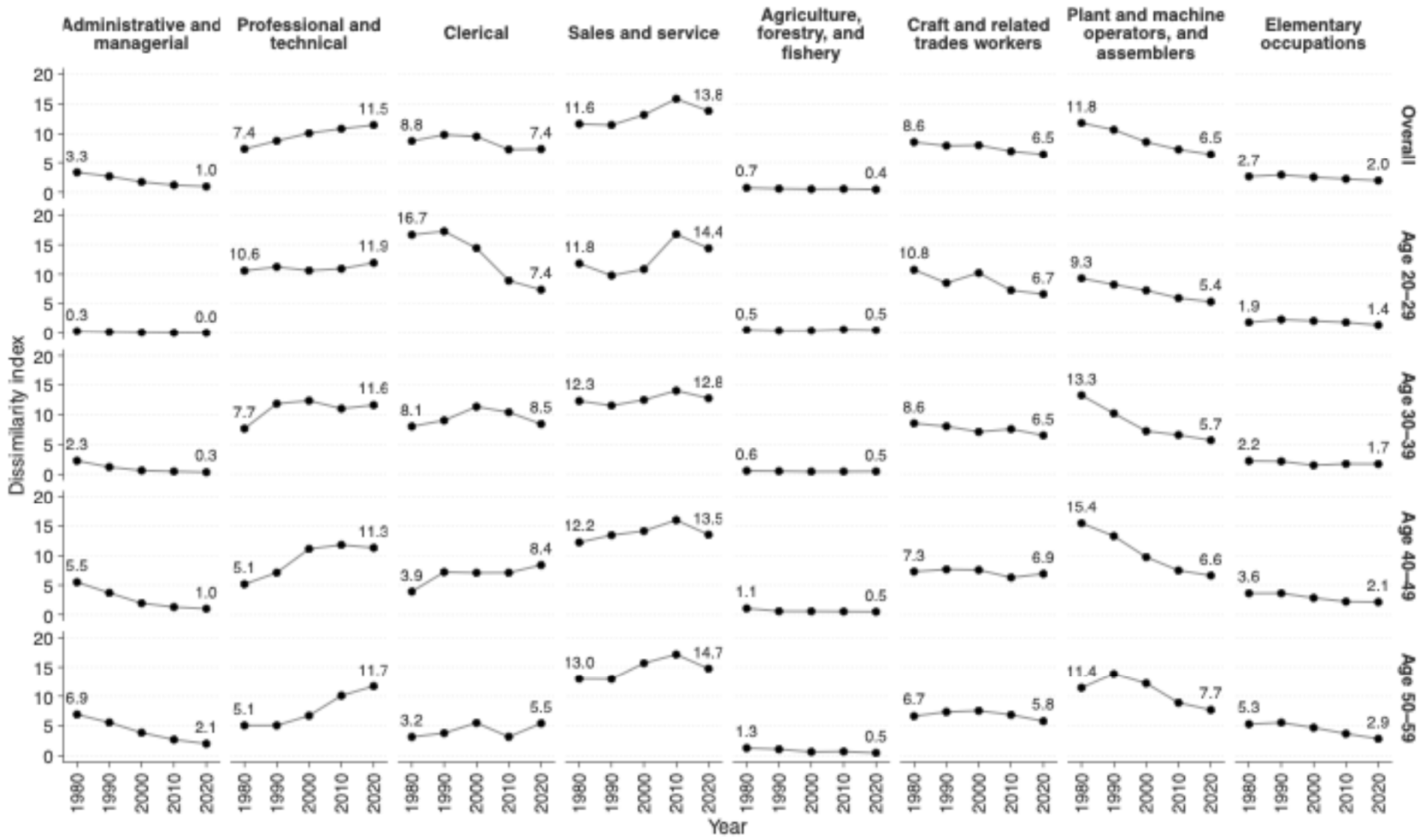


Figure A2. Disaggregated D-index across major occupational categories.
Source. Population Census of Japan (Statistics Bureau, Ministry of International Affairs and Communications). *Notes.* The disaggregated D-index is defined as $D_{kt} = 100 \times \frac{1}{2} \times \sum_{j \in k} \left| \frac{F_{jt}}{F_t} - \frac{M_{jt}}{M_t} \right|$, where k denotes a major occupational category, and the summation is taken over occupations j belonging to category k. Because the major occupational categories partition the full set of occupations, $\sum_k D_{kt}$ equals D_t.