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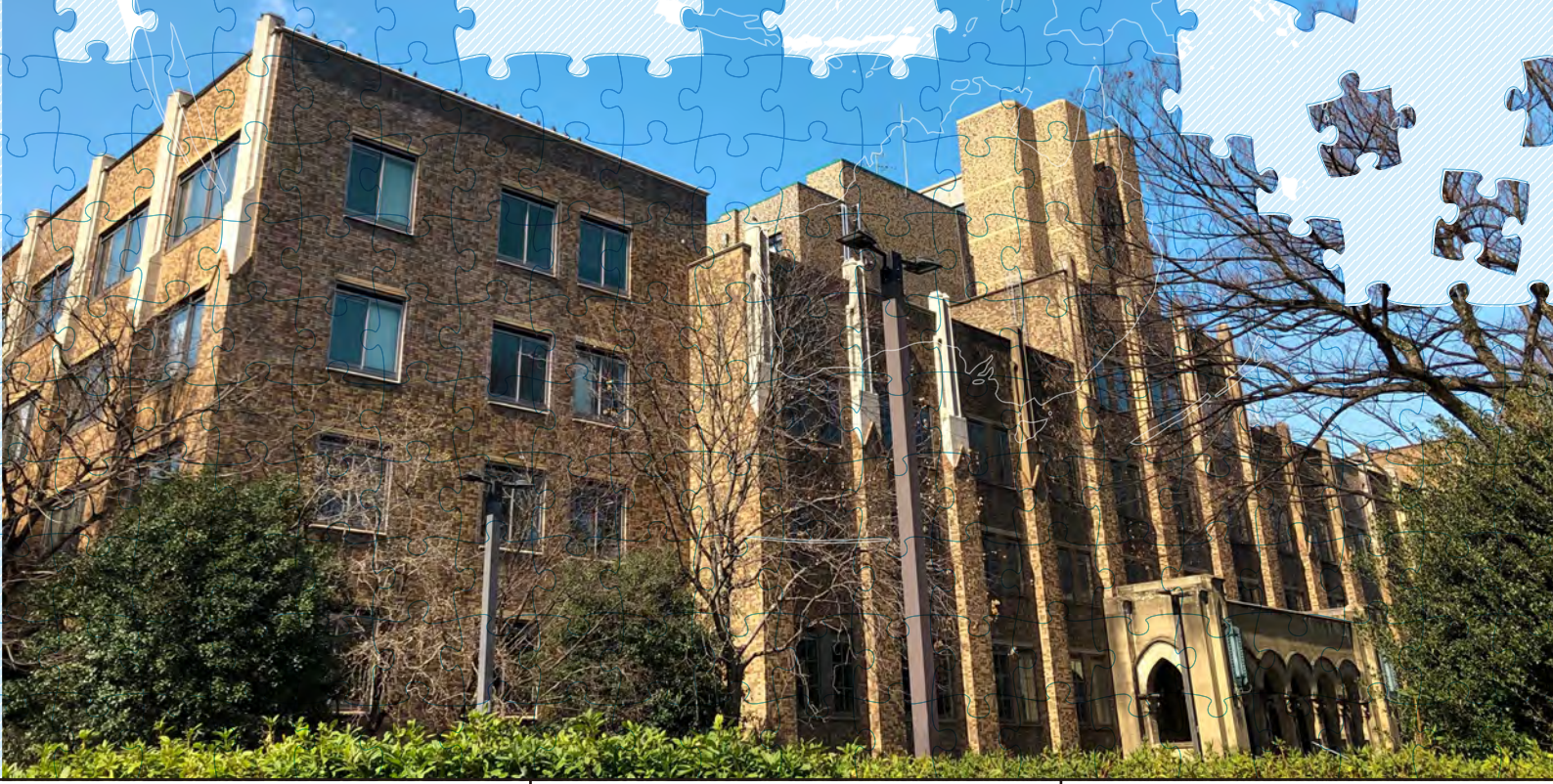
The Role of Women's Employment and Educational Assortative Mating for Earnings Inequality in Japan, 1982-2017: The Importance of Gendered Life Course Patterns



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Abstract

Cross-national evidence on how educational assortative mating and women's employment affect economic inequality remains inconclusive. Some studies argue that assortative mating has become less important as more women—especially those with lower education—enter the workforce. Others emphasize the growing influence of highly educated dual-earner couples. This study examines these competing views in Japan, where female employment has expanded widely, but educational differences in employment remain strong among younger cohorts. Using nationally representative Employment Status Survey data (1982–2017, N=1,131,014), we estimate the impacts of assortative mating and married women's employment on household earnings inequality across three age groups (25-34, 35-44, 45-54). Decomposition and counterfactual analyses show three main findings. First, between-group inequality would have risen 11–15% more if assortative mating had not declined. Second, its impact is smaller once educational differences in married women's employment are considered, especially among younger adults. Third, rising inequality is driven mainly by income variation within, rather than between, household types. These results highlight how women's education and employment jointly shape inequality.

Keywords: marriage, family, education, female employment, inequality, Japan

Introduction

Economic inequality has increased across advanced economies since the mid-1970s (Brandolini and Smeeding, 2009), raising concerns about its social consequences (e.g., Duncan and Murnane, 2011). While growing wage disparities by education remain a central explanation, recent scholarship emphasizes the role of family formation (Esping-Andersen, 2007; McCall and Percheski, 2010). Two changes are especially salient: (1) changes in spousal sorting in terms of education or earnings (e.g., Breen and Andersen, 2012; Breen and Salazar, 2010; Schwartz, 2010; Torche, 2010) and (2) increased women's labor force participation (e.g., Cancian and Reed, 1999; Grotti and Scherer, 2016; Kollmeyer, 2013; Sudo, 2017).

In theory, both can reshape household inequality. Stronger assortative mating may increase inequality by raising spousal earnings correlations, while expanded female employment, especially among the highly educated, can amplify household-level returns to education. Yet empirical findings are mixed, and the relative importance of these mechanisms remains debated (Breen and Andersen, 2012; Breen and Salazar, 2010; Goñalons-Pons and Schwartz, 2017; Shen, 2021).

A few recent studies provide an updated perspective to explain the complex relationship, by arguing that the impact of changing educational assortative mating on inequality depends on patterns of women's employment (Boertien and Permanyer, 2019; Herzberg-Druker and Stier, 2019). Specifically, Boertien and Permanyer (2019) argue that educational assortative mating may have weaker impacts in contexts where women's employment is prevalent, particularly if lower-educated women contribute to household income via paid labor. In such settings, women's earnings can offset the lower income of their partners, reducing household-level inequality. A simulation study by Sudo (2017) also suggests that more universal female employment reduces inequality, making assortative mating less consequential.

However, this perspective overlooks the educational differences in women's employment, that is, *who works* matters as much as how many work. Even with the same female employment rates, inequality effects differ depending on whether employment is concentrated

among higher- or lower-SES women. If labor market participation is skewed toward highly educated women, then household income inequality may increase despite high overall employment rates. Unfortunately, however, previous studies have not carefully accounted for this heterogeneity, leaving open the question of how differential return to education in employment and earnings shape the relationship between assortative mating and inequality.

This study addresses this gap by providing evidence from Japan, a context which provides a useful setting to examine the interplay between labor market institutions and gendered employment patterns. Historically, Japan's seniority-based wage systems and long working hours reinforced a male breadwinner model, limiting women's access to stable career paths (Estévez-Abe, 2008). In this context, lower-educated women contributed to household earnings primarily through part-time or less stable (non-standard) employment, which tended to reduce inequality (Abe and Oishi, 2007). However, this pattern is shifting since Japan has experienced one of the most rapid increases in women's labor force participation, rising from about 60% in the early 1980s to nearly 80% by the 2010s, above the OECD average as shown in Figure 1a. While many married mothers continue to reenter in non-standard jobs, increasing numbers of highly educated women now remain in continuous, stable employment (Mugiyama, 2024). Although part of the increase in labor force participation, more sharply among young women than older groups (see Figure 1a), reflects delayed marriage (Raymo and Fukuda, 2016), Figure 1b indicates that married women's participation has also grown, especially among those aged 25–34. These developments suggest that the inequality effects of assortative mating may vary across life stages.[1] Among middle-aged households, where women are still more likely to reenter the labor force in non-standard roles, assortative mating may have a limited impact on inequality. In contrast, among younger households, where full-time employment among highly

[1] It would be helpful to note that the expected differences between age groups result from both age and cohort effects. Also see the Discussion section for limitations related to this study's inability to distinguish among age, period, and cohort effects.

educated women is more prevalent and increasing over time, assortative mating may contribute more strongly to inequality.

[Figure 1 about here]

To evaluate this, we use the Theil index to decompose total household earnings inequality into between- and within-group components. We then construct three counterfactuals: (1) holding constant the association between spouses' educational attainment (i.e., educational assortative mating), net of changes in marginal educational distributions; (2) additionally fixing the association between women's education and employment; and (3) holding all household-type distributions at their base-year values. Results indicate three key findings. First, between-group inequality would have been 11–15% higher had assortative mating not declined over time. Second, the effect of assortative mating is substantially attenuated once educational gradients in married women's employment are taken into account, particularly among the youngest age group. Third, most of the overall change in inequality is driven by within-group variation, indicating that assortative mating plays a limited aggregate role. Together, these results clarify existing theories about the interplay of marriage markets and labor markets in shaping inequality. They highlight the importance of disaggregating women's employment by education and suggest that rising full-time work among highly educated women may reinvigorate the inequality-enhancing potential of assortative mating, even as female labor force participation rises overall.

Background

The relationship between economic inequality and changing family formation patterns

Changes in family formation have been identified as a key driver of rising inequality in advanced economies. McCall and Percheski (2010) outline three mechanisms linking family dynamics to inequality: shifts in family structure, women's expanded labor market participation, and increases in educational assortative mating. Among these, the growth of single-parent

households has been particularly consequential (McLanahan and Percheski, 2008), although its inequality effects vary across countries depending on the generosity of public income support (Gornick and Jäntti, 2012).

Women's labor force participation has historically equalized household income (Cancian and Reed, 1998), which is also supported by a comparative study across Western countries (Grotti and Scherer, 2016; Kollmeyer, 2013). However, other studies suggest that this equalizing effect is waning as dual-earner households become the norm (Machado and Ribeiro, 2021; Schwartz, 2010). In particular, educational gradients in women's employment, especially among mothers, have intensified (McLanahan, 2004), with important implications for inequality. This is because as women's employment advantages increasingly align with their partners' socioeconomic status, assortative mating may further bifurcate household economic resources (Schwartz, 2010).

Assortative mating thus plays an important role in shaping economic inequality, but the empirical evidence is mixed. Some studies find no association between trends in educational assortative mating and rising inequality in contexts such as Britain (Breen and Salazar, 2010), Finland (Erola and Kilpi-Jakonen, 2022), the United States (Hryshko et al., 2017), and other Western countries (Eika et al., 2019). Others report that rising educational assortative mating has reduced inequality in countries such as China (Hu and Qian, 2015) and the United States (Breen and Salazar, 2011). In contrast, evidence from Denmark suggests that assortative mating can exacerbate inequality in settings with high female labor force participation (Breen and Andersen, 2012; Esping-Andersen, 2007), largely because highly educated women are more likely to work full-time. In this view, the inequality-enhancing effect of assortative mating stems less from changes in spousal sorting itself than from educational expansion among women and their increased attachment to full-time employment (Breen and Andersen, 2012: 886).

Efforts to synthesize this body of inconsistent evidence suggest the influence of educational assortative mating and women's labor force participation on inequality depends on institutional contexts, especially the extent to which women's education translates into labor

market participation and earnings (Boertien and Permanyer, 2019; Herzberg-Druker and Stier, 2019; Schwartz, 2013). The increase in female employment, in theory, may reduce inequality if such increases are broadly distributed across socioeconomic strata (Bouchet-Valat, 2017; Boertien and Permanyer, 2019). In contrast, inequality may increase if employment gains are concentrated among highly educated women (McLanahan, 2004). Using a cross-sectional comparative data on 21 Western (EU and US) countries, one recent study supports the former (Boertien and Permanyer, 2019), while another study that examined the Israeli case between 1983 and 2008 supports the latter (Herzberg-Druker and Stier, 2019).

The relationship between educational assortative mating and economic inequality is further complicated by educational expansion and the reversal of the gender gap in schooling, both of which have contributed to rising educational hypogamy (i.e., women marrying down) (Esteve et al., 2016). These shifts in spousal pairing may have important implications for gender dynamics within households. A growing literature examines whether such patterns influence the division of domestic labor (Bonke and Esping-Andersen, 2011; Miller, 2020). Drawing on marital bargaining theories, some scholars argue that men are more likely to participate in domestic work when partnered with more highly educated women (Miller, 2020). The rise in educational hypogamy may therefore help explain increases in stable employment among married women, even after childbirth. If so, employment gains among highly educated women do not necessarily amplify household earnings inequality. Because hypogamy implies educational heterogamy, it may weaken earnings correlations between spouses. Indeed, highly educated women's earnings may reduce inequality if they supplement the incomes of less-educated husbands, whose earnings are typically lower than those of highly educated men.

While comparative research offers important insights, cross-national analyses may obscure the influence of institutional differences, such as welfare regimes or labor market structures, on the links between women's education, employment, and family formation (Pepinsky, 2019). To address this limitation, the present study focuses on Japan as a single-country case that provides a unique opportunity to test competing theoretical expectations. The

next section motivates this case selection by highlighting how age-group comparisons within Japan offer new insights into the literature on inequality, assortative mating, and female labor force participation.

Contextual background

Married women's employment in Japan

Japan's gendered employment trajectory provides an important backdrop for understanding the interaction between spouse pairing patterns and women's work. The labor market historically rewarded continuous tenure and firm-specific experience (Yamada and Kawaguchi, 2015). Yet these returns were difficult for women to access due to expectations of post-childbirth withdrawal and limited reentry opportunities (Nemoto, 2016). Educational attainment was even negatively associated with post-marital employment (Raymo and Lim, 2011). However, recent evidence documents that highly educated women are increasingly remaining in stable, full-time employment across the life course (Mugiyama, 2024), accumulating human capital and reinforcing labor market advantages (Kawaguchi, 2006). Consequently, while married women's employment, typically part-time or non-standard, primarily supplemented male earnings and tended to reduce household income inequality (Abe and Oishi, 2007), it may now contribute to rising inequality due to a growing educational gradient in stable employment (Kambayashi et al., 2008).

Educational assortative mating

The historically weak link between married women's education and employment is partly rooted in traditional partner selection patterns. Japanese women were long expected to "marry up" (hypergamy), placing limited weight on their own earnings potential in the marriage market (Brinton et al., 2021). Recent shifts, however, indicate women with stronger economic prospects are now more likely to marry (Fukuda et al., 2020), while educational homogamy and hypergamy have declined in both absolute and relative terms (Fujihara and Uchikoshi, 2019;

Fukuda et al., 2021). Spousal educational similarity, for example, fell by 25% across cohorts born between the 1950s and 1970s.

A corresponding rise in educational hypogamy (women marrying down) may promote more egalitarian household arrangements and potentially reduce inequality if highly educated wives offset lower-earning husbands. This possibility aligns with Esping-Andersen and Billari's (2015) multiple-equilibrium framework, which posits the early stage of family change as a period of "less family" among highly educated, career-oriented women, whose opportunity costs of marriage and motherhood are high under gender-inegalitarian conditions. As gender-egalitarian norms diffuse, however, the association between women's socioeconomic status and family behavior weakens or even reverses, producing a new equilibrium. In this later stage, one might expect a negative educational gradient in lifelong singlehood (Bellani et al., 2017) alongside increases in both educational homogamy and hypogamy (Esping-Andersen and Billari, 2015; Fukuda et al., 2020).

Meanwhile, in Japan, the gender-asymmetric division of labor within families continues to impose strong expectations that women bear primary responsibility for domestic duties and caregiving (Bumpass et al., 2009). These norms are reflected in the persistent gender gap in household labor (Kan et al., 2022) and have generated growing tension as women's educational attainment and economic opportunities have expanded (Mugiyama, 2024). Concepts such as "egalitarian familism" capture this coexistence of labor market egalitarianism and traditional domestic norms (Brinton and Lee, 2016).

Thus, the rise in educational hypogamy may not simply indicate a shift toward gender egalitarianism in Japan. Alternative interpretations include that education has become a less reliable signal of male socioeconomic status, particularly amid rising within-group inequality (Kambayashi et al., 2008) or the decline in educational homogamy (and rise in female hypogamy) reflects compositional shifts in the college-educated population, including growth in less selective institutions (Uchikoshi, 2022). If so, changing patterns of educational assortative marriage may not be directly related to earnings inequality.

Taken together, these patterns imply countervailing effects. If highly educated homogamous couples increasingly consist of dual full-time earners, inequality may rise. If hypogamy expands and highly educated wives support lower-earning husbands, inequality may fall. In both cases, the key mechanism is not assortative mating alone but its interaction with women's employment.

The importance of gendered life-course

While many married mothers return to part-time positions with limited earnings potential, recent cohorts of highly educated women are more likely to maintain full-time employment, making age and education central to understanding inequality dynamics. Unlike many Western countries, inequality increases with age due to seniority-based wage structures, although inequality has recently risen most rapidly among younger adults (Kitao and Yamada, 2019), which may possibly reflect growing educational gradients in stable employment among women.

Analytically, focusing on age heterogeneity allows us to examine the impacts of female employment with relatively homogenous setting. Prior research suggests that expanding female employment can dampen the inequality effects of homogamy when lower-educated women enter the labor force (Boertien and Permanyer, 2019). However, if employment growth is concentrated among highly educated women in stable jobs, especially those married to similarly educated men, the effect may instead amplify inequality. Age-based analysis helps distinguish these dynamics, as the educational divide in stable employment is most pronounced among younger cohorts.

Research Questions and Hypotheses

Previous findings on the relationship between educational assortative mating and economic inequality are inconclusive. Recent studies suggest the earlier literature ignored changing couple's work arrangement towards more prevalence of dual-earner households especially among the highly educated couples (Herzberg-Druker and Stier, 2019). Another line

of studies emphasized that educational assortative mating is increasingly less important for household income inequality as female employment becomes universal especially for low-educated women (Boertien and Permanyer, 2019).

To address these gaps, we examine the relationship between household earnings inequality and changes in family formation practice over the three decades in Japan. The growing educational divide in stable employment among the recent cohort of women suggests that educational assortative mating contributes to increasing inequality, which is at least partly explained by the fact that highly educated women increasingly participating in the labor market as fulltime, stable employees. We expect this effect to be especially pronounced among younger households. Specifically, we test the following hypotheses.

Hypothesis 1a: Among younger households, changes in educational assortative mating are associated with household earnings inequality.
Hypothesis 1b: Among younger households, this relationship is partially accounted for by considering changing educational gradients in married women's labor force participation and employment patterns.

By contrast, we expect that educational assortative mating has limited impacts on inequality among middle-aged groups. This is because for this group educational attainment is not strongly associated with their employment (Raymo and Lim, 2011). Rather, female employment tends to reduce inequality to the extent that employment is taken as a way to compensate for the lower earnings of their male spouse.

Hypothesis 2: Among middle-aged households, changes in educational assortative mating are not associated with household earnings inequality.

Data, Variables, and Method

Data

The current study uses data from the Employment Status Survey (ESS), one of the nationally representative cross-sectional surveys conducted by the Japanese government. The ESS was administered every three years between 1956 and 1982 and every five years thereafter. The ESS employs a stratified two-stage random sampling method to select households, with data collected from all household members aged 15 or older (3,228,432 observations). First, we limited the sample to married couples (1,145,424 observations excluded, 35.5%), reducing the sample size to 2,083,008 cases. Second, we restricted to heterosexual, married couples in which the female household head or the spouse of the male household head is aged between 25 and 54 (907,223 excluded, 43.6%), reducing the sample size to 1,175,785 cases. Third, to avoid outliers, we excluded couples where the husband's age deviated more than three standard deviations from the mean husband age within each wife-age by survey-year cell (15,784 excluded, 1.3%), reducing the sample size to 1,160,001 cases.[2] Fourth, we dropped observations with missing values on educational attainment, earnings, or employment status (15,577 excluded, 1.3%). Finally, we restricted to households with positive earnings (13,410 excluded, 1.2%). The final analytical sample comprises 1,131,014 couple-year observations across eight survey waves (1982–2017).

Variables

The main variables of interest are (1) male and female spouse's educational attainment (3 groups respectively), (2) female spouse's employment status (3 groups), (3) female spouse's age (3 groups), and (4) household earnings. First, we construct nine household types based on a three-category representation of male and female spouse's educational attainment (i.e., high school or less, junior college, and BA+). Second, female spouse's employment is classified into

[2] The mean husband's age ranges from approximately 43 to 45 across survey years, with standard deviations of approximately 8.5 to 9.1. The ±3SD thresholds are computed within each wife's age by survey year cell, yielding lower bounds of approximately 17 to 19 and upper bounds of approximately 69 to 72.

three groups (standard employment, non-standard employment, and non-employed). Definition of standard and non-standard employment does not necessarily depend on contract, work hours, or types of work. Rather, it is a more sort of membership *status*. Standard employment (*seiki koyō*) is generally considered a "good job," in which workers enjoy economic rewards by accumulating firm-specific skills through on-the-job training. At the same time, they are expected to engage in various practices associated with the lifetime employment system such as long work hours. By contrast, nonstandard employment (*hiseiki koyō*) is another employment status often regarded as less desirable or a "bad job" (Raymo and Shibata, 2017). Workers in this employment typically have face weaker job security or fewer opportunities for career development compared to those in standard employment. Third, age is grouped into three categories (25-34, 35-44, 45-54).

Last, household earnings are constructed as follows. The ESS has collected information on both individual labor earnings and household income. Following Breen and Salazar (2011), we use the sum of pretax labor earnings of the household head and his or her partner as household earnings to measure earnings inequality. We equivalize the household earnings by dividing by the square root of the number of household members.[3]

The ESS has collected information about all individual labor earnings and household income by using pre-coded categories on the questionnaire. We imputed midpoints to each categorical response except for the top-coded categories.[4] We assigned zero values to earnings for those who were not currently working. We use the consumer price index to adjust earnings in each period to constant 2017 Japanese yen.

After removing samples with missing information about the variables listed above, 1,131,014 households remain. Table 1 presents the descriptive statistics.

[3] Households of zero earnings are removed from the sample.
[4] For high values of earnings and income, the ESS used top-coding. In the following analysis, we imputed the lowest value of interval to the top coded category in each survey.

[Table 1 about here]

Method

Following upon earlier studies (e.g., Breen and Andersen, 2012; Breen and Salazar, 2010, 2011), this study uses a counterfactual decomposition approach to investigate the impact of women's employment and educational assortative mating on earnings inequality, measured as Theil index, a special case of general entropy family of inequality measure (Cowell, 2000: 109-110). We use the Theil index, which is widely used in prior research on assortative mating and inequality (e.g., Breen and Salazar, 2011), because it is relatively more sensitive to the upper tail of the earnings distribution (Cowell, 2000: 110).[5] This feature is particularly suitable for our research question, as we are interested in the potential role of employment among high-earning, highly educated couples in shaping overall earnings inequality. Nevertheless, we conduct sensitivity analyses using an alternative generalized entropy measure, the Mean Logarithmic Deviation, which is more sensitive to the lower tail of the earnings distribution (see Sensitivity Analysis).

We begin with a basic definition of the Theil index as it is used in research on economic inequality:

$$T = \frac{1}{n}\sum_{i=1}^{n}\frac{x_i}{\bar{x}}\ln\frac{x_i}{\bar{x}} \quad (1)$$

where n is the number of households, x_i is the earnings of household i, $\bar{x}$ is the average earnings across households. The lowest value is 0, meaning that household earnings are equally distributed across households, while the highest value is $\ln(n)$ for a sample of size n, which indicates perfect inequality.

One methodological advantage of the Theil index compared with other inequality measures is the ability to additively decompose the index into within-group inequality (T_w) and

[5] This property relates to the parameterization of the Theil index. See Appendix materials on the generalized entropy measures.

between-group inequality (T_b). Applying this index to earnings inequality and patterns of female employment and assortative mating, T for the *j*th group (T_j) can be written as follows:

$$T_j = \frac{1}{n_j}\sum_{i=1}^{n_j}\frac{x_{i|j}}{\bar{x}_j}\ln\frac{x_{i|j}}{\bar{x}_j} \quad (2)$$

where n_j is the number of households within the jth group, $x_{i|j}$ is the household earnings of household i within the jth group, $\bar{x}_j$ is the mean of the household earnings within group j. Note that we obtain earnings information for 81 household groups (3 male spouse's educational attainment $\times$ 3 female spouse's educational attainment $\times$ 3 female spouse's employment status $\times$ 3 female spouse's age groups). Using the group-specific Theil index, we can decompose the overall Theil index into a between-group component (T_b) and a within-group component (T_w) as follows.

$$T = \sum_j p_j\frac{\bar{x}_j}{\bar{x}}\ln\frac{\bar{x}_j}{\bar{x}} + \sum_j p_j\frac{\bar{x}_j}{\bar{x}}T_j = \left(\sum_j p_j\frac{\bar{x}_j}{\sum_j p_j\bar{x}_j}\ln\frac{\bar{x}_j}{\sum_j p_j\bar{x}_j}\right) + \left(\sum_j p_j\frac{\bar{x}_j}{\sum_j p_j\bar{x}_j}T_j\right) = T_b + T_w \quad (3)$$

The between-group component represents inequality across groups measured by the group-mean using the share of group type p_j as weight. The within-group component is the weighted average of the Theil index of each group (T_j), where the weights are each group's share of total earnings ($p_j\bar{x}_j/\bar{x}$).

As the equation above shows, the overall Theil index depends on three group-level quantities: the group-specific level of earnings inequality (T_j), the average household earnings within the group ($\bar{x}_j$), and the prevalence of different groups (p_j). Although the decomposition allows for counterfactual substitution of any of these three quantities, we focus on p_j because it directly captures changes in household composition arising from educational assortative mating and women's employment. This property facilitates counterfactual analyses by replacing one or more of these quantities at their base-year (t_1) values while keeping the remaining quantities at their observed values in year t_2. Specifically, we compute a counterfactual Theil index by substituting p_j at t_2 with its value from t_1, while letting group-specific inequality (T_j) and group mean earnings ($\bar{x}_j$) take their observed t_2 values:

$$T_{cf} = \sum_j p_{1j} \frac{\bar{x}_{2j}}{\sum_j p_{1j}\bar{x}_{2j}} \ln \frac{\bar{x}_{2j}}{\sum_j p_{1j}\bar{x}_{2j}} + \sum_j p_{1j} \frac{\bar{x}_{2j}}{\sum_j p_{1j}\bar{x}_{2j}} T_{2j} \quad (4)$$

The group share (p_j) consists of marginal distribution (composition) in each subgroup (female spouse's employment, female spouse's education, and male spouse's education)[6] and their associations (e.g., assortative mating). Our main goal is to assess how changing educational pairings contribute to inequality, and whether changes in women's employment patterns mediate this relationship.

A conceptual framework of our counterfactual analyses is shown in Figure 2. This framework posits that household earnings vary according to wives' and husbands' educational attainment and wives' employment (shown in solid gray lines). Each number in Figure 2 corresponds to one counterfactual exercise. First, we assess whether changes in the spousal educational association account for shifts in earnings inequality. To do this, we fix the association between wives' and husbands' educational attainment at its 1982 level while allowing all other components to vary as observed. Second, we incorporate wives' employment status, fixing its association with wives' education, to evaluate whether the effects of educational assortative mating on inequality operate through changing educational gradients in women's employment. Third, we hold the entire distribution of household types constant at its 1982 level by fixing all remaining marginal distributions and associations, including the association between husbands' education and wives' employment.

Here, we acknowledge that individual (labor supply) and household (marriage) choices are interdependent and may be shaped by common unobserved characteristics (shown in the upper left of Figure 2). The nature of our research design does not allow this interdependence to be fully disentangled. Nevertheless, we see clear sociological rationales for these counterfactual exercises and their contributions to the literature. For example, the first counterfactual analysis is grounded in research showing that multiple sociocultural forces shape spouse-pairing patterns,

[6] Age groups are also added for the total sample.

including changing gender norms that favor less traditional matches (e.g., hypogamy) (Esteve et al., 2016). Such macro-level shifts may independently influence the distribution of spousal pairings net of individual-level, time-constant characteristics. Similarly, changes in the group-level relationship between married women's education and employment may reflect broader societal transformations that promote women's labor force participation, such as work–life balance policies, which may differentially benefit specific educational groups (Mugiyama, 2024). As such, our counterfactual framework represents an empirical attempt to estimate household earnings inequality under alternative assumptions about macro-level forces shaping assortative mating and education-specific labor force participation.

To isolate associational changes from compositional shifts, we apply iterative proportional fitting (Deming and Stephan, 1940), a method widely used in prior research. This approach adjusts joint distributions, such as the association between spouses' education, while holding marginal distributions constant (see Breen and Salazar, 2010 for details). Note that decomposition analyses were conducted separately for each survey year. We did not pool observations across years; rather, we computed year-specific inequality indices and then examined temporal trends by comparing these estimates across the eight survey waves.

[Figure 2 about here]

Results

Descriptive findings (1): Earnings inequality trends

First, Figure 3 describes trends in household earnings inequality, measured by the Theil index, for the overall population and three age groups. Overall inequality has remained stable or slightly declined over the past three decades. However, age-specific patterns diverge. Among those aged 25–34, inequality has risen in recent years. For ages 35–44, the trend parallels the overall pattern but at consistently lower levels. In contrast, inequality among those aged 45–54

has declined more substantially. These results suggest that the forces shaping earnings inequality differ across age groups.

[Figure 3 about here]

Descriptive findings (2): Women's employment, spouse pairing patterns, and earnings

To understand these trends, we examine factors underlying earnings inequality across years and age groups. Figure 4 and Table 2 reveal clear differences by age and education. Although married women's labor force participation has risen overall as shown in Figure 1b, its composition varies substantially. Among women aged 35–44 and 45–54, increases are driven primarily by growth in non-standard employment. In contrast, women aged 25–34 have experienced a marked rise in standard employment, especially among the university educated (32% to 50%). This pattern indicates strengthening labor market attachment among highly educated younger women, consistent with prior research (Mugiyama, 2024).[7]

[Figure 4 about here]

Turning to spouse pairing patterns, Table 2 presents the distributions of nine educational pairings across age groups, comparing 1982 and 2017. In 1982, most couples were low-educated homogamous or hypergamous. Although the distribution of each educational pairing differs by age groups, the general pattern is the same. By 2017, the share of low-educated homogamy had declined across all age groups, while university-educated homogamy increased. Educational hypogamy also increased significantly: among 25–34-year-olds, from about 6% to over 20%. Although this result is not equal to the trend in the *relative* odds of assortative mating, the percentage distribution of assortative mating is arguably more important for investigating

[7] A similar trend appears when restricting the sample to married women with children (results not shown).

inequality trends than the margin-free association. As such, the shift in spouse pairing patterns over the three decades may have implications for household earnings inequality.

One may wonder how changing spouse pairing patterns intersect with educational gradients in married women's employment. For this, we also examine married women's employment status by spouse pairing patterns (shown in Appendix Figure 1). Interestingly, male spouse education has little impact on female employment, except among low-educated women, for whom marrying a highly educated husband is associated with lower labor force participation.

[Table 2 about here]

What does married women's employment imply for household economic well-being? Figure 5 shows average household earnings by women's employment status, spouse pairing patterns, and age group. Standard employment among wives is consistently associated with higher household earnings across all age groups, whereas non-standard employment adds little relative to non-employment. This finding echoes prior research characterizing women's part-time work as a supplement to husbands' earnings. As shown earlier, the share of women in standard employment has risen among the youngest cohort, particularly among the highly educated. To the extent that growth in dual full-time earners increases dispersion in the earnings distribution, the expansion of standard employment among highly educated young women may be an important driver of rising inequality in younger age groups.

We also examine whether the association between women's employment status and household earnings varies by educational pairing (results shown in Appendix Figure 2). Across pairings, wives' standard employment is associated with higher household earnings, whereas the earnings surplus from non-standard employment is modest and comparable to that of non-employed women. This pattern is broadly consistent across spouse pairings.

[Figure 5 about here]

Counterfactual estimates

The evidence above suggests that changes in women's employment and educational assortative mating have shaped age-specific trends in earnings inequality. Although female employment has risen overall, only the youngest group (25–34) experienced substantial growth in standard employment, closely linked to educational attainment. By contrast, non-standard employment increased across all age groups, particularly among middle-aged women. Because standard employment is more strongly associated with higher household earnings, expanding educational gradients in married women's employment likely contribute to rising inequality among younger households. For middle-aged groups, in contrast, non-standard employment may reduce inequality by supplementing male earnings.

To test these expectations, we use a counterfactual decomposition framework that quantifies how specific changes (e.g., assortative mating or employment patterns) contribute to earnings inequality over time.

Before providing counterfactual estimates, Table 3 decomposes the Theil index into within- and between-group components, where we define groups by age, spouses' educational attainment, and women's employment status (81 household types in total). Results show that the overall decline in inequality (–13.0%) is driven primarily by middle-aged households, especially those aged 45–54 (–30.5%). Decomposition results further indicate most of this decline stems from reductions in within-group inequality. For example, within-group inequality among 45–54-year-olds declined by 31.9%, accounting for 84% of the total reduction in this group.

By contrast, inequality for the youngest age group increased slightly (from 0.099 to 0.109), with a 92% rise in between-group inequality, despite a slight decline in within-group inequality. This increase suggests that shifting patterns of assortative mating and women's labor force participation, particularly growing educational gradients, may drive the rise in inequality among young households.

[Table 3 about here]

To evaluate if the speculation made above is correct, Table 4 examines three counterfactual estimates which keep a given household distribution constant at the value of 1982, while allowing other aspects to change including the group-specific Theil index (T_j) and the average household earnings within the group ($\bar{x}_j$). We concentrate on the between-group inequality, as earlier results suggest that the trend differs greatly by age groups.[8] We present percent change from the observed value in 2017 to counterfactual values.

First, using the Deming-Stephan iterative proportional fitting procedure, we hold the association between wives' and husbands' educational attainment at its 1982 level while allowing all other components, including the marginal distributions of education, to vary ([Wife's education][Husband's education] constant). This counterfactual yields the level of earnings inequality that would have been observed in 2017 had the strength of educational assortative mating remained unchanged. Second, we extend this specification by additionally fixing the association between wives' education and employment status at its 1982 level ([Wife's education][Husband's education, Wife's employment] constant). That is, we hold constant both educational assortative mating *and* the educational gradient in married women's employment, while allowing other components to vary. This estimate assesses whether changes in inequality are driven by shifts in educational differentials in wives' employment. Finally, we fix all marginal distributions and associations at their 1982 values (All p_j constant). This counterfactual provides the level of earnings inequality that would have prevailed in 2017 had the joint distribution of spouses' education and wives' employment remained unchanged.

According to the first counterfactual estimate, keeping the association the same as in 1982 *increases* the between-group inequality for all age groups. Combined with this evidence that the relative odds of educational homogamy declined in Japan (Fujihara and Uchikoshi, 2019;

[8] Also, changing the composition of household type (p_j) did not largely affect within-group inequality.

Fukuda et al., 2021),[9] this result suggests that declining educational homogamy and hypergamy (or increasing educational hypogamy) contribute to the equalization of the household earnings distribution. Considering the changes in observed between-group inequality between two periods, the size of the contribution is not small. This finding is interesting in light of findings from an existing comparative study across Europe and North America (Boertien and Permanyer 2019), which argued that the increase in female employment attenuates the impacts of assortative mating on economic inequality. In comparative perspective (Figure 1), the Japanese women's labor force participation rates are not low, and importantly, increased rapidly over decades.

To what extent does the contribution of educational assortative mating to earnings inequality reflect growing educational gradients in standard employment, particularly among younger cohorts? The second counterfactual addresses this question. If the estimated contribution of assortative mating declines substantially after additionally fixing the association between women's education and employment, this suggests that widening educational differentials in female employment underlie the link between assortative mating and inequality. The results indicate that this is indeed the case. When we hold constant both educational assortative mating and the education–employment association, the relative change in inequality declines markedly across all age groups, most notably among those aged 25–34 (from 10.9% to 2.8%). This implies that although inequality would be higher in the absence of changes in assortative mating, the additional contribution of assortative mating beyond that of the education–employment gradient is substantially smaller. Because this sequential decomposition is order-dependent, we note that these results should be interpreted as an accounting exercise rather than as isolating the independent contribution of assortative mating. A reverse-order decomposition yields substantively similar conclusions (Appendix Table 1). In 1982, the association between women's education and employment was considerably weaker than in 2017, especially for the youngest group. The strengthening of this gradient, particularly the rise of highly educated women in

[9] We also estimated a UNIDIFF model, which assumes uniform cohort change in the strength of assortative mating, to assess trends over time. The results (not shown) indicate a steady decline in the association across all age groups.

standard employment, suggests that assortative mating becomes more consequential for inequality when the education–employment gradient is steeper. In this sense, the structural conditions under which assortative mating translates into earnings inequality have intensified among younger cohorts. This finding aligns with Herzberg-Druker and Stier's (2019) argument that rising inequality is driven by the growth of doubly advantaged households, characterized by high education and dual full-time earnings. By contrast, the attenuation is smaller among the two middle-aged groups, suggesting a weaker link between women's education and employment at those ages. As shown earlier, increases in non-standard employment—often understood in Japan as compensating for limited male earnings—occur across educational levels in these cohorts.[10] Separate decompositions by educational attainment alone and by wife's employment type alone further support this interpretation: the increase in between-group inequality among 25-34 year-olds was 74.4% for education and 152.2% for employment type (Appendix Table 2).

Finally, results from the last counterfactual model, where all the household-type distributions are held constant at their 1982 values, show that keeping the household type composition constant in 1982 would reduce earnings inequality. These results indicate that educational assortative mating contributes to inequality as we confirmed earlier, but the size of the contribution is smaller than that of compositional changes. As such, the driver of changing between-group inequality is mainly compositional. Specifically, the changing educational distribution for both men and women, as well as the compositional change in women's employment, have a larger impact on household earnings inequality trends.

[Table 4 about here]

Sensitivity analysis

[10] Instead, we speculate that the positive contribution of assortative mating for inequality is driven by educational gradients in earnings for a male spouse. The educational gradients are especially the case for middle-aged groups, as returns to education widen with age in Japan characterized by the labor market emphasizing age seniority.

Our results are influenced by the characteristics of the earnings data, particularly top coding. As in many surveys, high earnings are top-coded in ESS. The main analysis assigns the lower bound of each top-coded interval to respondents in that category, which necessarily understates the overall level of inequality. For example, in 2017 earnings above JPY 20 million (approximately USD 178,300), roughly the top 1% of the distribution in Japan, were top-coded. Although this limitation likely reduces the estimated level of inequality, our primary interest lies in differences across groups rather than absolute levels. Nonetheless, we conduct several sensitivity analyses to assess the potential impact of top-coding, which yield qualitatively similar results (Appendix Table 3).

A related issue concerns the choice of inequality measure. While the Theil index (GE(1)) is widely used in research on assortative mating and inequality, it is relatively sensitive to the upper tail of the distribution. To assess robustness, we replicate the analyses using two alternative generalized entropy measures: GE(0), or the Mean Log Deviation (MLD), and GE(2), which equals half the squared coefficient of variation. Like the Theil index, both belong to the generalized entropy class of inequality measures. The MLD is defined as follows:

$$MLD = \frac{1}{n}\sum_{i=1}^{\mathrm{n}} \ln\frac{\bar{x}}{x_i}$$

And GE(2) is expressed as:

$$GE(2) = \frac{1}{2n}\sum_{i=1}^{n}\left[\left(\frac{x_i}{\bar{x}}\right)^2 - 1\right]$$

While the MLD is relatively more sensitive to the lower tail of the earnings distribution, GE(2) is relatively more sensitive to the upper tail. Since our main analysis uses GE(1) (Theil index), we assess robustness using GE(0) (MLD) and GE(2), which are more sensitive to opposite ends of the distribution.

The results are highly consistent across all three measures (Appendix Tables 4 and 5). Most notably, the sharp increase in between-group inequality among young couples (25–34) is confirmed regardless of the index used: +98.4% for GE(0), +91.8% for GE(1), and +87.2% for

GE(2). The overall decline in household earnings inequality is likewise robust (-10.8% for MLD, -13.0% for the Theil index, and -15.2% for GE(2)). These findings indicate that our main conclusions are not sensitive to the choice of inequality measure.

Furthermore, entropy-based between-group inequality, such as the Theil index and MLD, calculated across a small number of groups (81 in our case) is mechanically smaller than within-group inequality. We address this concern by applying the subgroup inequality correction of Elbers et al. (2005). The corrected estimates show trends consistent with our main results: the ratio of between-group to maximum between-group inequality (*Rb'*) increased across all age groups, most notably among young couples (from 22.5% to 37.6%) (Appendix Table 6).

Finally, to address concerns about small cell sizes, we computed bootstrapped standard errors and 95% confidence intervals based on 1,000 replications (Appendix Table 7). The standard errors are consistently small (typically < 0.001), and the confidence intervals indicate that the observed changes in between-group inequality are unlikely to be driven by sampling variability.

Discussion

Existing studies have discussed a seemingly counter-intuitive finding: changes in educational assortative mating, *net of* compositional change, have little impact on economic inequality (Boertien and Permanyer, 2019; Breen and Salazar, 2010, 2011; Erola and Kilpi-Jakonen, 2022). These empirical findings appear inconsistent with theoretical arguments that rising assortative mating is a key driver of inequality in advanced economies (Esping-Andersen, 2007; McCall and Percheski, 2010). To address the research gap, a few recent studies have suggested that educational assortative mating has limited consequences for inequality when increases in women's labor force participation are concentrated among those in lower-SES households (Boertien and Permanyer, 2019; Sudo, 2017). By contrast, assortative mating may reinforce inequality when stable, high-quality employment is concentrated among highly educated women who marry similarly educated men (Herzberg-Druker and Stier, 2019). As

such, the relationship between women's employment, educational assortative mating, and inequality is far more complex than theoretically expected.

This study examined these competing expectations by taking advantage of the Japanese case, where married women's employment patterns differ greatly by age groups. Japan belongs to one of the few countries that experienced a rapid increase in married women's employment over the recent decades, while there is an important age heterogeneity in married women's employment due to the gendered life-course trajectories. Using the age heterogeneous pattern of women's employment in a single society context, this study examined whether educational assortative mating contributes to household economic inequality, and if so, whether this is driven by better employment opportunities for highly educated women.

Results support this expectation. Counterfactual analyses show that, absent the decline in educational homogamy, household earnings inequality would be higher. However, the positive impact of assortative mating on inequality is attenuated by considering the changing relationship between women's educational attainment and employment, especially among the youngest households. These results are consistent with our Hypotheses 1a and 1b. Meanwhile, the impact of educational assortative mating on earnings inequality is weaker among the middle-aged groups, consistent with Hypothesis 2. Overall, these results highlight an important mechanism: educational differences in access to stable employment shape how assortative mating affects inequality.

This study contributes theoretical insights to the comparative literature on family and inequality. Simply put, the inequality consequences of assortative mating are context-dependent. In contexts where female employment, which itself tends to reduce inequality (Grotti and Scherer, 2016), is widespread and not stratified by education, the effects of assortative mating are muted (Boertien and Permanyer, 2019). In settings where stable employment is concentrated among the highly educated, assortative mating can amplify inequality (Herzberg-Druker and Stier, 2019). These results also align with recent comparative research showing that not only gender gaps in employment rates but also those in wages and working hours contribute to

household earnings inequality (Azzollini et al., 2023). While our decision to distinguish between standard and non-standard employment reflects the need to capture contextual realities, the findings suggest that focusing solely on employment levels may obscure important sources of household earnings inequality.

At the same time, our findings support the view that educational assortative mating is not a primary driver of rising family-based economic inequality. Although assortative mating can contribute to inequality when coupled with educationally stratified employment, its impact is modest relative to compositional shifts, such as rising educational attainment among men and women. Moreover, between-group differences account for a smaller share of overall inequality than within-group variation. These results are consistent with prior research highlighting the limited structural role of assortative mating and the greater importance of demographic and labor market changes (Breen and Andersen, 2012; Zagel and Breen, 2019).

We acknowledge several important limitations. First, the study relies on cross-sectional data. While suitable for examining macro-level trends and age-based heterogeneity, such data do not capture individual life-course transitions. Our interpretation assumes that age reflects life-stage differences, specifically, that the impact of assortative mating on inequality is concentrated among younger couples, where highly educated married women are more likely to work full-time than their middle-aged counterparts. Although age is a useful proxy for life stage, future research should test this assumption more directly. Longitudinal data would allow scholars to examine the dynamic relationships among partnership formation, subsequent family events (e.g., childbearing), and long-term economic outcomes (e.g., Goñalons-Pons and Schwartz, 2017; Qian, 2018). Future research could also address this limitation by constructing synthetic or pseudo-panels using repeated cross-sectional data (Cuesta et al., 2011; Moreno et al., 2021).

Another limitation is that we do not account for selection into marriage. The "shifting economic foundations of marriage" thesis (Sweeney, 2002) posits that highly educated women face higher opportunity costs of marriage and childbearing in contexts where gendered divisions of labor remain rigid, encouraging marriage postponement. Consistent with this perspective,

prior research documents growing positive socioeconomic gradients in marriage formation for both women and men in Japan (Fukuda et al., 2020), alongside rising lifelong singlehood. As a result, married couples have likely become increasingly selective over time. Future research should examine how these changing marriage market dynamics shape assortative mating patterns and their implications for household inequality. Furthermore, this study focuses solely on the educational attainment of individuals and their spouses. This does not imply that other traits are unimportant in assortative mating (Schwartz, 2013). A long tradition of stratification research highlights the role of social origins in shaping life chances, and numerous studies show that individuals also sort on "ascribed" characteristics such as parental social class (Mare, 2016) and wealth (Wagner et al., 2020). Recent evidence suggests that the influence of parental background on partner sorting may be increasing (e.g., Esping-Andersen et al., 2023). Future research should therefore incorporate these dimensions to better assess their implications for household inequality.

Also, we do not formally disentangle age, period, and cohort (APC) effects. The observed changes within age groups likely reflect a combination of period conditions (e.g., labor market structures, macroeconomic context) and cohort characteristics (e.g., educational attainment, gender norms). Because of the linear dependency among age, period, and cohort, repeated cross-sectional data cannot fully identify their independent effects. Although our strategy compares age groups across survey years, allowing us to observe how different cohorts experience inequality at similar life stages, future work would benefit from alternative designs or advanced statistical approaches that more directly address APC dynamics. Lastly, the system we analyze reflects the joint outcome of interdependent individual and household choices, observed only as a cross-sectional equilibrium. Consequently, our counterfactual estimates abstract from the endogenous behavioral responses that would likely accompany changes in employment, earnings, or partnering patterns shaped by macro-level sociological forces. Therefore, our results should be interpreted as an accounting exercise through decompositions of observed inequality, not as predictions of how outcomes would change under alternative policy or behavioral settings.

This study is, in part, descriptive in nature, aiming to assess the relative contributions of family-based processes to trends in household earnings inequality. A central challenge is that the determinants of inequality operate at multiple levels: women's labor force participation responds to broader labor market conditions, while mate selection is shaped by structural features of the marriage market. Understanding their joint implications requires a dynamic framework that captures their interdependence over time. One promising direction is the use of agent-based models, which can parameterize labor market conditions influencing women's employment alongside individual preferences governing mate selection. By generating counterfactual pairing patterns, such models allow researchers to evaluate how changes in employment and assortative mating jointly shape earnings inequality. Although implementing this approach is beyond the scope of the present study, which relies on repeated cross-sectional data, prior work using agent-based modeling offers a useful foundation (e.g., Grow and van Bavel, 2015; Xie et al., 2015). In this sense, our analysis provides an important first step by identifying a mechanism through which assortative mating does not necessarily translate into greater inequality, thereby laying the groundwork for future research using more dynamic methodological approaches.

To conclude, this study provides important insights for us to understand the potential role in family formation for inequality. Cross-national comparative studies have documented the limited or perhaps little impacts of assortative mating on inequality (e.g., Breen and Salazar, 2010, 2011) as well as the larger importance of compositional change (Breen and Andersen, 2012; Zagel and Breen, 2019). What distinguishes our findings from previous studies is the decline in within-group inequality. In contrast to growing within-group inequality trends in Western countries observed in these previous studies, our results present the decline in within-group inequality over time, regardless of age groups. Future studies need to explore potential drivers of the change, which provides another important insight to better the comparative perspective on the role of family for economic inequality.

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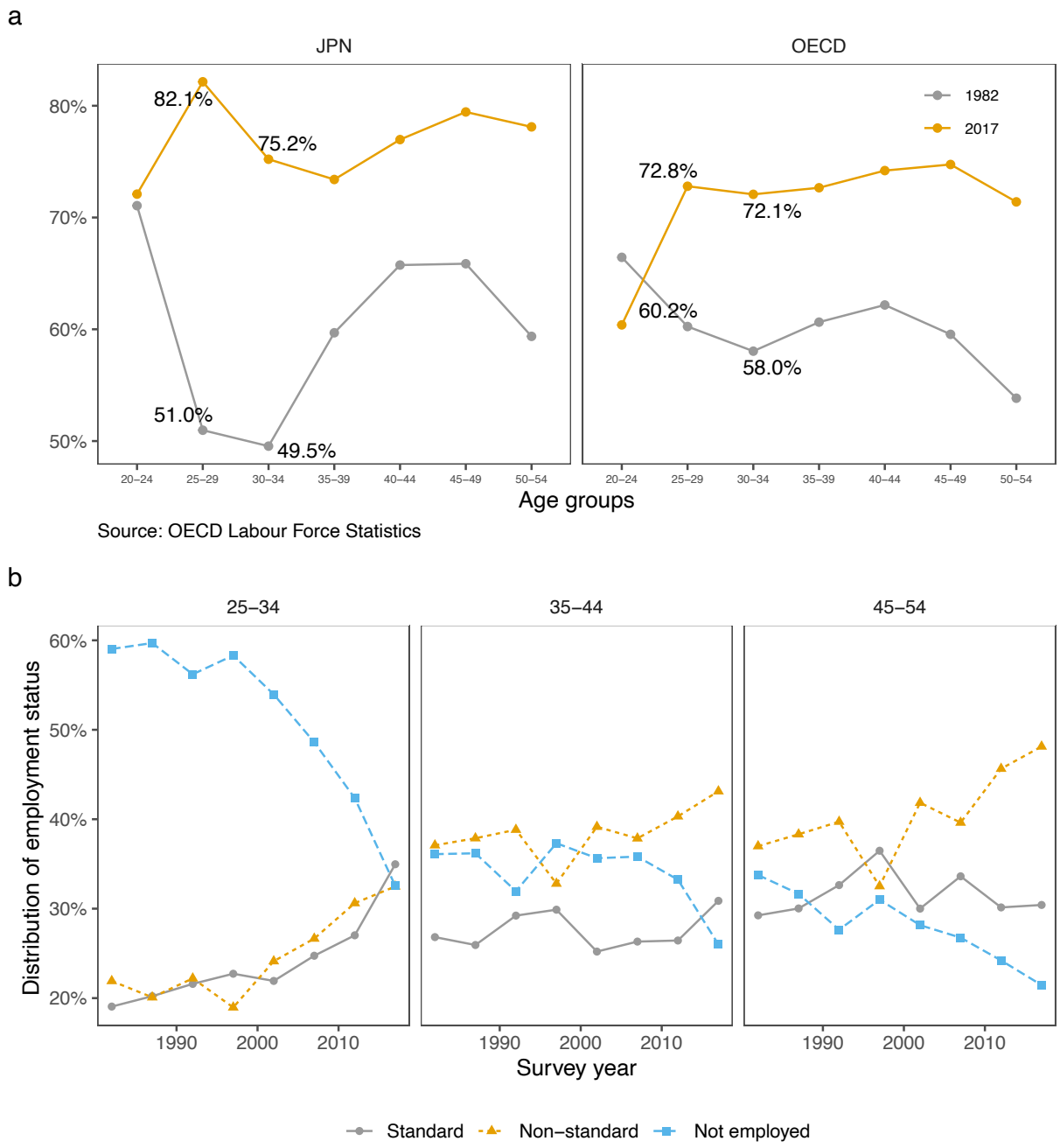


Figure 1 Age-specific women's labor force participation rate in Japan and OECD average (a) and Distribution of employment status among married women by age groups (b)

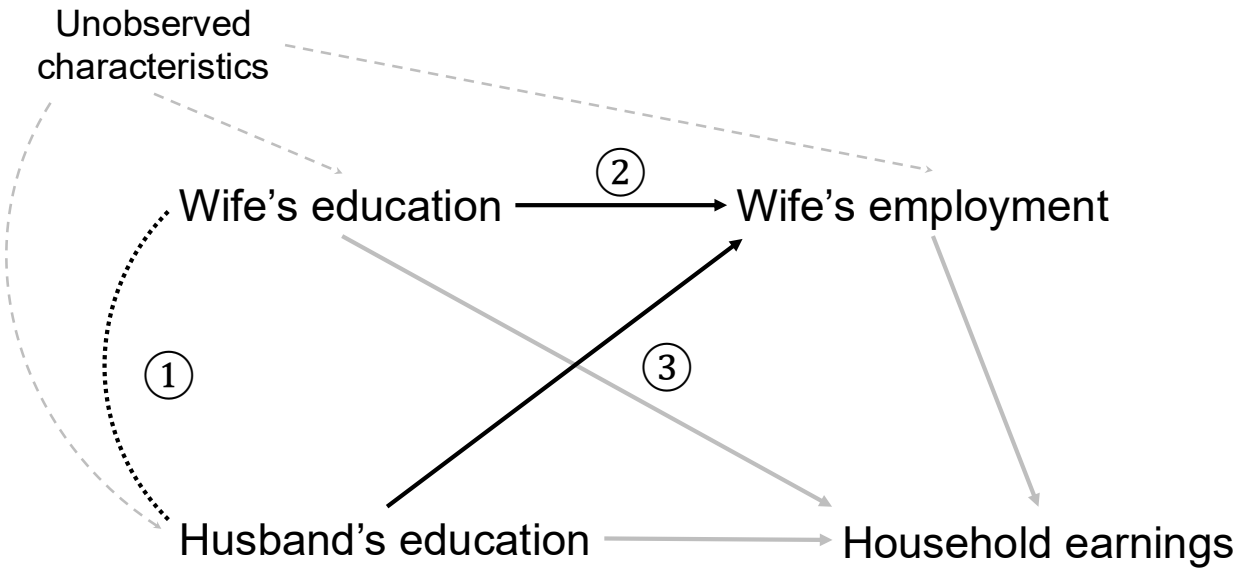
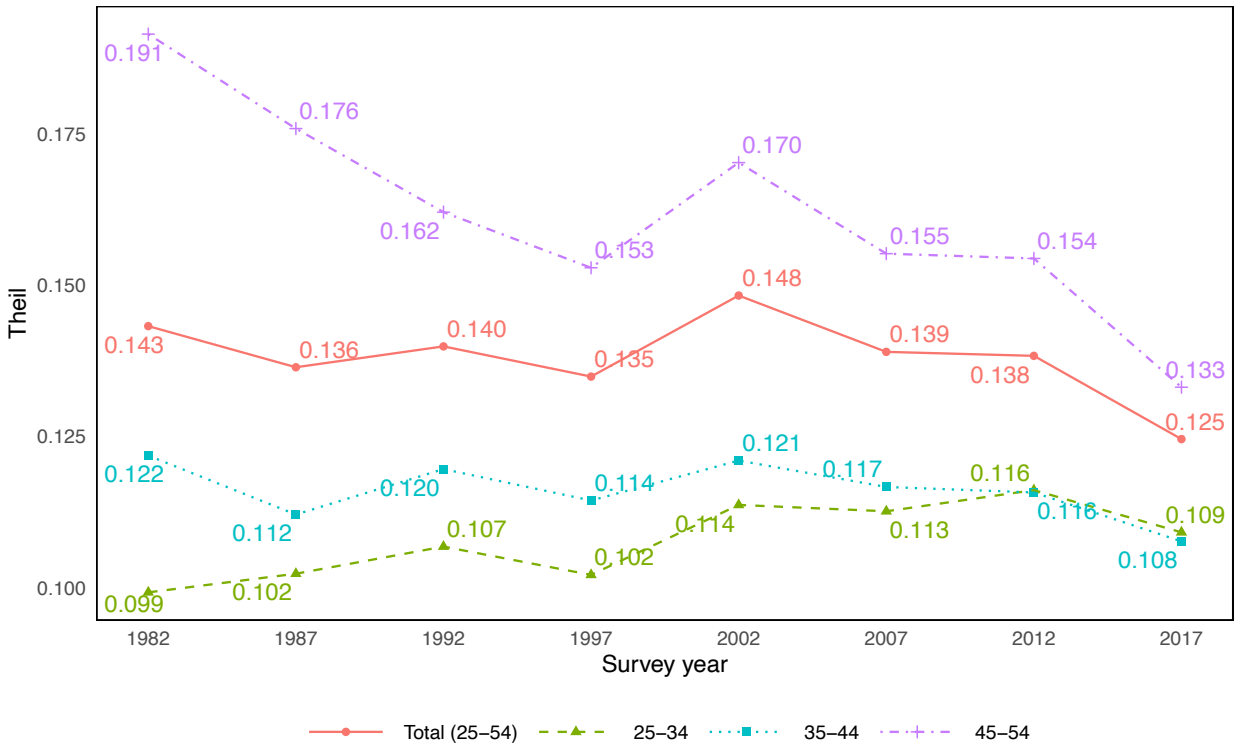
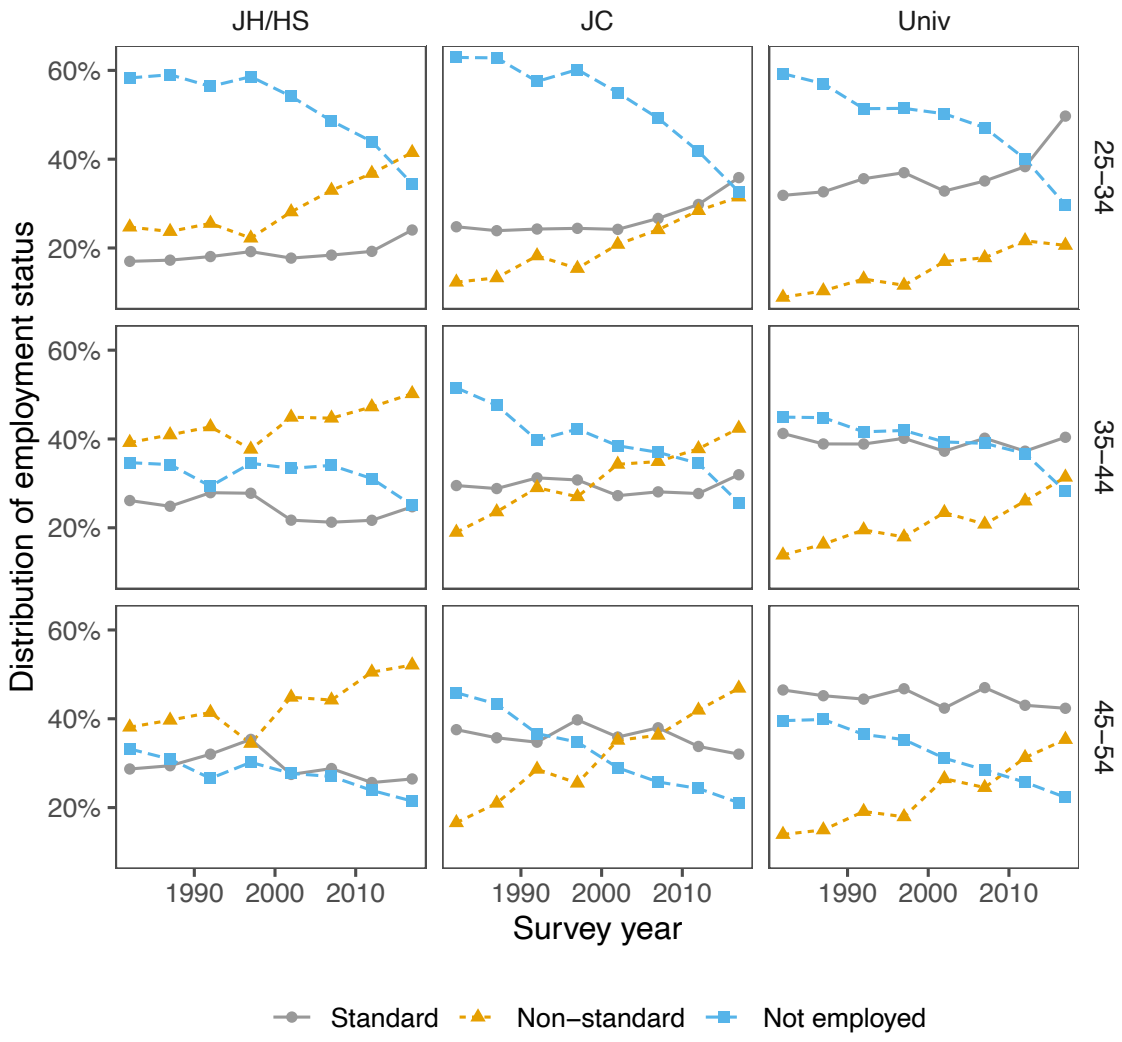


Figure 2 A conceptual framework of counterfactual analysis



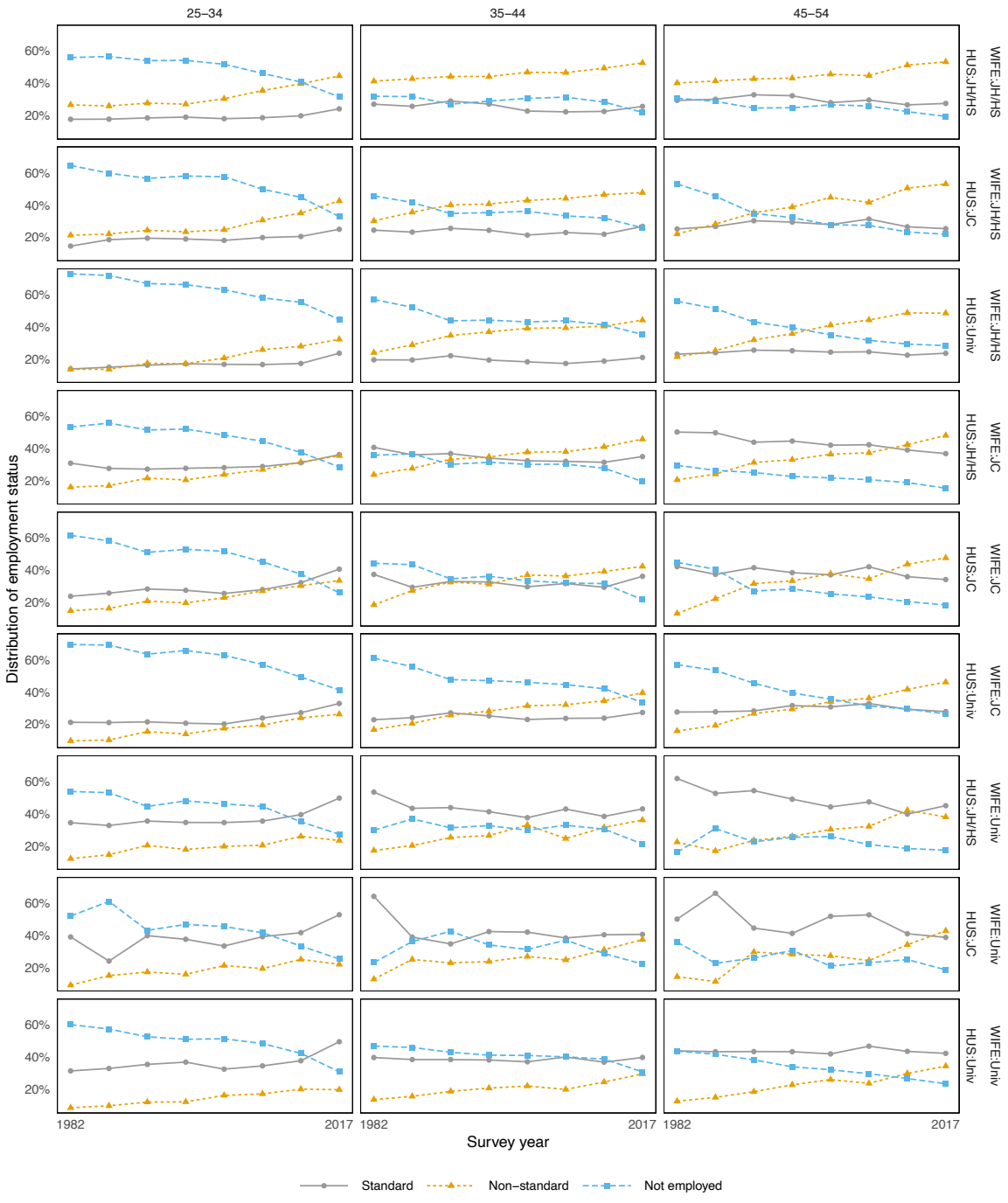
Source: Authors' calculation; ESS, 1982–2017

Figure 3 Earnings inequality trends by age groups



Source: Authors' calculation; ESS, 1982–2017
Note: JH/HS=Junior high school or High school, JC=Junior college, Univ=University or more

Figure 4 Married women's employment status by age and education



Source: Authors' calculation; ESS, 1982–2017.

Figure 5 Household equivalized earnings by women's employment status

Table 1 Descriptive statistics

	Survey years							
	1982	1987	1992	1997	2002	2007	2012	2017
Wife age								
25-34	0.31	0.24	0.21	0.22	0.22	0.21	0.19	0.17
35-44	0.36	0.40	0.39	0.34	0.32	0.36	0.40	0.39
45-54	0.34	0.36	0.39	0.44	0.45	0.42	0.42	0.44
Wife employment								
Standard	0.25	0.26	0.29	0.29	0.27	0.29	0.28	0.31
Non-standard	0.32	0.34	0.36	0.35	0.37	0.36	0.41	0.44
Not employed	0.42	0.40	0.35	0.36	0.36	0.35	0.31	0.25
Wife education								
JH/HS	0.88	0.84	0.78	0.71	0.64	0.51	0.51	0.47
JC	0.08	0.12	0.16	0.21	0.26	0.36	0.33	0.33
Univ	0.03	0.05	0.06	0.08	0.10	0.13	0.16	0.20
Husband education								
JH/HS	0.80	0.77	0.73	0.67	0.63	0.53	0.53	0.50
JC	0.04	0.04	0.05	0.06	0.08	0.13	0.10	0.11
Univ	0.16	0.19	0.23	0.27	0.30	0.35	0.36	0.38
Wife earnings								
Mean	65.4	82.5	115.3	127.8	127.0	135.0	137.4	156.8
SD	(100.9)	(121.5)	(161.7)	(184.6)	(178.8)	(179.3)	(172.6)	(178.4)
Husband earnings								
Mean	349.4	412.3	544.4	588.1	538.0	535.8	506.0	533.1
SD	(192.3)	(218.7)	(294.6)	(300.5)	(296.1)	(288.9)	(272.6)	(275.6)
Household earnings								
Mean	414.8	494.6	659.3	705.0	663.7	669.3	641.3	687.7
SD	(220.0)	(252.4)	(345.4)	(357.5)	(353.9)	(345.8)	(327.5)	(330.7)
Household size								
Mean	4.0	4.0	3.9	3.7	3.7	3.7	3.7	3.6
SD	(1.2)	(1.2)	(1.2)	(1.2)	(1.2)	(1.2)	(1.1)	(1.1)
N	175,144	160,087	177,442	158,016	136,893	114,036	111,487	97,909

Source: Authors' calculation; ESS, 1982–2017

Note: JH/HS=Junior high school or High school, JC=Junior college, Univ=University or more

Table 2 Spouse pairing patterns by education (grouped by survey year and wife's age)

Survey year	Wife age	Wife education	Husband education	%	N
1982	25-34	JH/HS	JH/HS	66.4%	35,658
			JC	2.8%	1,495
			Univ	10.0%	5,372
		JC	JH/HS	5.3%	2,825
			JC	1.2%	657
			Univ	8.2%	4,384
		Univ	JH/HS	0.6%	341
			JC	0.1%	77
			Univ	5.4%	2,910
	35-44	JH/HS	JH/HS	79.1%	49,569
			JC	2.2%	1,393
			Univ	9.0%	5,620
		JC	JH/HS	2.1%	1,335
			JC	0.5%	303
			Univ	4.0%	2,510
		Univ	JH/HS	0.2%	152
			JC	0.1%	39
			Univ	2.8%	1,737
	45-54	JH/HS	JH/HS	84.9%	49,911
			JC	4.1%	2,389
			Univ	5.9%	3,489
		JC	JH/HS	1.1%	673
			JC	0.8%	496
			Univ	1.8%	1,056
		Univ	JH/HS	0.2%	94
			JC	0.1%	56
			Univ	1.0%	603
2017	25-34	JH/HS	JH/HS	28.0%	4,590
			JC	4.8%	792
			Univ	8.5%	1,396
		JC	JH/HS	12.6%	2,064
			JC	6.5%	1,060
			Univ	11.0%	1,799
		Univ	JH/HS	5.3%	876
			JC	2.6%	423
			Univ	20.8%	3,413
	35-44	JH/HS	JH/HS	28.9%	10,986
			JC	4.3%	1,650
			Univ	8.1%	3,092
		JC	JH/HS	15.1%	5,732
			JC	6.2%	2,365
			Univ	14.7%	5,596
		Univ	JH/HS	4.4%	1,670
			JC	2.1%	782
			Univ	16.2%	6,155
	45-54	JH/HS	JH/HS	39.4%	17,124

		JC	4.4%	1,901
		Univ	10.5%	4,579
		JH/HS	12.5%	5,445
	JC	JC	4.2%	1,826
		Univ	15.3%	6,660
		JH/HS	2.0%	856
	Univ	JC	0.8%	344
		Univ	10.9%	4,733

Source: Authors' calculation; ESS, 1982 and 2017
Note: JH/HS= Junior high school or High school, JC=Junior college, Univ=University or more

Table 3 Decomposition of Theil index for two surveys (1982 and 2017)

	Total			25-34		
	Theil	Between	Within	Theil	Between	Within
1982	0.143	0.029	0.114	0.099	0.020	0.079
2017	0.125	0.033	0.092	0.109	0.038	0.071
% change	-13.0%	13.3%	-19.6%	10.0%	91.8%	-10.6%
	35-44			45-54		
	Theil	Between	Within	Theil	Between	Within
1982	0.122	0.020	0.102	0.191	0.037	0.154
2017	0.108	0.024	0.083	0.133	0.028	0.105
% change	-11.6%	23.9%	-18.5%	-30.5%	-24.4%	-31.9%

Source: Authors' calculation; ESS, 1982 and 2017
Note: Household types include women's age (for total), women's employment status, women's and men's educational attainment

Table 4 Deming-Stephan counterfactual estimates of between inequality (% change from the observed value in 2017)

	25-34	35-44	45-54
1. [Wife's education][Husband's education] constant	10.9%	15.0%	12.7%
2. [Wife's education][Husband's education, Wife's employment] constant	2.8%	7.1%	7.3%
3. All p_j constant	-27.1%	-27.9%	-43.8%

Source: Authors' calculation; ESS, 1982 and 2017.
Note: [] refers to either row or column of a frequency table to describe household types. '[Wife's education][Husband's education] constant' means that we keep the association between wife's and husband's educational attainment constant. Similarly, '[Wife's education][Husband's education, Wife's employment] constant' means keeping the association between (1) wife's and husband's educational attainment and (2) wife's educational attainment and wife's employment constant.

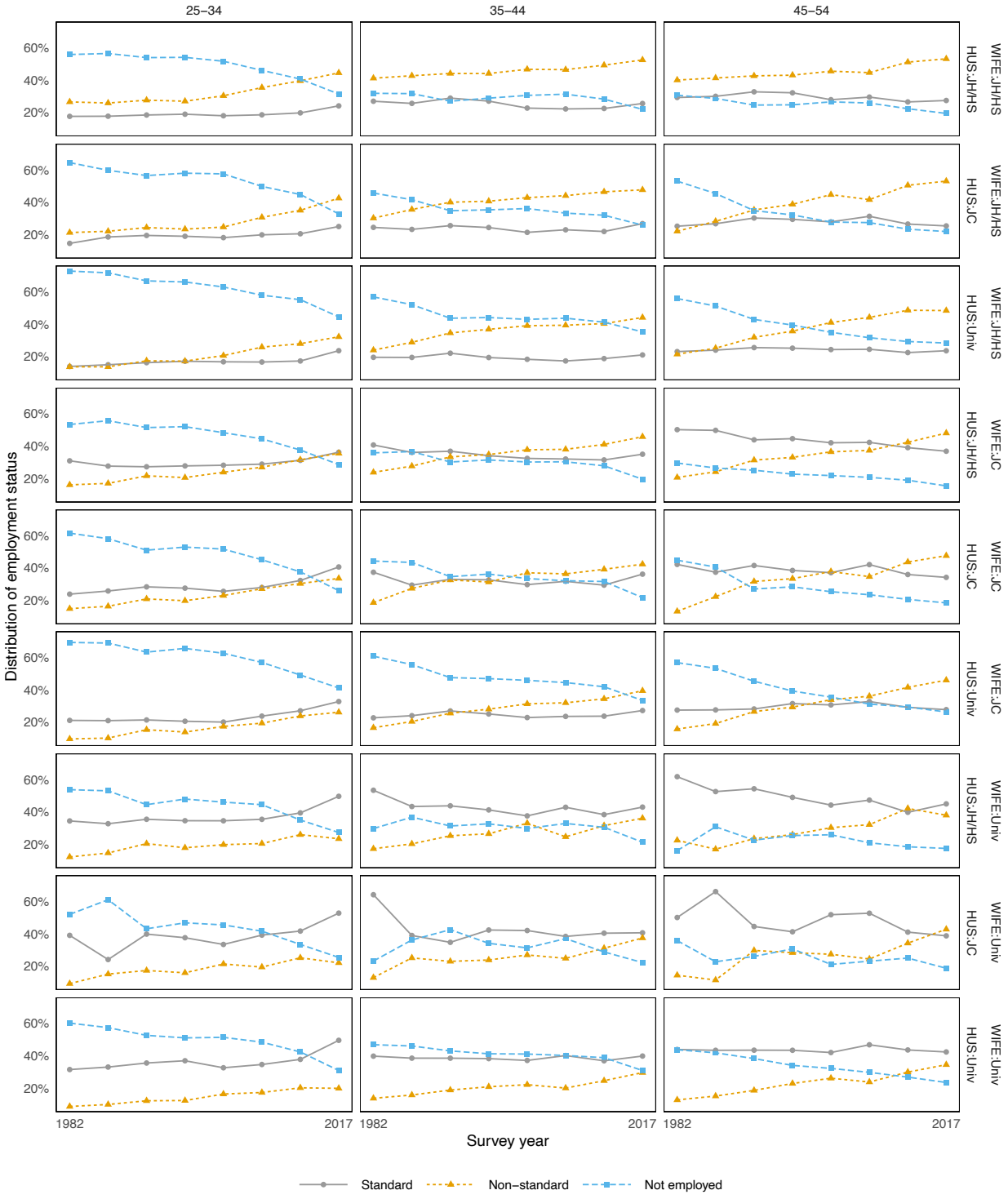
Appendix materials

A note on the generalized entropy measures and its sensitivity to upper or lower tails of the distribution

The generalized entropy (GE) family of inequality measures can be expressed as follows (Cowell, 2000: 100):

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{x_i}{\bar{x}}\right]^{\alpha} - 1\right]$$

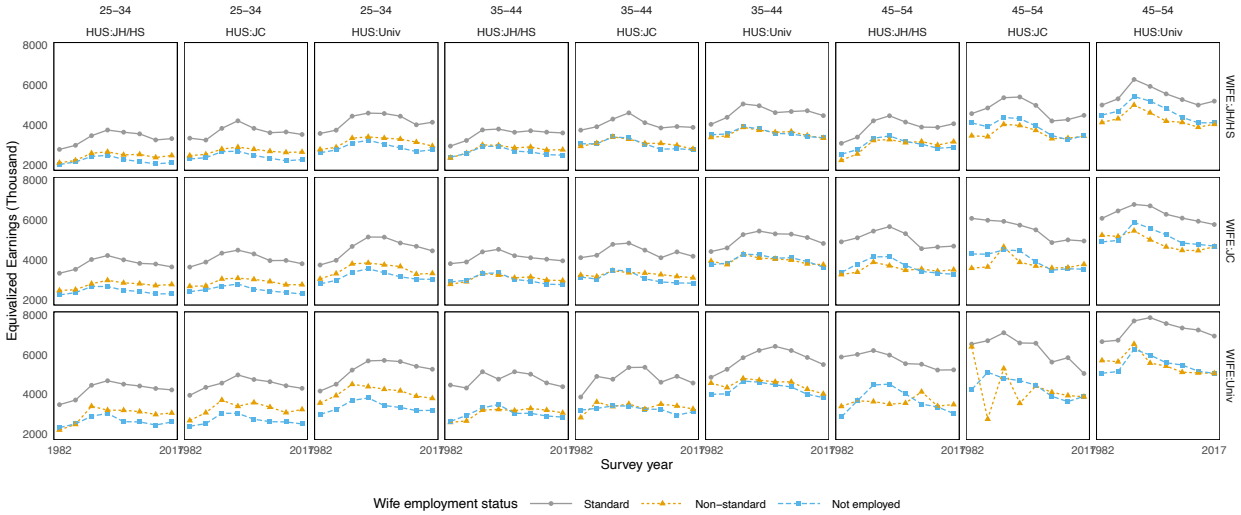
The Theil index is a special case of this general form when α=1, as expressed in equation (1) of the main text. When x_i is much larger than the mean ($\bar{x}$), both $\frac{x_i}{\bar{x}}$ and its logarithm are large, contributing to the inequality measure. In contrast, when x_i is much smaller than the mean, $\frac{x_i}{\bar{x}}$ is small, but its product with the log term is even smaller in magnitude. Intuitively, this is why the Theil index is more sensitive to changes in the upper tail of the distribution. By contrast, the Mean Logarithmic Deviation (MLD) uses $\ln\frac{\bar{x}}{x_i}$, which magnifies the contribution of the lower tail.



Source: Authors' calculation; ESS, 1982–2017

Note: JH/HS=Junior high school or High school, JC=Junior college, Univ=University or more

Appendix Figure 1 Married women's employment status by age and spouse pairing patterns



Source: Authors' calculation; ESS, 1982–2017

Note: JH/HS=Junior high school or High school, JC=Junior college, Univ=University or more

Appendix Figure 2 Household earnings by age and spouse pairing patterns

Appendix Table 1 Robustness of counterfactual estimates to decomposition order (% change from the observed between-group inequality in 2017)

Panel A: Forward order (assortative mating first)			
	25-34	35-44	45-54
1. [Wife education][Husband education] constant	10.9%	15.0%	12.7%
2. [Wife education][Husband education, Wife employment] constant	2.8%	7.1%	7.3%
Panel B: Reverse order (education-employment link first)			
	25-34	35-44	45-54
1. [Wife education][Wife employment] constant	-1.9%	4.4%	7.0%
2. [Wife education][Husband education, Wife employment] constant	2.8%	7.1%	7.3%

Note: Each cell reports the percent change from the observed between-group Theil index in 2017 to the counterfactual value. [] denotes row or column of a frequency table describing household types. Panel A fixes the spousal education association first (Counterfactual 1), then additionally fixes the education-employment association (Counterfactual 2). Panel B reverses this order, fixing the education-employment association first, then adding the spousal education association. Counterfactual 2 in both panels is identical by construction. Associations are adjusted via iterative proportional fitting (Deming-Stephan), holding marginal distributions at their observed 2017 values.

Appendix Table 2 Theil index decomposition by educational attainment and by wife's employment type

Panel A: Groups defined by wife's and husband's educational attainment

	Total			25-34		
	Theil	Between	Within	Theil	Between	Within
1982	0.143	0.014	0.129	0.099	0.011	0.088
2017	0.125	0.015	0.110	0.109	0.020	0.090
% change	-13.0%	6.7%	-15.2%	10.0%	74.4%	1.8%
	35-44			45-54		
	Theil	Between	Within	Theil	Between	Within
1982	0.122	0.015	0.107	0.191	0.029	0.162
2017	0.108	0.013	0.095	0.133	0.019	0.114
% change	-11.6%	-12.4%	-11.5%	-30.5%	-33.2%	-30.0%

Source: Authors' calculation; ESS, 1982 and 2017
Note: Household types include women's age (for total) and women's and men's educational attainment

Panel B: Groups defined by wife's employment type

	Total			25-34		
	Theil	Between	Within	Theil	Between	Within
1982	0.143	0.008	0.135	0.099	0.010	0.090
2017	0.125	0.013	0.112	0.109	0.025	0.085
% change	-13.0%	58.6%	-17.2%	10.0%	152.2%	-5.4%
	35-44			45-54		
	Theil	Between	Within	Theil	Between	Within
1982	0.122	0.005	0.117	0.191	0.011	0.181
2017	0.108	0.013	0.095	0.133	0.010	0.123
% change	-11.6%	139.7%	-18.4%	-30.5%	-7.4%	-31.9%

Source: Authors' calculation; ESS, 1982 and 2017
Note: Household types include women's age (for total) and employment type.

Appendix Table 3 Estimates using an alternative definition of top-coding

A. Decomposition of Theil index for two surveys (1982 and 2017)

	Total			25-34		
	Theil	Between	Within	Theil	Between	Within
1982	0.162	0.033	0.129	0.107	0.021	0.086
2017	0.145	0.036	0.109	0.114	0.038	0.075
% change	-10.4%	9.3%	-15.4%	6.2%	84.7%	-12.7%
	35-44			45-54		
	Theil	Between	Within	Theil	Between	Within
1982	0.139	0.022	0.117	0.217	0.044	0.173
2017	0.123	0.026	0.098	0.160	0.032	0.127
% change	-11.1%	16.2%	-16.3%	-26.4%	-26.2%	-26.5%

Source: Authors' calculation; ESS, 1982 and 2017
Note: Household types include women's age (for total), women's employment status, women's and men's educational attainment

B. Deming-Stephan counterfactual estimates of between inequality (% change from the observed value in 2017)

	25-34	35-44	45-54
1. [Wife's education][Husband's education] constant	10.9%	14.6%	12.4%
2. [Wife's education][Husband's education, Wife's employment] constant	3.0%	7.4%	7.5%
3. All p_j constant	-26.7%	-28.5%	-46.1%

Source: Authors' calculation; ESS, 1982 and 2017
Note: [] refers to either row or column of a frequency table to describe household types. '[Wife's education][Husband's education] constant' means that we keep the association between wife's and husband's education constant. Similarly, '[Wife's education][Husband's education, Wife's employment] constant' means keeping the association between (1) wife's and husband's educational attainment and (2) wife's educational attainment and wife's employment constant.

Appendix Table 4 Estimates using alternative measures of inequality, GE(0) (the Mean Logarithmic Deviation, MLD)

A. Decomposition of GE(0) for two surveys (1982 and 2017)

	Total			25-34		
	GE(0)	Between	Within	GE(0)	Between	Within
1982	0.155	0.026	0.128	0.104	0.019	0.086
2017	0.138	0.032	0.106	0.120	0.037	0.083
% change	-10.8%	20.9%	-17.4%	14.8%	98.4%	-3.6%
	35-44			45-54		
	GE(0)	Between	Within	GE(0)	Between	Within
1982	0.132	0.018	0.114	0.217	0.034	0.183
2017	0.119	0.024	0.095	0.152	0.027	0.124
% change	-10.2%	29.1%	-16.5%	-29.9%	-19.1%	-31.9%

Source: Authors' calculation; ESS, 1982 and 2017
Note: Household types include women's age (for total), women's employment status, women's and men's educational attainment

B. Deming-Stephan counterfactual estimates of between inequality (% change from the observed value in 2017)

	25-34	35-44	45-54
1. [Wife's education][Husband's education] constant	11.3%	15.3%	13.1%
2. [Wife's education][Husband's education, Wife's employment] constant	3.0%	7.3%	7.6%
3. All p_j constant	-30.2%	-29.3%	-44.8%

Note: Authors' calculation; ESS, 1982 and 2017. [] refers to either row or column of a frequency table to describe household types. '[Wife's education][Husband's education] constant' means that we keep the association between wife's and husband's education constant. Similarly, '[Wife's education][Husband's education, Wife's employment] constant' means keeping the association between (1) wife's and husband's educational attainment and (2) wife's educational attainment and wife's employment constant.

Appendix Table 5 Estimates using alternative measures of inequality, GE(2) (half the squared coefficient of variation)

A. Decomposition of GE(2) for two surveys (1982 and 2017)

	Total			25-34		
	GE(2)	Between	Within	GE(2)	Between	Within
1982	0.159	0.032	0.126	0.109	0.022	0.087
2017	0.134	0.034	0.100	0.117	0.040	0.077
% change	-15.2%	5.8%	-20.6%	7.8%	87.2%	-11.8%
	35-44			45-54		
	GE(2)	Between	Within	GE(2)	Between	Within
1982	0.131	0.021	0.110	0.209	0.043	0.166
2017	0.116	0.025	0.090	0.141	0.030	0.111
% change	-11.8%	19.4%	-17.9%	-32.6%	-30.2%	-33.3%

Source: Authors' calculation; ESS, 1982 and 2017
Notes: Household types include women's age (for total), women's employment status, women's and men's education

B. Deming-Stephan counterfactual estimates of between inequality (% change from the observed value in 2017)

	25-34	35-44	45-54
1. [Wife's education][Husband's education] constant	10.7%	14.7%	12.4%
2. [Wife's education][Husband's education, Wife's employment] constant	2.7%	7.1%	7.0%
3. All p_j constant	-23.9%	-26.5%	-43.0%

Note: Authors' calculation; ESS, 1982 and 2017. [] refers to either row or column of a frequency table to describe household types. '[Wife's education][Husband's education] constant' means that we keep the association between wife's and husband's education constant. Similarly, '[Wife's education][Husband's education, Wife's employment] constant' means keeping the association between (1) wife's and husband's educational attainment and (2) wife's educational attainment and wife's employment constant.

Appendix Table 6 Estimates using the subgroup inequality correction method developed by Elbers et al. (2005)

Year	Group	Theil	Observed Between	Bias	Corrected Between	Maximum Between	*Rb* (%)	*Rb′* (%)
1982	Total	0.143	0.029	0.00005	0.029	0.140	20.1%	20.5%
2017	Total	0.125	0.033	0.00007	0.033	0.123	26.1%	26.5%
1982	25-34	0.099	0.020	0.00004	0.020	0.089	20.1%	22.5%
2017	25-34	0.109	0.038	0.00012	0.038	0.102	35.1%	37.6%
1982	35-44	0.122	0.020	0.00004	0.020	0.111	16.1%	17.8%
2017	35-44	0.108	0.024	0.00006	0.024	0.103	22.6%	23.8%
1982	45-54	0.191	0.037	0.00005	0.038	0.176	19.6%	21.3%
2017	45-54	0.133	0.028	0.00007	0.028	0.128	21.2%	22.2%

Note: $Rb = T_B/T$; $Rb' = T_{B_{corrected}}/T_{B_{max}}$, following Elbers et al. (2005). $T_{B_{corrected}}$ adjusts for small-sample bias in the between-group component (bias < 0.4% of observed T_B in all cells). $T_{B_{max}}$ is the maximum attainable between-group inequality given group sizes.

Appendix Table 7 Bootstrapped standard errors and 95% confidence intervals (1,000 replications)

Panel A: Total inequality (Theil index)

Year	Age group	n	Estimate	SE	95% CI
1982	Total	175,144	0.1432	0.0005	[0.1421, 0.1443]
1982	25-34	53,719	0.0992	0.0008	[0.0977, 0.1008]
1982	35-44	62,658	0.1218	0.0008	[0.1204, 0.1234]
1982	45-54	58,767	0.1914	0.0011	[0.1892, 0.1936]
2017	Total	97,909	0.1245	0.0007	[0.1231, 0.1258]
2017	25-34	16,413	0.1092	0.0015	[0.1065, 0.1120]
2017	35-44	38,028	0.1077	0.0010	[0.1059, 0.1097]
2017	45-54	43,468	0.1331	0.0010	[0.1310, 0.1351]

Panel B: Between-group inequality (T_b)

Year	Age group	n	Estimate	SE	95% CI
1982	Total	175,144	0.0287	0.0003	[0.0282, 0.0295]
1982	25-34	53,719	0.0200	0.0004	[0.0192, 0.0209]
1982	35-44	62,658	0.0196	0.0004	[0.0189, 0.0205]
1982	45-54	58,767	0.0374	0.0007	[0.0361, 0.0389]
2017	Total	97,909	0.0326	0.0004	[0.0318, 0.0334]
2017	25-34	16,413	0.0383	0.0009	[0.0367, 0.0404]
2017	35-44	38,028	0.0243	0.0005	[0.0234, 0.0255]
2017	45-54	43,468	0.0283	0.0006	[0.0272, 0.0295]

Panel C: Within-group inequality (T_w)

Year	Age group	n	Estimate	SE	95% CI
1982	Total	175,144	0.1145	0.0005	[0.1135, 0.1153]
1982	25-34	53,719	0.0793	0.0006	[0.0779, 0.0804]

1982	35-44	62,658	0.1022	0.0007	[0.1008, 0.1034]
1982	45-54	58,767	0.1540	0.0010	[0.1520, 0.1559]
2017	Total	97,909	0.0920	0.0005	[0.0909, 0.0929]
2017	25-34	16,413	0.0708	0.0010	[0.0689, 0.0726]
2017	35-44	38,028	0.0833	0.0008	[0.0818, 0.0848]
2017	45-54	43,468	0.1048	0.0008	[0.1031, 0.1064]

Note: Bootstrap confidence intervals are based on the percentile method.