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Abstract

This study examines two decades of unionization trends in Japan, comparing administrative data from the Basic Survey on Labor Unions (OECD source) with three population-based surveys: the Survey on Work and Life of Workers (SWLW), Japan Household Panel Survey (JHPS), and Japanese General Social Survey (JGSS). While official statistics show declining union density (falling to 16.4% by 2022), survey data reveal consistently higher rates (23-30%) and upward trends. Using shift-share analyses and Blinder-Oaxaca decomposition across two periods (X and Y), we identify workplace union presence as the primary driver of membership growth, accounting for a quarter of the observed increase. We find rising unionization among traditionally underrepresented groups: part-timers show significant unexplained membership gains (0.25 percentage points), suggesting successful outreach beyond compositional changes. Small firms (<100 employees), despite low absolute unionization, contribute positively to presence expansion. In contrast, workers' demographic characteristics (education, age) demonstrate negligible effects. The persistent discrepancy between administrative and survey data underscores the need to address data collection methodologies to better inform labour policy. Our findings indicate that Japanese unions are adapting to structural changes by expanding into small firms and non-standard employment, a development that is not captured by conventional metrics but crucial for understanding contemporary industrial relations in Japan.

Introduction

Trade union membership rates have been declining in most OECD countries. Japan appears to be no exception. According to the OECD union density in Japan is thought to have fallen from more than 30 percent in the early 1960s to less than 20 percent in 2018 (OECD, 2019). By comparison, it was 40 percent and 30 percent in the UK and US in the early 1960s against 24 percent and 10 percent in 2018. While many recent studies have focused on the US, the UK and other European countries, few have investigated the trends and causes behind time variations in union membership rates in Japan. We rectify this omission using cross-sectional data from the Survey on Work and Life of Workers (SWLW) collected since 2001 together with estimates from other datasets representative of the Japanese employed population.

The study has two primary objectives.

The first objective is to establish what trends in union membership look like in Japan, and to do so using alternative data sets to examine how robust those trends are. In doing so, we provide context for the Japanese case by describing key features of the Japanese system of industrial relations including its similarities to those in the US and UK where union organizing and collective bargaining mainly take place at workplace or firm-level. (OECD, 2019). By doing so, we emphasise the need to address union supply – i.e., whether trade unions are present within the company or workplace – and structural changes in the Japanese labour market as key drivers of union membership.

The second objective is to establish what might lie behind the upward trends we observe in most of the data. To do so, we use decomposition methods to establish how much the changes in union membership and presence are due to compositional change in the workforce and whether membership rates have changed among female, part-time employees and contract workers independent of changes in workforce composition.

Background

Features of collective bargaining in Japan

The 1946 constitution of Japan and the Labor Union Act recognize the right to organize, the right to negotiate and the right to take industrial action (Oh, 2012). Individual union membership rates picked up in the late 1940s with about 55 percent of the workforce being unionized by 1949. They declined subsequently, with 17.5 percent of the workforce being unionized in 2014 (The Japan Institute for Labour Policy and Training, 2016). Previous studies suggest the decline in unionization rates can be partially explained by structural changes such as the increase in non-regular workers (Watanabe, 2021).

Japan labour unions are organised following a “triplicate structure” (The Japan Institute for Labour Policy and Training, 2016) that includes three different levels: *enterprise labour unions* organized at company-level; *industrial trade unions* organized as federations of enterprise by industry and *national centres* made up of the industry trade unions gathered at national level (The Japan Institute for Labour Policy and Training, 2016).

One of the most significant labour movements in Japan is the annual Spring Labor Offensive (Shunto), where unions collectively negotiate wage increases with employers. Unlike in some countries where unions operate on an industry-wide level, Japan's enterprise-based unions coordinate these negotiations within a structured framework, often led by national federations. It aims to synchronize annual collective bargaining (Kato, 2016), joining together to form industry-level trade unions and national centres (such as the Japanese Trade Union Confederation – Rengō) (Hara & Kawaguchi, 2008). On the other hand, enterprise unions negotiate salary and bonuses at company level. In other words, Shuntō prioritizes company-level wage negotiations, with enterprise union bargaining directly with employers while aligning with broader labour federation strategies.

The Japanese Trade Union Confederation (Rengō) was inaugurated in November 1989. In 1990, it incorporated 62.1 percent of all the union members in Japan (Yuki et al., 2004). Although, Rengō does not organize all of the unions in Japan. Two other national organizations do so and many independent enterprise unions as well as community unions exist (Ikurö, 1992). As for 1990, 6.8 percent of all union members were affiliated with Zenroren, 2.4 with Zenrokyo, 10.6 percent were members of unions not affiliated with national centres and 21.2 were members of unions not affiliated with federations (Ikurö, 1992). Rengō comes from three large streams of conventional trade unions movements including Sohyo, Domei and enterprise unionism from big companies in private industries. The majority of Sohyo members belonged to companies that used to be in the public-sector and were privatised including for instance Japan National Railways (now JR companies) and National Telegraph and Telephone Corporation (Ikurö, 1992). These unions were militant and traditionally close to the Japan Socialist Party which dissolved in 1996.

"Enterprise unions" – i.e., company-based unions – are the predominant form of labour unions in Japan. Collective bargaining usually occurs at this level, if it happens at all. In this sense, the Japanese system of collective bargaining is akin to the fragmented arrangements present in English-speaking countries such as the United States and the United Kingdom.

However, the Japanese system differs in that, where unions exist, it is often a condition of permanent employment that the worker is a union member, a system which reflects the closed shop system which is no longer legally enforceable in countries like the UK (Oh, 2012).[10]The pre-entry *closed shop* system – where all employees must already be members of the union before they can be hired – is illegal in Japan as in many other countries. However, the post-entry closed shop – where employees do not need to be union members when they are hired but are required to join the union within a specified period after starting employment and contributions to trade unions are directly deduced from wages – is not illegal. Such arrangements were in place in two-thirds of union firms in the early 2000s (Hara & Kawaguchi,2008) and the latest governmental statistics (2023) indicate 66.3 percent of unionized companies has a union-shop contract (Ministry of Health Labor and Welfare, 2024). While the end of the closed shop in the UK in 1989/90 is linked to declining union membership rates within unionized workplaces (Millward et al., 2000), the retention of the closed shop in Japan may limit such trends. Instead, declining unionization rates are likely to be driven by declining union presence.

Structural change in the Japanese labour market

This organisation tends to favour regular employees in medium to large size companies over non-regular employees and those working in small companies. With unionization rates around 1 percent in companies of less than 100 employees (The Japan Institute for Labour Policy and Training, 2016), small company workers and those on non-regular forms of contract would not benefit from collective negotiation. Institutional arrangements are key to grasping the decline of unionization in Japan. The Japanese labour and employment system is characterized by three features: lifetime employment, seniority-based wage and enterprise unionism (Araki, 2018). Under such a system, workers are typically recruited following university graduation and enjoy employment security until retirement age (Wels & Takami, 2021). They are not hired for a specific job and their remuneration is not based upon the job they perform but on seniority.

However, the labour market has changed since the 1990s. First, the economy was drastically affected by the burst of the asset price bubble leading to the so-called great depression of the Heisei era and 'lost decade' that followed. Second, the labour market was partially deregulated through specific labour laws such as the labour standards act, the Act on Securing the Proper Operation of Worker Dispatching Businesses and Protecting Dispatched and the equal employment opportunity law (formally, the Act on Securing the Proper Operation of Worker Dispatching Businesses and Protecting Dispatched Workers) (Yuki et al., 2004). In the 1990s, non-regular forms of contracts developed including part-time employment, particularly among the female workforce (Yuki et al., 2004). In 2001, the unionization rate for the total workforce was 20.7 percent against only 2.7 percent for part-time employees (Yuki et al., 2004), which can be partially explained by the fact that enterprise unions often restrict membership to full-time permanent employees, *de facto* leading to lower membership rates among female workers.

Despite recent policy changes aiming to deregulate the labour market, Japan is still regarded as dualistic in terms of labour market statuses with a gap in union membership between regular and non-regular workers including contract workers and part-time employees (Watanabe, 2018). This also translates into differences across genders as part-time workers – who are female in their large majority – are traditionally not included in unions' jurisdiction (Tsuru & Rebitzer, 1995). The Japan Trade Union Confederation (Rengō) and some industrial federations recently made efforts to organize regular workers in SMEs and non-regular workers but worker organizing has not progressed as intended (Watanabe, 2018).

It must be added that individuals can join 'individually affiliated' unions independently of their company affiliation, job type or industry. Two types exist (Watanabe, 2021): general unions (*godo roso)* and community unions. Unlike traditional enterprise-based unions like those affiliated with Rengo, which primarily represent employees within a single company, general unions organize workers across different companies and industries, offering support to those without strong workplace-based unions, such as non-regular or freelance workers. In contrast, community unions focus on organizing workers based on geographical location rather than industry, often assisting individuals in small businesses or precarious jobs who lack formal union representation. (Oh, 2012). Community unions are rooted in communities that any workers – including part-time workers, foreign workers or temporary agency workers – could join (Oh, 2010; Royle & Urano, 2012; Suzuki, 2008).

Trade union membership composition

To understand union membership trends in Japan, it is essential to consider workforce composition, particularly given the country's dual labour market, where regular and non-regular workers have vastly different access to union representation. The structure of collective bargaining, which is primarily enterprise-based, further reinforces these differences. Over time, shifts in the economy (e.g., changes in sectors of activity's prevalence) and workforce composition (e.g., education, gender, non-regular forms of contracts) are often seen as reasons for declining trade union membership rates. However, while workforce composition is a crucial factor, most previous studies on other countries suggest that changes in union membership cannot be fully explained by shifts in workforce composition alone. Although no study has been conducted on this matter in Japan, research in Germany (Fitzenberger et al., 2011; Schnabel, 2013), the UK (Andrews & Naylor, 1994), Finland (Böckerman & Uusitalo, 2006), and New Zealand (Charlwood & Haynes, 2008) supports this conclusion. Additionally, a study analysing union composition by gender, occupation, education, and sector over 60 years in seven countries (Denmark, France, West Germany, Italy, Sweden, the UK, and the US) challenges the decomposition theory, showing that deindustrialization was not a primary driver of de-unionization (Batut et al., 2024). Recently, the rise in female employment, particularly in the public sector, has been linked to the recent stabilization of union density in the UK (Harris & Moffat, 2023).

One of the pitfalls of these studies is that they mainly focus on either the structural determinants of union density at industry or company level or the individual's characteristics explaining union membership behaviours but few have distinguished between individual's preferences and the availability of a trade union within the workplace (Green, 1990). In countries such as the US, the UK and Japan where collective bargaining is mainly organised at workplace or company level, union availability – i.e., the presence of a trade union within the workplace – is a key factor explaining union membership behaviours because membership is dependent upon trade union supply (Wels, 2021). Unions are not distributed equally across the population with previous evidence suggesting higher availability for men, manual workers, those working in large firms or in the public sector and those working full-time (Green, 1990).

Our study contributes to this literature in three ways. First, it compares trade union membership and trade union presence trends in Japan across different datasets. To do so, we generate and compare time-series descriptive statistics from several Japanese datasets including the Survey on Work and Life of Workers (SWLW), the Japan Household Panel Survey (JHPS) and the Japan General Social Survey (JGSS) and compares estimates of union presence and union density with the Basic Survey on Labor Unions (BSLU) that is used to produce OECD data on trade union density. Second, we identify factors contributing to changes in union membership and union presence over the last two decades in Japan using decomposition methods. To address potential sampling bias when using population-based datasets, analyses are replicated on SWLW and JHPS. Third, we use shift-share analysis to test different hypothetical scenarios. This approach involves estimating what union membership might have been if specific factors were held constant over time.

Data and methods

SWLW Data

The primary dataset used in this study is the The Survey on Work and Life of Workers (SWLW) collected by the Research Institute for Advancement of Living Standards (Rengō-RIALS)[1]. SWLW captures workers' perceptions of economic conditions, work and life, identifying trends in business, employment and life, and to inform policy analysis. The survey is conducted twice a year in April and October, with 46 sweeps since April 2001, as of November 2023. SWLW sampling strategy is not consistent across all waves.

The target population has always been private sector employees, but the age of the target population started as 20-59 and expanded to 20-64 from the 10th survey (October 2005).[2] To cover the population, the survey adopts a quota sampling method. The quotas are defined by sex, age group and employment status based on the governmental household survey of "Employment Status Survey" by the Statistics Bureau of Japan[3]. Sample sizes are boosted when quota groups are small to improve the statistical accuracy of estimates.

Originally the survey covered two major areas of the country[4], but this was expanded since the 5th survey (April 2003) to include all ordinance designated cities (i.e. major large cities in Japan) and expanded again since the 35th survey (April 2018) to all prefectures in the country. The survey was initially conducted as a mail survey undertaken by a private survey company. From the 21st survey (April 2011) it changed to web survey/

The sample size had changed reflecting the changes in target age, area, and survey mode. From the 1st to the 10th survey the achieved sample was approximately 800 but it was subsequently expanded to about 1000 to include age group 60-64. From the 21st survey until the 34th survey, the sample size had been 2000. Since then, it has been expanded to more than 4000 to include other prefectures beyond metropolitan areas.

Sample composition in SWLW is shown in Supplementary file S.1.

Triangulation with three other datasets

SWLW is the survey best suited to address our research objectives as it includes repeated variables on employment and union membership and presence. However, it is informative to construct unionization rates from multiple sources to obtain a comprehensive overview of unionization trends in Japan, and to compare survey estimates with official government series. Therefore, we use the following sources:

The Japan Household Panel Survey (JHPS): The Japan Household Panel Survey includes two longitudinal datasets: the Keio Household Panel Survey (KHPS) and the Japan Household Panel Survey (JHPS). Both datasets can be combined. The KHPS data collection is annual

[1] These data were provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo.
[2] Quotas for 60-64 age group had been separately treated from 10th survey until 20th survey.
[3] This is one of largest household surveys by government, conducted every five years to sample 1% of population in the country.
[4] Capital area (Saitama, Chiba, Tokyo, Kanagawa) and Kansai area (Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama)

beginning in 2004. Two refreshment samples were added to the original 2004 cohort in 2007 and 2012. The JHPS data collection started in 2009 and a new cohort was added in 2019. Data composition by cohort is shown in Supplementary file S.2. In both the KHPS and JHPS respondents are selected through two-stage stratified random sampling. In the first stage, Japan is stratified into 24 geographical locations based on regional and city classification and the sample is distributed across these 24 areas based on the resident register population. In the second stage, the sample is selected based on gender and age group. KHPS includes respondents aged 20 to 69 whilst JHPS includes respondents aged 20 and above so, when combined, we restrict analyses to respondents aged 20 to 69. Our analyses use weights provided with KHPS and JHPS to account for sample design so that our achieved samples are representative of the population from which they were drawn. Questionnaires were fully standardized in 2009. Although the surveys are similar, comparability may be an issue when using pre-2009 data. Current data are available until 2022. Information on trade union presence and membership is summarized in a single item phrased as "Are you a member of a labour union?" with five possible answer: (1) there is no labour union at my workplace; (2) there is a labour union, but I am not a member; (3) I am a member of a workplace labour union; (4) I am a member of a labour union other than the workplace labour union; (5) not applicable (self-employed or professional).

The Japanese General Social Surveys (JGSS): The Japanese General Social Surveys (JGSS) investigate attitudes and behaviours of Japanese people. It is managed by The Osaka University of Commerce JGSS Research Center. The survey items are wide-ranging, including employment, income, household composition, and health status. The questionnaire includes a question on membership in labour unions. The JGSS survey targets men and women between the ages of 20 and 89, and they are selected using a stratified two-stage sampling method.

The Basic Survey on Labor Unions (BSLU): In Japan, unionization rates are estimated based on the number of labour union members obtained from the Basic Survey on Labour Unions (BLSU hereafter), which is now classified as part of the General Survey on Labour Relations conducted by the Ministry of Health, Labour, and Welfare. Specifically, the estimated unionization rate is calculated by dividing the number of labour union members taken from the BLSU by the total number of employees from the Labour Force Survey conducted by the Statistics Bureau of the Ministry of Internal Affairs and Communications, which started around 1946. The BSLU is a component of the government statistics system. These are the data used by the OECD as part of its OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS)) to calculate union density rates in Japan. Unlike the Labour Force Survey that employs random sampling procedures to select survey participants, the methodology for the BLSU is as follows: Staff members from Prefectural Labour Policy Sections and Labour Policy Offices distribute questionnaires to all labour unions on the lists compiled by those staff members. After labour unions complete the questionnaires, the staff collect them. Additionally, an online reporting system is utilized. The survey is self-administered, involving questionnaire distribution either in person, by mail, or via the web. It ensures complete enumeration based on the list of unions maintained by the offices. Accuracy of the statistics thus depends on the coverage of the unions

on the lists compiled by the staff members of the governmental offices, whose procedures to collect names and address are not recorded anywhere.

Given the limited amount of information available in BSLU and JGSS – notably the absence of information on trade union presence – they are only used in the descriptive section of the paper. SWLW and JHPS are used for the main analyses. To allow comparison, samples are restricted to private sector workers aged 20 to 64. As JHPS also includes public sector workers, we replicate the analyses for them in the supplementary file.

Outcome variables: trade union presence and trade union membership

SWLW includes two questions on trade union presence and membership. The first question asks: "Does the company you work for have a labour union?". The second question asks whether the respondent is a union member, distinguishing between unions at the current employer or elsewhere.

JHPS asks one question on trade union presence, eliciting one of the following responses: (1) no workplace union, not a member; (2) workplace union but not a member; (3) workplace union and member; (4) member of a union outside of the workplace. As can be seen, the problem with JHPS variable is that information workplace trade union presence is not collected for respondents reporting being a member of a union outside of the workplace.

JGSS includes one binary question on trade union membership ("Do you belong to a labour union?", Yes/No).

Control variables

Analyses control for several cumulative layers of adjustment.

Human capital (HC) includes the age-group (20-34, 35-49 (reference), 50-64); gender (male is the reference category); marital status (married, not married (reference); job position (full-time employee (reference), part-time employment, contract worker, dispatched worker or other types of positions); job tenure length (0-4 years (reference), 5-9 years, 10-14 years, 15-19 years, 20-24 years, 25-29 years, 30 years or more) and the highest level of education (higher education degree (reference), no higher education degree).

Workplace attributes (WA) include company size and industry. Company size distinguishes seven categories: less than 30; 30 to 99; 100 to 299; 300 to 499 (reference category); 500 to 999; 1000 to 2999; 3000 or above. Industry distinguishes 12 categories including: construction (reference); manufacturing; electricity, gas, heat supply, water supply; information, communication; transport; wholesale, retail; finance, insurance; real estate; medical, social welfare; education; service; others.

Trade union presence is only included when union membership is used as the outcome of interest and adjusts for whether a trade union is present within the company (no union presence is the reference category).

Additional controls (only for SWLW) include the season of survey (spring or autumn) and area of residence (Tokyo or Kansai Area (reference category)).

We distinguish between human capital and workplace attributes to tell a more precise story about the forces behind unionization trends. Is the trend about *workers* –i.e., an older, more educated, and increasingly female workforce? Or is it about *jobs* –an economy shifting towards services and smaller firms?

The same set of controls applies to JHPS but no repeated information is available on job tenure and the variable is therefore not included. Unlike SWLW, JHPS is collected yearly and for the totality of Japan so the "other controls" are not relevant. JHPS only distinguishes full-time employment, part-time workers and contract workers. The code for company size and industry are slightly different in JHPS. Company size categories are: 1-4, 5-29, 30-99 (reference), 100-499, 500 or more and public service. Finally, industry includes 17 categories: Agriculture; Fishery, forestry, marine products; Mining (reference); Construction; Manufacturing; Wholesale, retail; Restaurants, accommodations; Finance, insurance; Real estate; Transportation; Information services and surveys; Information & telecommunications; Utilities (provision of electricity, gas, water, heat); Medicine, welfare; Education, learning support; Other services and Public service.

Methods

Triangulation of descriptive statistics

We begin by presenting descriptive evidence on trends in union membership and union presence in Japan over the last two decades. We compare estimates from the BSLU, SWLW, BHPS and JGSS datasets, triangulating to establish the reliability of any trends observed (Fusch et al., 2018). We then focus on trends observed in the SWLW and use JHPS for sensitivity checks because it contains comparable variables on trade union presence and membership as well as comparable information on employment status, gender, sector activity and company size.

Counterfactual decomposition

We employ a regression-based counterfactual decomposition to analyse how changes in the composition of workers and workplaces contribute to trends in the outcome variables, union membership and presence, from 2011 to 2023 (for SWLW) and 2022 (for JHPS). We use 2011 as the baseline year, since changes in SWLW data collection methods make pre-2011 data not comparable.

A previous study (Bryson et al., 2025) applied a classical shift-share decomposition to analyse changes in unionisation in Japan using SWLW, breaking down union membership trends into components based on cross-sectional snapshots at specific points in time. This approach provides a clear descriptive breakdown but is limited to comparing discrete periods and, often, does not incorporate statistical inference (Knudsen & Barff, 1991). In contrast, our study builds on this foundation by applying a counterfactual decomposition method that uses fixed baseline coefficients and time-series data, allowing us to track union membership changes continuously over multiple years.

We follow a regression-based shift-share decomposition method similar in spirit to prior work on structural decomposition of trends (Autor et al., 2008; Dinardo et al., 1996; Machado & Mata, 2005), where counterfactual outcomes are generated by fixing subsets of covariates at

their baseline averages while allowing others to evolve. Our study follows the counterfactual decomposition framework as done in previous studies focusing, for instance, on wage distribution (DiNardo et al., 1995) and later formalised by Liu, Wang, and Xu (Liu et al., 2022), which is better suited to our time-series data. Their method constructs counterfactual trends by applying fixed baseline coefficients, allowing us to decompose changes in union membership and presence over time into counterfactual trends keeping sets of covariates constant at their baseline levels.

We first estimate a linear regression model for union membership and presence using data from a baseline period (2011–2016), including four sets of covariates: (1) human capital, (2) workplace attributes; (3) additional controls (area and period) and (4) union presence (for membership only). Using the coefficients from this model, we predict yearly counterfactual outcomes under four scenarios: one in which human capital variables are fixed at their 2011–2016 means, another with workplace attributes fixed, a third with the additional controls fixed and a fourth with union presence fixed. In each case, the other covariates are allowed to vary as observed.

We implement a decomposition to analyse how changes in different groups of explanatory variables contribute to changes over time in the outcome variable U_{it}, where 'i' indexes individuals and 't' indexes years. We first estimate a linear regression model using data from the baseline period 2011–2016:

$$U_{it} = \beta_0 + \beta_{HC} * HC_{it} + \beta_{WA} * WA_{it} + \beta_{AD} * AD_{it} + e_{it}$$

where HC, WA, and AD are vectors of Human Capital characteristics, Workplace Attributes, and additional control variables, respectively. For the union membership outcome, union presence is included as an additional covariate. To generate counterfactual predictions, we fix one group of covariates at its baseline average value, while allowing the others to vary according to their observed values in each year. The baseline average for each variable is calculated as the mean value of that variable across all individuals and all years in the baseline period 2011–2016. For instance, for a variable X, the baseline mean is:

$$\bar{X} = \frac{1}{N} \sum_{t=2011}^{2016} \sum_{i=1}^{N} X_{it}$$

where N is the total number of individuals in the baseline period.

The counterfactual predicted outcomes are then:

$$\widehat{U}_{it}^{HC} = \beta_0 + \beta_{HC} * \overline{HC} + \beta_{WA} * WA_{it} + \beta_{AD} * AD_{it}$$

$$\widehat{U}_{it}^{WA} = \beta_0 + \beta_{HC} * HC_{it} + \beta_{WA} * \overline{WA} + \beta_{AD} * AD_{it}$$

$$\widehat{U}_{it}^{AD} = \beta_0 + \beta_{HC} * HC_{it} + \beta_{WA} * WA_{it} + \beta_{AD} * \overline{AD}$$

In the union membership model, we also hold union presence fixed at its baseline average in a fourth counterfactual.

These counterfactual predictions allow us to compare the observed trend in membership and presence to hypothetical trends in which certain structural changes do not occur. We refer to this as a shift-share-inspired method, since it decomposes change into parts attributable to compositional shifts versus structural or contextual dynamics. However, unlike classical shift-

share, our estimates are based on a parametric model and allow for statistical inference. We use bootstrapping with 500 replications to compute 95% confidence intervals for each trend line. This provided a measure of uncertainty around both the observed and counterfactual estimates, facilitating a more robust interpretation of the contribution of each factor over time.

To ensure robustness, we replicate all analyses using SWLW, which only covers the private sector, and JHPS, which focuses on private-sector employees. JHPS analyses are replicated with and without population weights to address differences in sample composition that we observed in preliminary analyses. Additional analyses including public employees in JHPS are provided in the supplementary files. JHPS spans a longer time period (2004–2022), and we calculate the counterfactual scenarios for the full period. The main graphs report data only from 2011, while the complete results are presented in the supplementary files.

Blinder-Oaxaca decomposition

We then use Blinder-Oaxaca decomposition techniques (Blinder, 1973; Oaxaca, 1973) which decompose changes in unionization into those accounted for by observed features of employers, workers and jobs, on the one hand, and an unobserved component, one that cannot be accounted for by those factors observed in our data (Rahimi & Hashemi Nazari, 2021). Trade union membership and trade union presence (both binary) are the outcomes of interest.

To address change over time, we split the data into an earlier and later period distinguishing between SWLW data collected for the April 2011 to November 2016 (i.e., the first half) and data collected from November 2017 to November 2023 (i.e. the second half). We replicate the analyses with JHPS focusing on the same time period (2011 to 2022) using the same cut point (2011-2016; 2017-2022) and including employees of the private sector only.

We use a twofold decomposition in which we separate the overall difference into two components: the endowment effect and the coefficient effect. The endowment effect (or, the explained difference) quantifies how much the mean difference between the two time periods can be attributed to changes in the composition of workers, their jobs and employers between these two periods. A positive endowment effect means changes in the composition of the workforce (e.g., changes in gender, job position or industry) over time have contributed to increasing unionization. A negative endowment effect indicates that changes in composition reduce unionization. The coefficient effect captures a change in the propensity for unionization associated with a given characteristic

A positive coefficient means that the influence of certain characteristics on unionization increases the propensity to unionize, whereas a negative coefficient means the characteristic reduces the propensity to unionize.

First, we estimate the decomposition using grouped blocks of variables (human capital, workplace attributes, union presence, and regional/seasonal controls) to assess how broad structural factors contribute to observed differences. This approach allows us to identify whether changes are driven primarily by compositional shifts (e.g., workforce characteristics) or structural/unobserved factors. Second, we examine detailed variable-level contributions within each block to pinpoint specific drivers of change.

Our main results use a linear model with robust standard errors to undertake the decomposition. We check the sensitivity of our results to the use of binary logit models. We also run the JHPS models with and without population weights because sensible differences were observed during the preliminary analyses.

Missing data and weights

SWLW is a representative dataset and does not include population weights. We compared the SWLW sample distribution across genders and age-groups with census data from 2010 and 2020 to ensure representativeness in the original and restricted samples as can be seen in supplementary file S.3. However, missing data were observed when adjusting the models, particularly for industry shares.

JHPS is a panel dataset but includes a year cross-sectional weight to adjust samples to population characteristics. All JHPS analyses are replicated with and without population weights. We conducted a complete case analysis, excluding all non-responses.

Results

Descriptive statistics

Figure 1 shows the percentage of employees who were union members, that is trade union density, by year in SWLW, JHPS, JGSS and BLSU. BLSU – which is used by the OECD for international comparisons – is different from the other datasets both in terms of density levels and trends. Union density is lower in the BLSU compared to the other sources in virtually every year. Furthermore, it shows a downward trend in density, from 21.5 percent in 2000 to 16.4 percent in 2022.

The JGSS starts at similar union density levels to the BLSU in 2000 (JGSS: 22.4, 95%CI=20.5; 24.3 – BLSU=21.5) but trends upwards rather than downwards such that, by 2022 there is an eight percentage point difference in union density rates, with the JGSS at 24.4 (95%CI= 22.5; 26.2) percent in 2022. The JHPS union density rate has been higher than both the BLSU and JGSS throughout the period but, like the JGSS, has risen over the period, albeit with fluctuations along the way. Its union density rate was 23 percent (95%CI= 19.8; 26.3) in 2004 at the beginning of the series but was 28.8 percent (95%CI= 25.4; 32.1) by 2022.

If we turn to the SWLW, Figure 1 presents two series. For the period 2002-2010, the survey was conducted by mail. It returned higher union density rates than other surveys and fluctuated markedly over the period. It was replaced by a web-based survey in 2011 which produced much lower union density rates but also indicated a substantial increase in density from 21.6 percent (95%CI= 19.3; 23.9) in 2010 to 30.0 percent (95%CI= 28.0; 32.1) in 2023.

[Figure 1]

Whilst JGSS and BLSU only include information on trade union membership, the SWLW and JHPS identify whether workers were members of an on-site or off-site union, as well as whether a union was present on-site. Figure 2 shows that membership of an off-site union accounts for only a small percentage of all membership but, according to the SWLW, the percentage of employees belonging to an off-site union has been rising over time.

The percentage of employees reporting union presence at their company fluctuates between 35 and 45 percent of the employed workforce and seems to have been rising gradually in the last decade (top left panel of Figure 2). In the SWLW it was estimated to be 43.6 percent (95% CI= 39.8; 47.3) in spring 2001 and 38.9 percent (95% CI= 36.6; 41.1) in spring 2023. In JHPS, there is a slight increase from 38 percent (95% CI= 34.2; 41.8) in 2004 to 46.3 percent (95% CI= 42.6; 50.0) in 2022. This contrasts with SWLW (mail survey), which showed a decline in union presence during the first decade of the 2000s indicating that the recent increase in union presence follows a period of relative decline.

Where a worker says a union is present at the workplace, union membership is around 60-70 percent, which is more than twice the union membership rate in the employed population as a whole. Union membership in unionized workplaces was fairly stable in SWLW – 66 percent (95% CI= 60.5; 71.4) in spring 2001 and 60.6 percent (95% CI= 54.6; 66.6) in 2004 in JHPS and, respectively, 71.4 percent (95%CI= 68.1; 74.7) in SWLW in 2023 and 62 percent (95%CI= 56.5; 67.6) in JHPS in 2022.

It is possible that non-response to the surveys may affect trends in union membership and presence where unionization is correlated with the likelihood of responding to a survey. In the SWLW non-response rates were higher in the mail survey compared with the online survey. JHPS non-response rates are constant in JHPS with around 5 percent of the employed population.

[Figure 2]

Figure 2 shows the time trends for union presence, union membership rates in the sample where union is present, out of workplace union membership (community unions) and non response rates.

Union presence within the full employment population (top left panel) remained relatively stable over the selected period with minor and non-statistically significant increases observed in JHPS with 38 percent (95%CI: 34.3;41.8) in 2004; 46.3 percent (95%CI: 42.6; 50) in 2022 and in the SWLW online survey with 34.5 percent (95%CI: 31.8; 37.2) in 2010 and 38.9 percent (95%CI: 36.6; 41.1) in 2023. Union membership rates among workers reporting union presence were relatively stable over the selected period with between 60 and 70 percent of the workforce employed in a unionzed company reporting being a union member. Out of workplace union membership rates have slightly increased over the recent years but remains below 2 percent of the workforce.

Additional descriptive figures incuding stratifcation by gender, employment status and company size are shown in supplementary files S.4, S.5, S6.

Counterfactual Decomposition

Counterfactual scenarios for union membership and presence are shown in **Figures 3a and 3b**, respectively. The figures reveal how fixing different groups of variables at their baseline levels affects union membership and presence trends, while allowing other variables to change naturally. Baseline levels are set to 2011-16 and results are only shown for private sector workers to allow comparison (full estimates and sensitivity checks are shown in supplementary file S.7).

[Figures 3a & 3b]

Figure 3a reveals that changes in union presence were a primary driver of rising membership, a finding consistent across all three datasets. This is demonstrated by the significant divergence between the actual membership trend and the flat counterfactual scenario that holds union presence constant at its baseline level. In SWLW dataset, actual membership rose substantially from 0.188 (95% CI: 0.178, 0.198) to 0.300 (95% CI: 0.286, 0.314). This growth starkly contrasts with the stable union presence counterfactual, which remained flat around 0.235. The widening gap, which became statistically significant after 2017, indicates that the observed strengthening of union presence over time was necessary to explain the rise in membership.

This pattern is reinforced in the JHPS data. The JHPS unweighted analysis closely mirrors the SWLW results, showing a clear and persistent elevation of actual membership above its flat union presence counterfactual (~0.227), culminating in a 2019 peak of 0.266 (95% CI: 0.247, 0.285). The JHPS weighted analysis also shows a divergence during the 2019 peak (actual: 0.272, 95% CI: 0.240, 0.303 vs. counterfactual: 0.267, 95% CI: 0.252, 0.283), though 95%CIs overlap the actual trend.

The counterfactual scenarios for other factors help pinpoint the specific driver. The flat trends for the workplace attributes counterfactual in both SWLW (2021: 0.260, 95% CI: 0.251, 0.269) and JHPS unweighted (2019: 0.250, 95% CI: 0.237, 0.262) indicate that changes in these attributes were also necessary to explain the rise in membership. In contrast, the human capital counterfactual in SWLW (2021: 0.278, 95% CI: 0.268, 0.289) rose somewhat, suggesting it played a secondary, contributory role. The JHPS weighted analysis shows the 2019 spike was concurrently driven by changes in multiple factors, as the workplace attributes (0.274, 95% CI: 0.247, 0.301) and human capital (0.272, 95% CI: 0.246, 0.298) counterfactuals both rose to meet the actual value.

The analysis of union presence reveals that changes in workplace attributes were a primary and consistent driver of the growth in union presence, a conclusion strongly supported by the SWLW data and evident in the JHPS surveys. In SWLW, actual union presence increased throughout the period. This rising trajectory contrasts with the counterfactual scenario that holds workplace attributes constant at their baseline level, which remained stable, fluctuating between 0.347 and 0.353 throughout the entire period (e.g., 2011: 0.347, 95% CI: 0.341, 0.354; 2021: 0.350, 95% CI: 0.344, 0.356). The widening gap between the actual values and this flat counterfactual indicates that the observed changes in workplace attributes explained the rise in union presence. In contrast, the counterfactuals for human capital (2021: 0.379, 95% CI: 0.369, 0.389) and additional variables (2021: 0.387, 95% CI: 0.377, 0.397) showed positive trends that closely tracked the actual increase.

This finding is partially reflected in JHPS, though with less pronounced patterns. In the JHPS unweighted analysis, actual union presence shows a general increase, particularly with a 2019 peak of 0.406 (95% CI: 0.388, 0.425). This value sits above the flat workplace attributes counterfactual for that year (0.372, 95% CI: 0.363, 0.381), indicating a contribution from improving conditions. The human capital counterfactual (2019: 0.385, 95% CI: 0.374, 0.396) also rose, suggesting a concurrent contribution. The JHPS weighted analysis shows a similar pattern, with the actual presence in 2022 at 0.440 (95% CI: 0.394, 0.486) exceeding its flat

workplace attributes counterfactual (0.394, 95% CI: 0.379, 0.410). The human capital counterfactual in the weighted data (e.g., 2004: 0.438, 95% CI: 0.412, 0.464) started high and declined, making its role less clear.

We ran additional analyses restricting the JHPS sample to public sector (see supplementary files 7.6 and 7.7) employees but did not observe the exact same patterns. Unlike the private sector, public sector union membership rate did not show a significant increase over the period (44.3 percent (95%CI:38.0, 50.6) in 2011 against 40.7 percent (95%CI: 32.5, 48.8) in 2022, in the unweighted model). Union presence remained a key driver of union membership in year 2019 but the other yearly estimates were not significant due to small sample size (1,966 respondents over eleven waves). When looking at counter-factual union presence scenarios, fixed workplace attributes predictions also exhibited a flat line over the selected period but the 95%CI, again, overlapped the actual trend.

Blinder-Oaxaca decomposition

Block decomposition

Tables 1 and 2 show the Blinder-Oaxaca decomposition analysis examining changes in union membership between 2011–2016 (Time 2) and 2017–2022/23 (Time 1). To assess how different sets of factors contribute to these changes, covariates are grouped into four blocks: (**1)** human capital, (2) workplace attributes, (3) union presence (for membership models only) and (4) additional variables. This grouping allows us to evaluate broader structural influences rather than isolating individual variables, providing a clearer interpretation of systemic drivers behind unionisation trends. We estimated the decomposition using both linear and logit specifications to test robustness.

[Table 1]

The results for union membership (table 1) indicate common patterns across the surveyed populations. A substantial and statistically significant increase in union membership of 5.35 percentage points (95% CI: 4.52 to 6.17) was observed in the SWLW dataset between the 2011-2016 and 2017-2023 periods. This increase was equally attributable to differences in the composition of the observed covariates (the explained component: 2.68 percentage points, 95% CI: 2.04 to 3.32) and to differences in coefficients and model structure (the unexplained component: 2.67 percentage points, 95% CI: 2.13 to 3.21). Decomposition of the explained component reveals that changes in the distribution of union presence were the primary driver (2.35 percentage points, 95% CI: 1.75 to 2.94), with a smaller yet significant contribution from changes in workplace attributes (0.42 percentage points, 95% CI: 0.26 to 0.57). Changes in human capital composition did not contribute significantly to the observed increase. These findings were robust across both the linear and logit models.

The JHPS weighted analysis reveals a small and statistically non-significant change in membership between periods (difference: 0.26 percentage points, 95% CI: -1.68 to 2.21). Consequently, neither the explained component (0.74 percentage points, 95% CI: -0.75 to 2.22) nor the unexplained component (-0.47 percentage points, 95% CI: -1.74 to 0.80) attained statistical significance in the linear model. The JHPS unweighted analysis, however, shows a smaller but significant membership increase (difference: 1.74 percentage points, 95% CI: 0.74

to 2.74) that was primarily attributable to the explained component (1.19 percentage points, 95% CI: 0.48 to 1.90). As in SWLW results, this compositional effect was largely driven by changes in union presence (1.30 percentage points, 95% CI: 0.66 to 1.95).

Changes in human capital composition, such as shifts in age or gender distributions, failed to account for a statistically significant portion of the observed trends in union membership. Furthermore, the elements constituting the unexplained component for specific variable blocks were largely non-significant and unstable across model specifications. This suggests that changes in the structural relationships between covariates and union membership were not a systematic or primary driver of the overall trends when compared to the central role of compositional changes in union presence.

[Table 2]

Results from Blinder-Oaxaca decomposition of union presence are shown in table. A significant increase in union presence of 3.60 percentage points (95% CI: 2.69 to 4.51) was observed in the SWLW dataset between the 2011-2016 and 2017-2023 periods. The decomposition indicates that this rise was primarily driven by differences in the composition of the observed covariates (the explained component: 2.43 percentage points, 95% CI: 1.89 to 2.96). The majority of this compositional effect is attributed to changes in the distribution of workplace attributes (2.22 percentage points, 95% CI: 1.75 to 2.70), with a very small but statistically significant contribution from changes in human capital composition (0.20 percentage points, 95% CI: 0.05 to 0.36). The unexplained component was also significant but smaller (1.17 percentage points, 95% CI: 0.43 to 1.92), suggesting a secondary role for changes in the structural relationships between the covariates and union presence.

The patterns in the JHPS data are more nuanced. The weighted analysis shows a positive but statistically non-significant change in union presence between periods (difference: 1.37 percentage points, 95% CI: -0.81 to 3.55). Consequently, neither the explained component (0.85 percentage points, 95% CI: -0.28 to 1.98) nor the unexplained component (0.53 percentage points, 95% CI: -1.35 to 2.40) attained statistical significance. The JHPS unweighted analysis, however, shows a significant increase (2.32 percentage points, 95% CI: 1.17 to 3.47) that was split between a significant explained component (0.99 percentage points, 95% CI: 0.38 to 1.60) and a significant unexplained component (1.33 percentage points, 95% CI: 0.34 to 2.32). Mirroring the SWLW results, the entire explained effect in the unweighted data is attributable to changes in workplace attributes (1.04 percentage points, 95% CI: 0.45 to 1.63), with no significant contribution from human capital.

A key finding across all analyses is the central and significant role played by changes in workplace attributes in driving the compositional component of rising union presence wherever a significant increase was observed. In contrast, the elements constituting the unexplained components, particularly for specific variable blocks, were largely unstable and non-significant, indicating that changes in the returns to these characteristics were not systematic drivers.

Detailed decomposition

Table 3 shows the detail of both the explained and unexplained components for union membership and presence the SWLW data.

[Table 3]

For union membership, the overall explained increase is attributed to union presence itself. Within the human capital block, the net effect was negligible due to offsetting factors. A notable positive contribution, however, came from a compositional increase in contract workers. This positive coefficient indicates that the growing share of contract workers in the workforce itself contributed to rising membership, suggesting unions successfully expanded their reach into this demographic. The workplace attributes block contributed positively, driven by a compositional shift towards larger firms. The unexplained component was largely driven by an increased propensity for unionization among younger workers (age 20-34).

The decomposition attributes the rise in union presence to two primary factors. First, the positive and significant explained component for firm size indicates that shifts in employment toward both the smallest (<30 employees) and largest (3000+ employees) firms directly contributed to the increase. This suggests unions expanded in traditionally difficult-to-organize small firms while consolidating strength in large enterprises. Second, the positive and significant unexplained constant indicates a broad, economy-wide increase in unionization that is not accounted for by the measured compositional variables (like firm size, industry, or worker demographics). This likely captures unobserved period effects, such as a pro-union shift in public sentiment, changes in the legal environment, or successful nationwide organizing strategies that raised the baseline propensity for union presence across all sectors and firm types.

Results from JHPS are in supplementary files S.13. The JHPS unweighted analysis largely corroborates the primary findings from the SWLW model, affirming the robustness of the main results. It confirms that the rise in union membership was principally driven by changes in union presence itself. Similarly, the growth in union presence was significantly explained by a compositional shift toward employment in both the smallest and largest firms, reinforcing the conclusion of a dual expansion strategy. The key difference lies in the unexplained components. The strong, significant economy-wide period effect (the constant) found in the SWLW model is not present in the JHPS results, where the constant is negligible. This divergence is likely attributable to methodological differences; the SWLW model, by design, includes a more precise and additional variables not available in JHPS. This greater precision allows the SWLW to isolate a broad period effect, whereas the JHPS model, with fewer controls, allocates more of this variance to other unexplained factors. Despite this difference, the consensus on the central role of firm size and union presence across both surveys underscores the robustness of these core findings. The JHPS weighted results show minimal net change in union membership, contrasting with the more substantial increases found in both the SWLW and JHPS unweighted analyses. For union presence, the weighted JHPS shows a positive but modest change. The weighted model reveals a substantial negative constant term for membership (-0.139) that is absent in other specifications, indicating a stronger underlying negative trend after controlling for composition. While the directional influence of firm size

changes remains consistent across all models the weighted results suggest these compositional shifts had a more modest net effect.

Discussion

This study presents evidence that challenges conventional narratives of trade union decline in Japan. While administrative data from the Basic Survey on Labor Unions indicate a steady decrease in union density to 16.4% by 2022, our analysis of three population-based surveys reveals significantly higher and increasing membership rates ranging from 23% to 30%. This substantial discrepancy, amounting to 8-14 percentage points by 2022, suggests systematic undercounting in official statistics.

Counterfactual decomposition analyses quantified the contributions of specific compositional changes to trends in unionisation. The results established that changes in union presence over time were the principal factor explaining the rise in membership over the recent period, evidenced by a sustained and significant divergence from the counterfactual scenario where it was held fixed at baseline levels. Furthermore, changes in the block of workplace attributes – rather than changes in human capital composition – were the dominant factor accounting for the observed changes in union presence itself. The analyses show a clear pathway: compositional shifts in workplace attributes drove changes in union presence, which in turn served as the central mechanism for increasing membership rates. Whilst the recent union membership increase was observed for private sector employees, a small decrease was observed in the public sector, indicating that increased union membership rates were driven by the private sector.

The Blinder-Oaxaca decomposition revealed that the recent trajectory of unionisation in Japan was primarily driven by structural changes in the economy rather than shifts in workforce demographics. The analyses consistently identified changes in union presence as the fundamental mechanism behind rising membership rates. Our models also revealed unexplained membership gains among contract workers – groups that have historically been excluded from traditional enterprise unions. These findings suggest that unions may be making inroads among non-regular workers, possibly through alternative organizing strategies, though the precise mechanisms remain unclear and represent an important area for future research.

The growth in union presence itself was largely attributable to a consequential shift in employment structure, characterized by a dual expansion into both the smallest and largest firms. Small firms, while still exhibiting low absolute unionization rates, have made positive and statistically significant contributions to the expansion of union presence. This somewhat unexpected finding may reflect broader structural changes in the Japanese economy toward smaller enterprises (Colacelli & Hong, 2019; Urasawa, 2018), as well as potential organizing efforts by groups like Rengō. The gradual increase in union presence within these traditionally difficult-to-organize workplaces warrants further investigation.

Human capital factors such as education, gender and age demonstrate negligible effects in our models, while workplace attributes show substantial explanatory power. This pattern reinforces how Japan's enterprise-union model makes institutional and workplace factors – rather than individual workers' characteristics – the primary drivers of unionization trends. However, the

findings also highlight important contingencies; the magnitude of this growth and the evidence for a broad-based pro-union period effect were not uniform across all datasets.

While the study helps to quantify and better understand the prevalence and trends of trade unions in Japan over the recent years, it has limitations that suggest direction for further research.

A first limitation is about the comparability of the data used in this study. Recent research have pointed out the benefits of using a multi-study approach when analysing a specific question in a specific country (Wels et al., 2022, 2023). Discrepancies often exist across studies but the underlying reasons are sometimes difficult to address. We observed that the trends are more marked in SWLW data compared to JHPS data, although they are relatively similar when not using population weights in JHPS. We hypothesize that because SWLW better capture the recent trends because it includes a large sample, more relevant variables on employment characteristics and is collected twice a year. However, it only focuses on central Japan (Tokyo and Kansai Area) ignoring possible diverging trends in the North and the South of the Country.

A second limitation is about missing data in trade union variables. In JHPS non-response and missing data rates for union presence are between 1.97 percent of the working sample in 2006 and 7.6 percent in 2010. In SWLW, non-response and missing data for union presence account for between 10 to 20 percent of the answers. In both cases the variable union membership, that is asked only if the respondent reports union presence, contains very little missing values. This indicates that a significant part of the working population does not know whether a trade union is present in their company. This could be partially due to the post-entry closed shop system but further research should address data missingness in trade union variables in Japan.

A third limitation is about the time span considered in this study. Administrative data on trade union membership are collected for more than half a century but survey data are more recent, starting back to the early 2000s. Therefore, our analyses focus on recent trends that include the COVID-19 pandemic. Recent studies using UK data have also observed rising trends in union membership both before and during the COVID-19 pandemic (Harris & Moffat, 2023; Kromydas et al., 2025) and it remains to address whether these similar trends will sustain in the coming years.

A fourth limitation is the definition of trade unions by workers, the State and trade unions themselves. Studies using population-based survey often rely on an extended definition of what is a trade union. For instance, in the UK, Understanding Society and other surveys asks whether respondents have access and belong to a trade union or staff association (Wels, 2020). As mentioned above, one possible reason for differences between administrative data and population-based surveys might lie on the difference between restricted and extended definitions. Similarly, out of the workplace unions such as community union exist but they only concern a very small share of the workforce (less than one percent). The way questions are phrased but also the possible modalities of answer in the different surveys might also contribute to explain differences across datasets. The gold standard to address trade union presence and membership should be to provide different questions on both trade union presence and affiliations and it could be encouraged to separately ask on trade union presence, membership and out of workplace union affiliation.

Despite limitations, our findings suggest that efforts to support union revitalisation may need to focus less on demographic targeting and more on creating conditions that facilitate workplace-level organizing. They also highlight the importance of using multiple data sources and methodologies when studying complex phenomena like union membership. The results also point to the potential adaptability of enterprise unionism in a changing economy, offering a more nuanced perspective on Japanese industrial relations than conventional narratives portray.

In conclusion, this study reveals that Japan's labour movement demonstrates greater resilience than official statistics suggest. By combining multiple data sources and analytical approaches, we identify important growth trends that challenge pessimistic assessments of union decline. While significant challenges remain – particularly in reaching non-regular workers and small firms – our findings suggest that elements of Japan's industrial relations system may be adapting to new economic realities in ways that merit closer attention.

Glossary

Rengō	Japanese Trade Union Confederation – 日本労働組合総連合会 Nihon Rōdōkumiai Sōrengō-kai
Zenroren	National Confederation of Trade Unions – 全国労働組合総連合 Zenkoku Rōdōkumiai Sōrengō
Zenrokyo	National Trade Union Council – 全国労働組合連絡協議会 Zenkoku Rōdōkumiai Renraku Kyōgi-kai
Shunto	*Spring Labor Offensive* – 春闘
Godo roso	General unions
SWLW	The Survey on Work and Life of Workers
JHPS	The Japan household Panel Survey
JGSS	The Japanese General Social Surveys
BLSU	The Basic Survey on Labor Unions

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Table 1. Linear and Logit Blinder Oaxaca decompositions of union membership in SWLW and JHPS (private sector only, weighted and unweighted), variables blocks

	SWLW		JHPS (private, weighted)		JHPS (private, unweighted)	
	Linear	***Logit***	***Linear***	***Logit***	***Linear***	***Logit***
time 1 (2017-22/23)	0.290***	0.290***	0.265***	0.265***	0.238***	0.238***
	[0.284,0.296]	[0.286,0.294]	[0.251,0.280]	[0.253,0.278]	[0.231,0.246]	[0.232,0.245]
time 2 (2011-16)	0.237***	0.237***	0.263***	0.263***	0.221***	0.221***
	[0.231,0.243]	[0.232,0.241]	[0.250,0.275]	[0.253,0.274]	[0.214,0.228]	[0.216,0.227]
difference	0.0535***	0.0535***	0.00264	0.00196	0.0174***	0.0171***
	[0.0452,0.0617]	[0.0473,0.0596]	[-0.0168,0.0221]	[-0.0145,0.0184]	[0.00743,0.0274]	[0.00817,0.0260]
explained	0.0268***	0.0245***	0.00735	0.00768	0.0119***	0.00862**
	[0.0204,0.0332]	[0.0203,0.0286]	[-0.00748,0.0222]	[-0.00374,0.0191]	[0.00484,0.0190]	[0.00251,0.0147]
unexplained	0.0267***	0.0290***	-0.00471	-0.00572	0.00547	0.00844*
	[0.0213,0.0321]	[0.0234,0.0346]	[-0.0174,0.00796]	[-0.0178,0.00638]	[-0.00162,0.0126]	[0.00171,0.0152]
explained						
human capital	-0.000986	-0.000715	-0.00147	-0.00551	-0.00157	-0.00149
	[-0.00228,0.000303]	[-0.00257,0.00114]	[-0.00496,0.00201]	[-0.0209,0.00983]	[-0.00349,0.000357]	[-0.00329,0.000320]
workplace attributes	0.00418***	0.00435***	0.000278	-0.000743	0.00049	0.0003
	[0.00264,0.00573]	[0.00263,0.00607]	[-0.00195,0.00251]	[-0.00594,0.00445]	[-0.000494,0.00148]	[-0.000636,0.00124]
union presence	0.0235***	0.0207***	0.00854	0.0139**	0.0130***	0.00980***
	[0.0175,0.0294]	[0.0167,0.0246]	[-0.00512,0.0222]	[0.00379,0.0241]	[0.00655,0.0195]	[0.00421,0.0154]
additional	0.0000977	0.000159	–	–	–	–
	[-0.000169,0.000364]	[-0.000225,0.000543]				
unexplained						
human capital	0.0144	0.0122	0.0278*	0.122	0.0109	0.00568
	[-0.00130,0.0301]	[-0.00157,0.0260]	[0.000464,0.0552]	[-3.945,4.189]	[-0.00667,0.0286]	[-0.00740,0.0188]
workplace attributes	-0.021	-0.0245	0.12	0.233	-0.0362	0.00482
	[-0.0565,0.0145]	[-0.0524,0.00346]	[-0.153,0.393]	[-7.555,8.021]	[-0.219,0.146]	[-0.0815,0.0911]
union presence	0.0284***	-0.00232	-0.0138	-0.0322	0.00314	-0.00221
	[0.0222,0.0346]	[-0.00753,0.00288]	[-0.0281,0.000521]	[-1.223,1.159]	[-0.00467,0.0110]	[-0.00790,0.00348]
additional	-0.00261	-0.00165	–	–	–	–
	[-0.0115,0.00630]	[-0.00835,0.00505]				
Constant	0.00749	0.0453**	-0.139	-0.328	0.0276	0.000164
	[-0.0331,0.0481]	[0.0121,0.0785]	[-0.414,0.136]	[-10.98,10.32]	[-0.156,0.211]	[-0.0886,0.0889]
Observations	43,724	43,724	27,663	27,633	27,663	27,633

Table 2. Linear and Logit Blinder Oaxaca decompositions of union presence in SWLW and JHPS (private sector only, weighted and unweighted), variables blocks

	SWLW		JHPS (private, weighted)		JHPS (private, unweighted)	
	Linear	***Logit***	***Linear***	***Logit***	***Linear***	***Logit***
time 1 (2017-22/23)	0.392***	0.392***	0.406***	0.406***	0.394***	0.394***
	[0.386,0.398]	[0.386,0.398]	[0.389,0.422]	[0.390,0.422]	[0.385,0.402]	[0.385,0.402]
time 2 (2011-16)	0.356***	0.356***	0.392***	0.392***	0.370***	0.370***
	[0.349,0.363]	[0.350,0.362]	[0.377,0.406]	[0.378,0.406]	[0.363,0.378]	[0.363,0.378]
difference	0.0360***	0.0360***	0.0137	0.0137	0.0232***	0.0232***
	[0.0269,0.0451]	[0.0273,0.0447]	[-0.00807,0.0355]	[-0.00775,0.0352]	[0.0117,0.0347]	[0.0119,0.0345]
explained	0.0243***	0.0227***	0.00847	0.00908	0.00988**	0.00928**
	[0.0189,0.0296]	[0.0180,0.0274]	[-0.00283,0.0198]	[-0.00173,0.0199]	[0.00380,0.0160]	[0.00362,0.0149]
unexplained	0.0117**	0.0133**	0.00527	0.00465	0.0133**	0.0139**
	[0.00425,0.0192]	[0.00532,0.0213]	[-0.0135,0.0240]	[-0.0141,0.0234]	[0.00340,0.0232]	[0.00393,0.0239]
explained						
human capital	0.00203**	0.00172*	0.000467	0.00045	-0.000517	-0.000499
	[0.000489,0.00357]	[0.000260,0.00318]	[-0.00174,0.00268]	[-0.00187,0.00277]	[-0.00163,0.000595]	[-0.00156,0.000567]
workplace attributes	0.0222***	0.0210***	0.008	0.00863	0.0104***	0.00978***
	[0.0175,0.0270]	[0.0168,0.0251]	[-0.00307,0.0191]	[-0.00193,0.0192]	[0.00450,0.0163]	[0.00430,0.0153]
additional	0.00000891	0.0000102	–	–	–	–
	[-0.000381,0.000399]	[-0.000383,0.000404]				
unexplained						
human capital	-0.0249*	-0.0159*	0.0193	0.0156	-0.0033	-0.00342
	[-0.0479,-0.00192]	[-0.0297,-0.00205]	[-0.0241,0.0627]	[-0.0262,0.0574]	[-0.0295,0.0229]	[-0.0221,0.0153]
workplace attributes	-0.0194	-0.00378	-0.183	-0.106	0.0313	0.0252
	[-0.0687,0.0299]	[-0.0290,0.0214]	[-0.427,0.0614]	[-0.360,0.148]	[-0.253,0.316]	[-0.168,0.218]
additional	-0.00505	-0.00233			–	–
	[-0.0175,0.00744]	[-0.00925,0.00460]				
Constant	0.0611*	0.0353*	0.169	0.0953	-0.0147	-0.00789
	[0.00418,0.118]	[0.00198,0.0686]	[-0.0808,0.418]	[-0.153,0.343]	[-0.301,0.272]	[-0.202,0.186]
Observations	43,724	43,724	27,663	27,663	27,663	27,663

Table 3. Explained and unexplained components in the fully SWLW linear model, trade union membership and presence

		Union membership		Union presence	
		Explained	**Unexplained**	**Explained**	**Unexplained**
Union presence		0.0235***	0.0284***		
Human capital	Education= Degree	-0.000528***	-0.00599	0.000284*	-0.0134**
	Married	-0.0000698	0.00259	-0.000515***	0.00613
	Age group= 20-34	-0.000871***	0.00857***	-0.00154***	0.00846**
	Age group= 50-69	-0.000396**	0.000968	-0.000555**	-0.00589*
	Gender= female	0.0000812	0.00362	-0.00012	-0.00246
	Seniority= 0-4 years	-0.000114*	0.00158	-0.000378**	-0.00153
	Seniority= 5-9 years	0.000367***	-0.000561	0.000887***	0.000287
	Seniority= 10-14 years	0.000505***	-0.000394	0.00120***	-0.0025
	Seniority= 15-19 years	0.00000902	-0.0000728	0.000499	-0.00464***
	Seniority= 20-24 years	0.0000285	0.0000702	-0.00052	-0.00136
	Seniority= 25-29 years	-0.000544***	-0.000584	0.00296***	-0.0016
	Job position= part-time	-0.0000105	0.00266	-0.00000197	-0.00366
	Job position= contract worker	0.000745*	0.0012	0.0000279	-0.00194
	Job position= dispatched and other	-0.000188	0.000761	-0.000193	-0.000802
	Job type= professional	-0.00349***	-0.00182	-0.000394**	-0.005
	Job type= office work	-0.00239*	0.00018	-0.0000956	-0.00808
	Job type= sales	0.00182*	0.000224	0.000251	-0.00347
	Job type= service	0.00229**	0.0021	0.000227*	-0.00156
	Job type= security, guard	0.0000693	0.000478	-0.0000234	0.00000413
	Job type= other	0.00498***	0.000396	0.000107	-0.0019
Workplace attributes	Firm size= less than 30	0.000498*	-0.00106	0.0102***	0.00162
	Firm size= 30 to 99	0.0000713	0.000734	0.00107	-0.000738
	Firm size= 100 to 299	-0.0000176	0.00000826	-0.000088	-0.000578
	Firm size= 500 to 99	-0.000132	-0.0000174	0.000559*	-0.000338
	Firm size= 1000 to 2999	-0.000045	-0.00278	0.00149**	-0.00353
	Firm size= 3000 or above	0.000599**	-0.00666*	0.00805***	-0.00203
	Industry= manufacturing	0.0000636	-0.00367	-0.00152***	-0.00118
	Industry= electricity, gas, heat/water supply	0.0000566	0.0000101	0.000244*	0.000293
	Industry= information, communication	-0.0000632	-0.00121	-0.000206	0.000279
	Industry= transport	-0.00000369	-0.00252*	0.00125***	-0.000759
	Industry= wholesale, retail	-0.0000103	-0.00198	-0.000021	0.00228
	Industry= finance, insurance	0.0000747	0.000177	0.000471	0.00264
	Industry= real estate	0.00000296	0.000762	-0.000142	0.000939
	Industry= medical, social welfare	-0.000122	-0.00158	-0.000440**	0.000815
	Industry= education	-0.0000633	-0.000417	-0.0000305	0.000706
	Industry= service	0.000185	-0.00216	0.000893***	0.00115
	Industry= other	-0.000186*	-0.000198	0.000330*	-0.000936
Additional variables	Area= Tokyo-to	-0.0000596	0.000945	-0.000113	0.0037
	Season	0.000157	-0.00356	0.000122	-0.00875*
Constant			0.00749		0.0611*

Note: Sig. *** >0.90, ** >0.96, * >0.99

Figure 1. Trade union density rates by year in SWLW, JHPS, JGSS and OECD (BLSU)

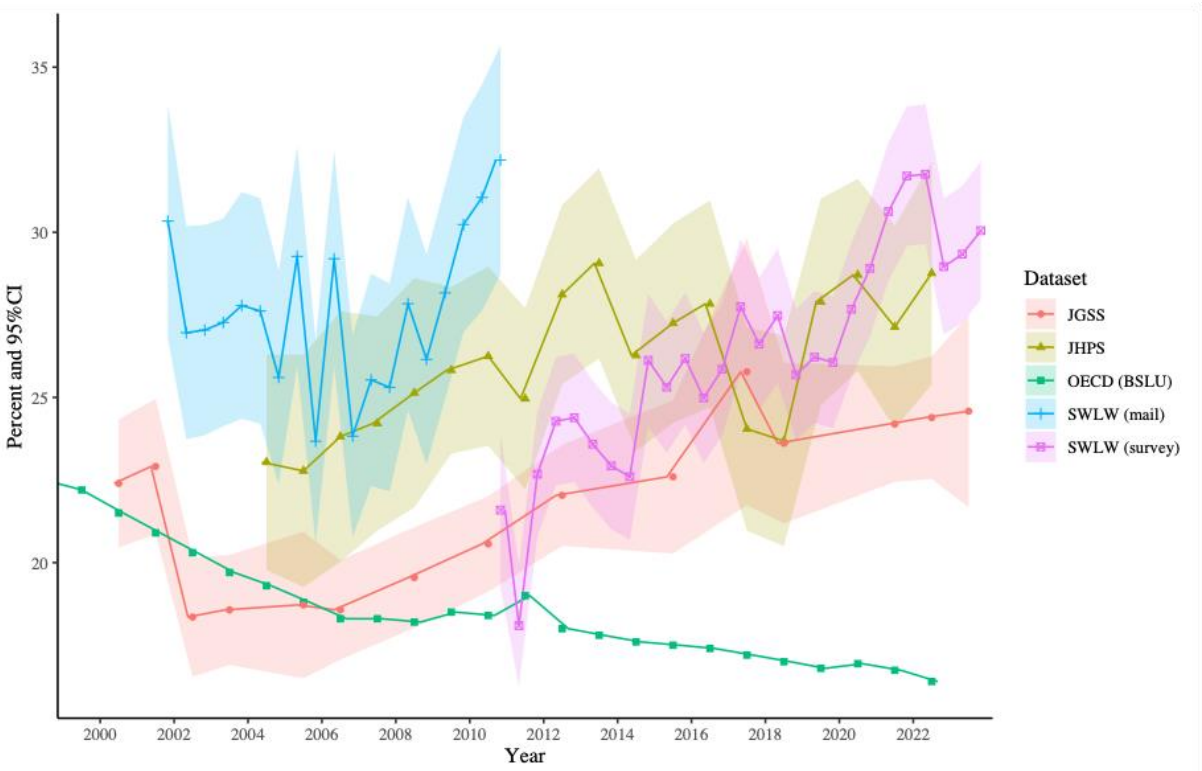


Figure 2. Workplace union presence, trade union membership when a workplace union is present, out of workplace union membership and non-response rate by year in JHSPS and SWLW.

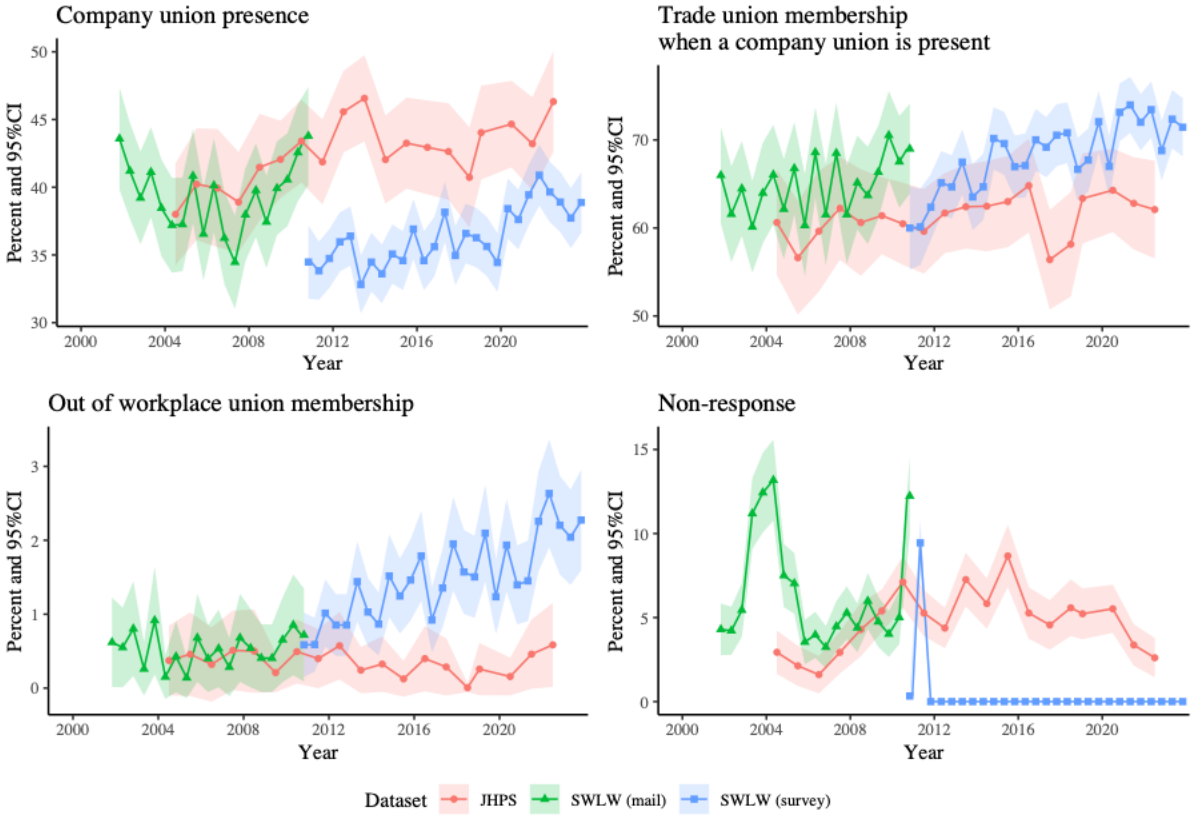


Figure 3a. Counterfactual decomposition of union membership in SWLW and JHPS

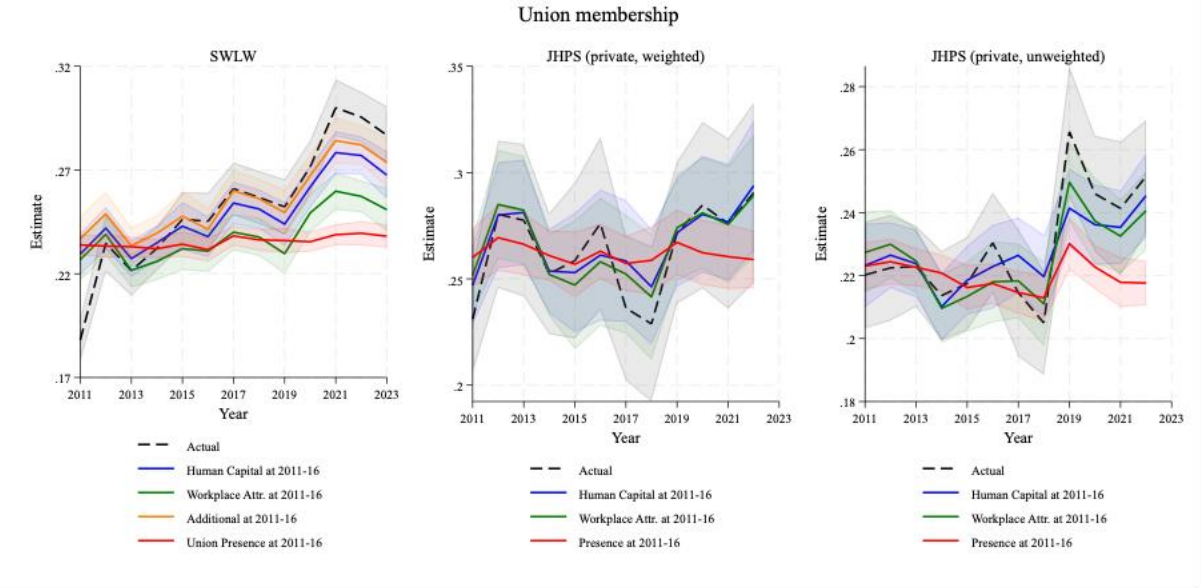
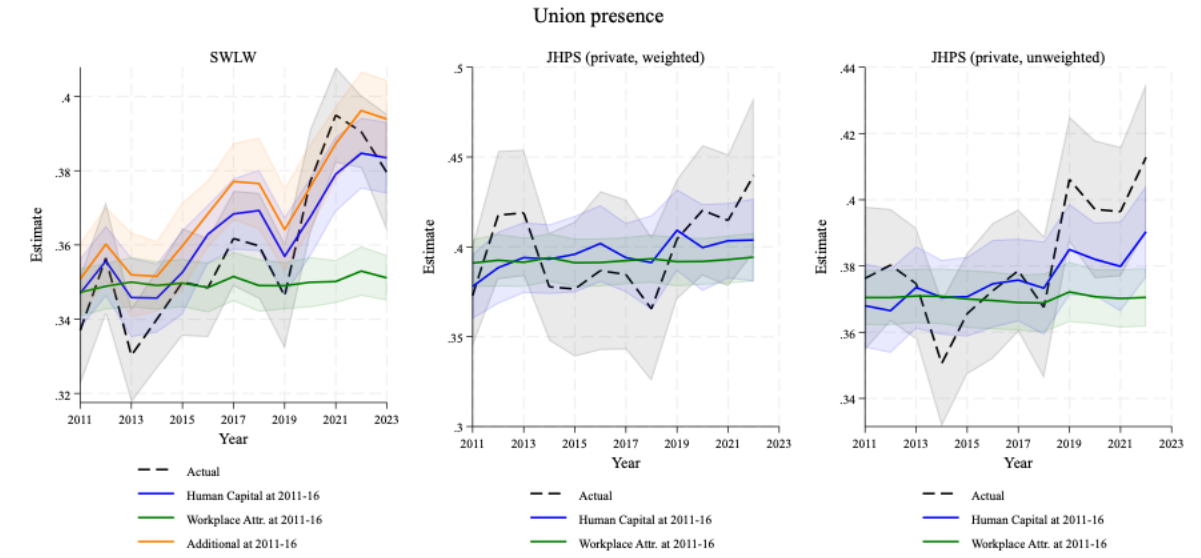


Figure 3b. Counterfactual decomposition of union presence in SWLW and JHPS



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Conflicts of interest

The authors report no conflict of interest. Jacques Wels reports being a member of the user committee of the Belgian Health Data Agency. Akie Nakamura is employed by Rengo-RIALS. The funders were not involved in the making, writing and decision to publish this study.

Authors statement

JW: Conceptualization, Methodology, Software, Data curation, Writing - Original draft, Visualization, Investigation, Supervision, Validation, Writing- Reviewing and Editing; **AB**: Conceptualization, Methodology, Investigation, Supervision, Validation, Writing- Reviewing and Editing; **RK**: Conceptualization, Methodology, Software, Data curation, Investigation, Supervision, Validation, Writing- Reviewing and Editing; **SK**: Conceptualization, Methodology, Software, Data curation, Investigation, Supervision, Validation, Writing-Reviewing and Editing; **AN**: Conceptualization, Methodology, Software, Data curation, Investigation, Supervision, Validation, Writing- Reviewing and Editing

Data access statement

The Japan Household Panel Survey (JHPS) is hosted by Keio University (Japan) and can be accessed using the Keio data portal: https://www.pdrc.keio.ac.jp/en/paneldata/datasets/jhpskhps/.

The Survey on Work and Life of Workers (SWLW) is collected by the Research Institute for Advancement of Living Standards (Rengō-RIALS). Data can be accessed upon request via the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo:

https://ssjda.iss.u-tokyo.ac.jp/Direct/

Japanese General Social Survey (JGSS) is collected by the JGSS research center and can be accessed upon request via the following link: https://jgss.daishodai.ac.jp/english/data/dat_top.html.

Further macro data used in this study were directly downloaded via the OECD data portal: https://www.oecd.org/en/data.html

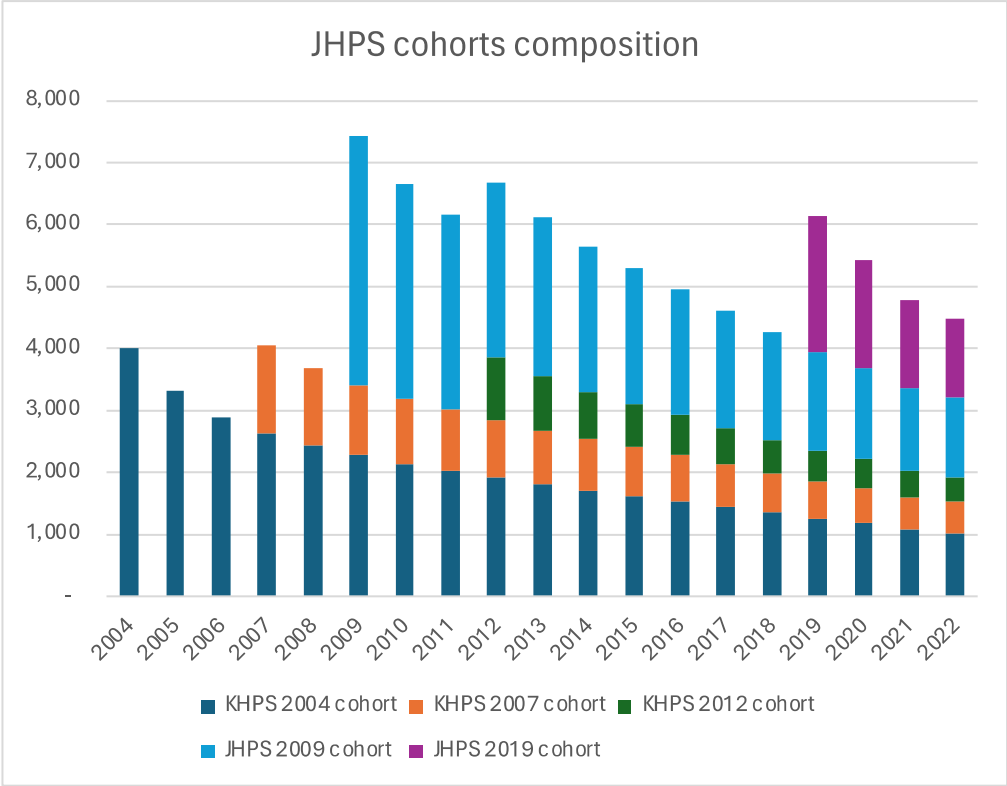
Supplementary files

Supplementary file S.1. SWLW sample description

Year	Month	Wave	Freq.	Percent
2011	April	21	1,803	3.96
	October	22	1,796	3.95
2012	April	23	1,818	4
	October	24	1,805	3.97
2013	April	25	1,811	3.98
	October	26	1,733	3.81
2014	April	27	1,770	3.89
	October	28	1,736	3.82
2015	April	29	1,756	3.86
	October	30	1,758	3.86
2016	April	31	1,755	3.86
	October	32	1,766	3.88
2017	April	33	1,740	3.83
	October	34	1,766	3.88
2018	April	35	1,749	3.84
	October	36	1,720	3.78
2019	April	37	1,739	3.82
	October	38	1,723	3.79
2020	April	39	1,761	3.87
	October	40	1,719	3.78
2021	April	41	1,726	3.79
	October	42	1,683	3.7
2022	April	43	1,742	3.83
	October	44	1,701	3.74
2023	April	45	1,686	3.71
	October	46	1,728	3.8
Total			45,490	100

Supplementary file S.2. JHPS sample composition by cohorts

Year	KHPS 2004 cohort	KHPS 2007 cohort	KHPS 2012 cohort	JHPS 2009 cohort	JHPS 2019 cohort	Total
2004	**4,005**					4,005
2005	3,314					3,314
2006	2,884					2,884
2007	2,636	**1,419**				4,055
2008	2,442	1,239				3,681
2009	2,280	1,130		**4,022**		7,432
2010	2,141	1,049		3,468		6,658
2011	2,037	976		3,158		6,171
2012	1,926	920	**1,012**	2,818		6,676
2013	1,819	865	866	2,576		6,126
2014	1,712	823	758	2,352		5,645
2015	1,626	785	693	2,193		5,297
2016	1,539	741	642	2,043		4,965
2017	1,454	692	575	1,880		4,601
2018	1,354	641	526	1,737		4,258
2019	1,259	603	490	1,582	**2,203**	6,137
2020	1,180	576	461	1,472	1,746	5,435
2021	1,073	530	425	1,337	1,416	4,781
2022	1,024	508	393	1,290	1,257	4,472



Supplementary file S3. Comparison between SWLW sample and census population by age, gender and area of residence

SWLW (Tokyo and Kansai, waves 21-46) - full sample			
Age	Region	Female	Male
20-34	Total	7,718	8,420
	%	*33.4*	*29.1*
35-49	Total	9,079	12,507
	%	*39.3*	*43.3*
50-64	Total	6,317	7,959
	%	*27.3*	*27.6*
Total	Total	23,114	28,886
	Gender %	*44.5*	*55.6*

SWLW (Tokyo and Kansai, waves 21-46) - restricted sample			
Age	Region	Female	Male
20-34	Total	6,280	7,408
	%	*33.3*	*27.8*
35-49	Total	7,344	11,703
	%	*39.0*	*43.9*
50-64	Total	5,225	7,530
	%	*27.7*	*28.3*
Total	Total	18,849	26,641
	Gender %	*41.4*	*58.6*

SWLW (Tokyo only, waves 21-46) - full sample			
Age	Region	Female	Male
20-34	Total	5,104	5,633
	%	*34.1*	*29.2*
35-49	Total	5,857	8,489
	%	*39.1*	*44.0*
50-64	Total	4,022	5,163
	%	*26.8*	*26.8*
Total	Total	14,983	19,285
	Gender %	*43.7*	*56.3*

SWLW (Tokyo only, waves 21-46) - restricted sample			
Age	Region	Female	Male
20-34	Total	4,156	4,931.00
	%	*34.1*	*27.8*
35-49	Total	4,728	7,966.00
	%	*38.8*	*44.8*
50-64	Total	3,314	4,868.00
	%	*27.2*	*27.4*
Total	Total	12,198	17,765.0
	Gender %	*40.7*	*59.3*

Census (Employed, All areas, 2020)			
Age	Region	Female	Male
20-34	Total	5,832,807	6,521,465
	%	*26.4*	*25.1*
35-49	Total	8,533,377	10,129,495
	%	*38.6*	*39.0*
50-64	Total	7,767,918	9,346,894
	%	*35.1*	*36.0*
Total	Total	22,134,102	25,997,854
	Gender %	*46.0*	*54.0*

Census (Employed, All areas, 2010)			
Age	Region	Female	Male
20-34	Total	6,821,706	8,311,757
	%	*29.9*	*27.6*
35-49	Total	8,520,843	11,540,368
	%	*37.3*	*38.3*
50-64	Total	7,474,945	10,305,657
	%	*32.8*	*34.2*
Total	Total	22,817,494	30,157,782
	Gender %	*43.1*	*56.9*

Census (Employed, Tokyo-to, 2020)			
Age	Region	Female	Male
20-34	Total	735,547	734,884
	%	*31.1*	*26.9*
35-49	Total	889,614	1,060,149
	%	*37.6*	*38.8*
50-64	Total	742,369	934,754
	%	*31.4*	*34.2*
Total	Total	2,367,530	2,729,787
	Gender %	46.4	53.6

Census (Employed, Tokyo-to, 2010)			
Age	Region	Female	Male
20-34	Total	770,465	891,804
	%	*34.0*	*29.3*
35-49	Total	861,217	1,234,273
	%	*38.0*	*40.5*
50-64	Total	636,755	919,191
	%	*28.1*	*30.2*
Total	Total	2,268,437	3,045,268
	Gender %	42.7	57.3

Note: Census data are available at
https://www.stat.go.jp/english/data/kokusei/index.html

We provide descriptive statistics on SWLW distribution across age groups (20-34, 35-49 and 50-64), gender and area of residence (Kansai and Tokyo-to) across all selected years. We use the full SWLW sample (N=52,000 among which 34,268 respondents live in Tokyo) as well as the restricted sample (N=45,490 among which 29,963 live in Tokyo) after excluding missing data in the fully adjusted Blinder-Oaxaca decomposition to address potential bias caused by non-response. We compare these statistics with 2000 and 2010 census data of the employed population (i.e., excluding the non-employed or self-employed respondents). As Kansai is not an administrative region within the census, we distinguish Tokyo and Japan populations (including all regions).

Looking at gender, we observe that the full SWLW sample contains 44.5 percent of female respondents in both Tokyo and Kansai and 43.7 percent in the Tokyo area only. Once restricted, these percentages drop to 41.4 and 40.7. By comparison, the percentage of employed female workers within the full Japanese population aged 20-64 was 43.1 and 46 percent respectively in 2010 and 2020. In Tokyo, percentages reach 42.7 and 46.4. In other words, to original SWLW sample well reflects census data but missing data slightly reduce female representativeness.

By contrast, the SWLW sample slightly underrepresents the 50+ employed population in both Kansai and Tokyo. Before restriction the full 50-64 sample is 27.3 and 27.6 percent of female and male respondents. It is 27.7 and 28.3 after adjustment. Census data show percentages of 32.8 and 34.2 in 2010 and 35.1 and 36 percent in 2020. The same pattern is observed for Tokyo. In SWLW, female and male employed respondents aged 50 to 64 are 26.8 and 26.8 before adjustment and 27.2 and 27.4 after adjustment. In the census, rates reach 28.1 and 30.2 in 2010 and 31.4 and 34.2 in 2020.

To address differences observed in the adjusted model, we provide sensitivity analyses using an inverse probability weight for missingness to address sample attrition due to missing data.

Supplementary file S.4. Stratification of descriptive statistics by gender

Figure S.4.1.

Figure S.4.a. Union membership among employed respondents

Figure S.4.b. Union presence among employed respondents

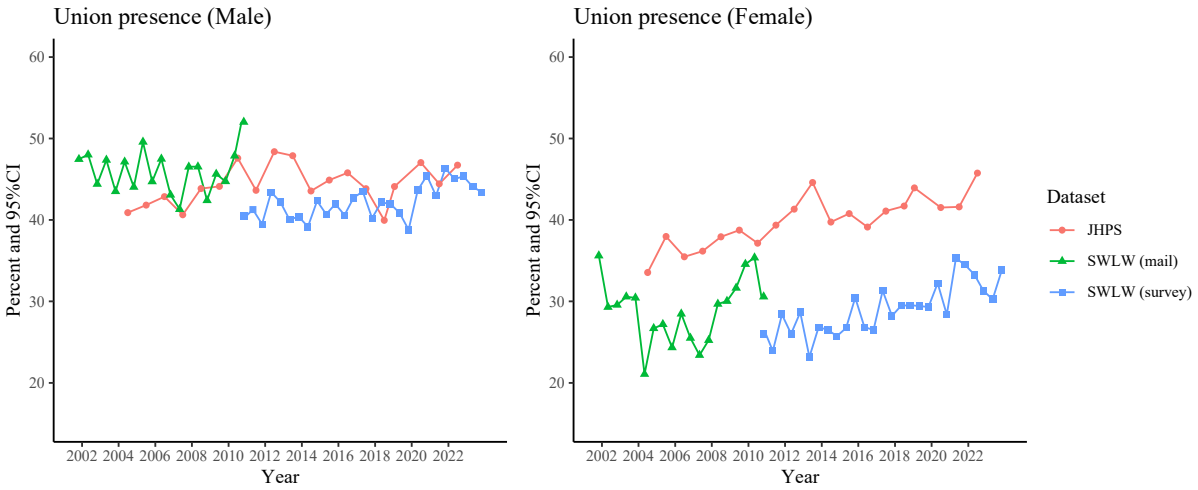
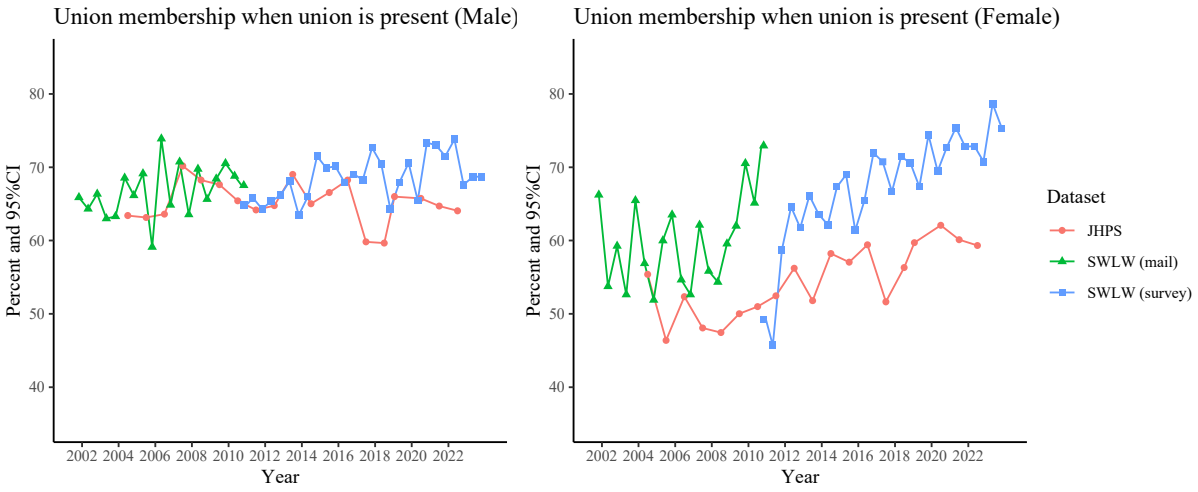


Figure S.4.c. Union membership among respondents reporting union presence



Supplementary file S.5. Stratification of descriptive statistics by employment status

Figure S.5.a. Union membership among employed respondents

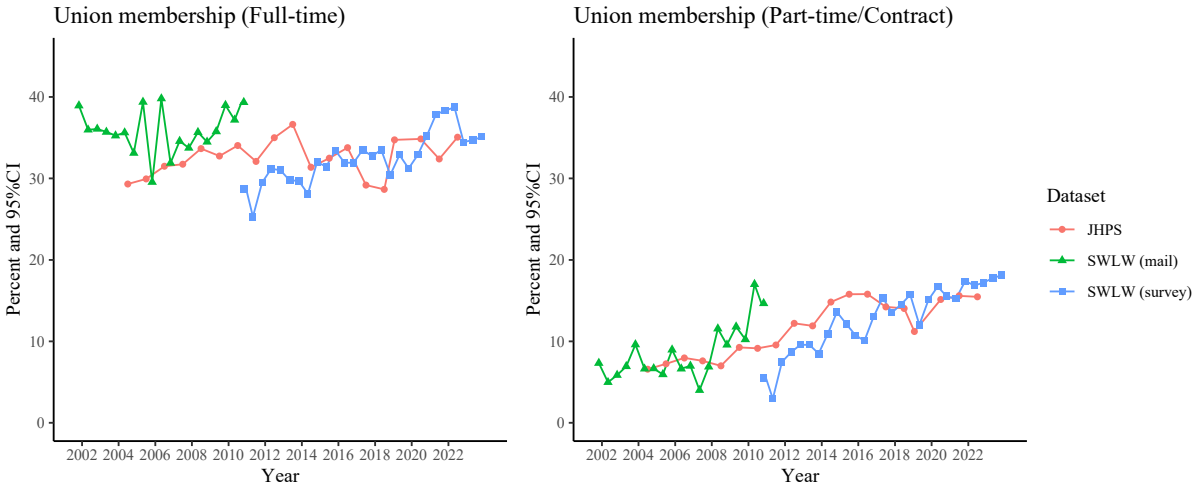


Figure S.5.b. Union presence among employed respondents

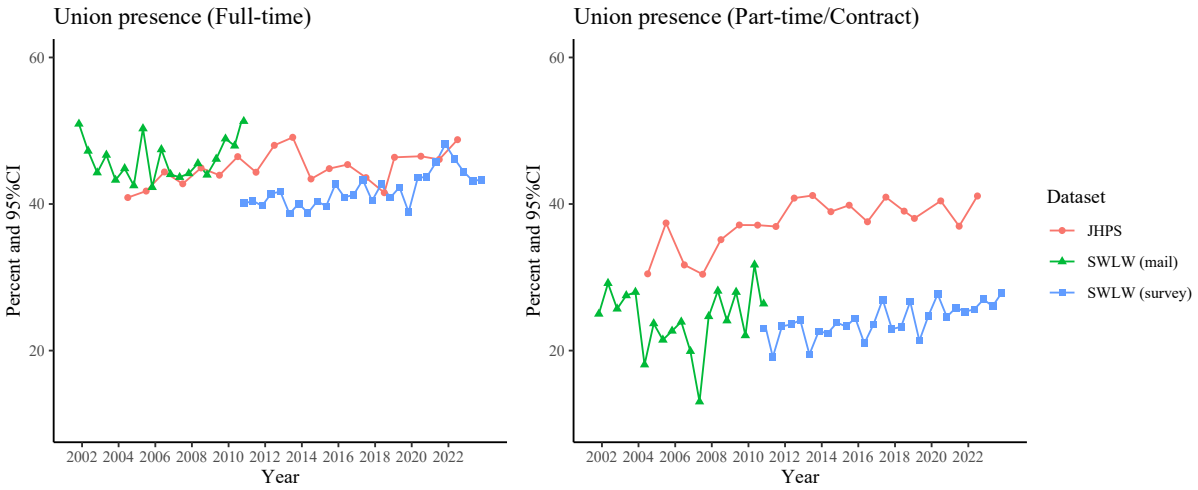
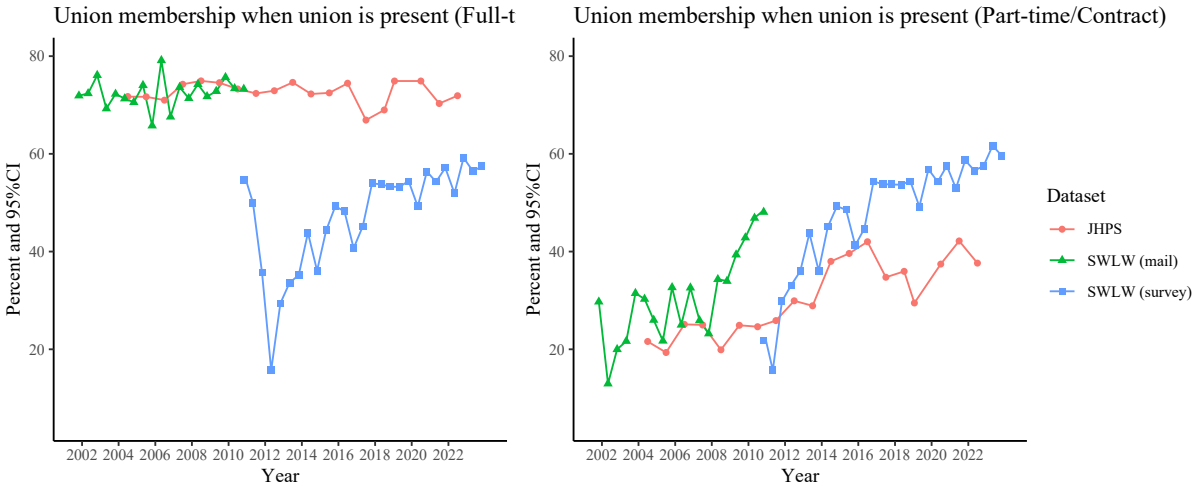


Figure S.5.c. Union membership among respondents reporting union presence



Supplementary file S.6. Stratification of descriptive statistics by company size
Figure S.6.a. Union membership among employed respondents

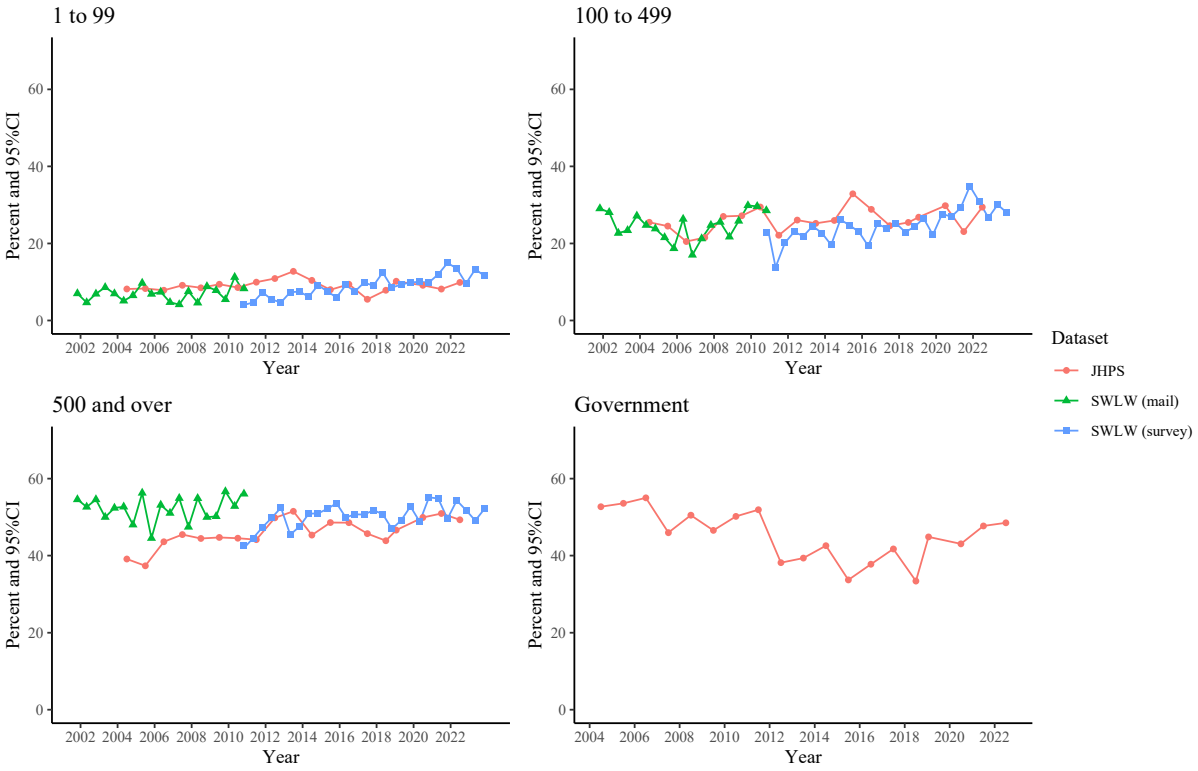


Figure S.6.b. Union presence among employed respondents

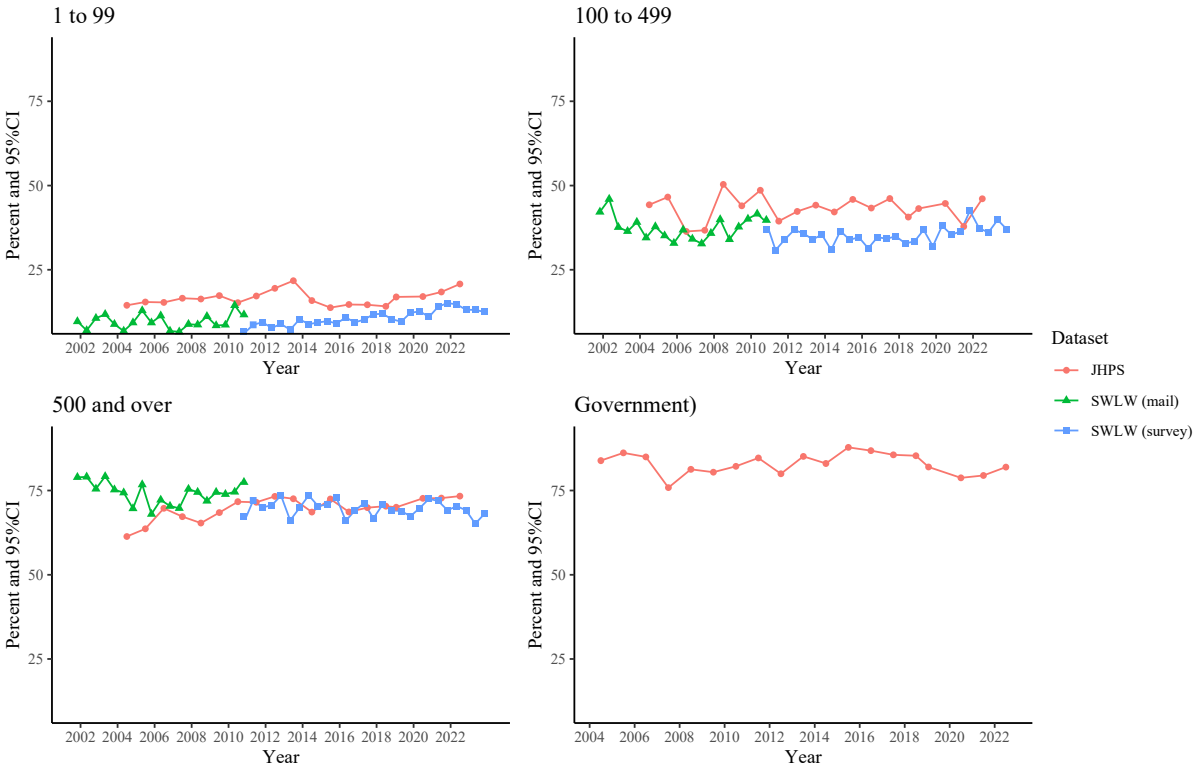
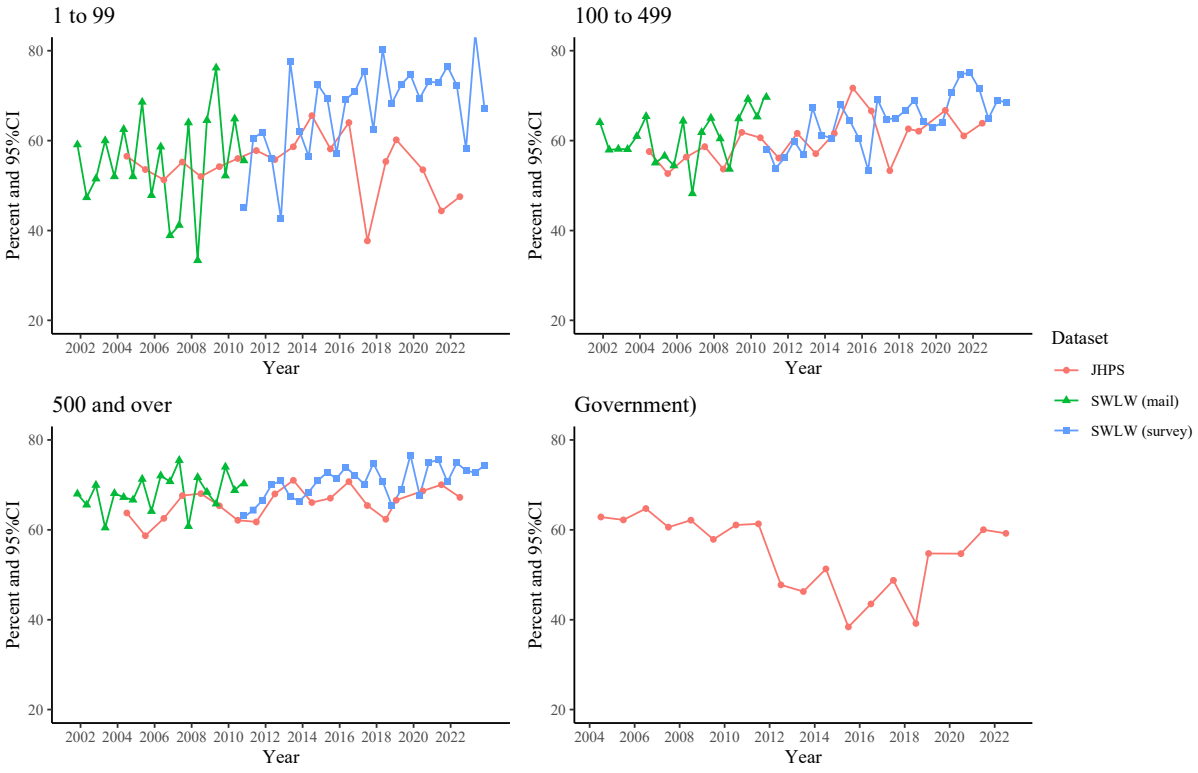


Figure S.6.c. Union membership among respondents reporting union presence



Supplementary file S.7. Counterfactual Decompositions (Shift Share)

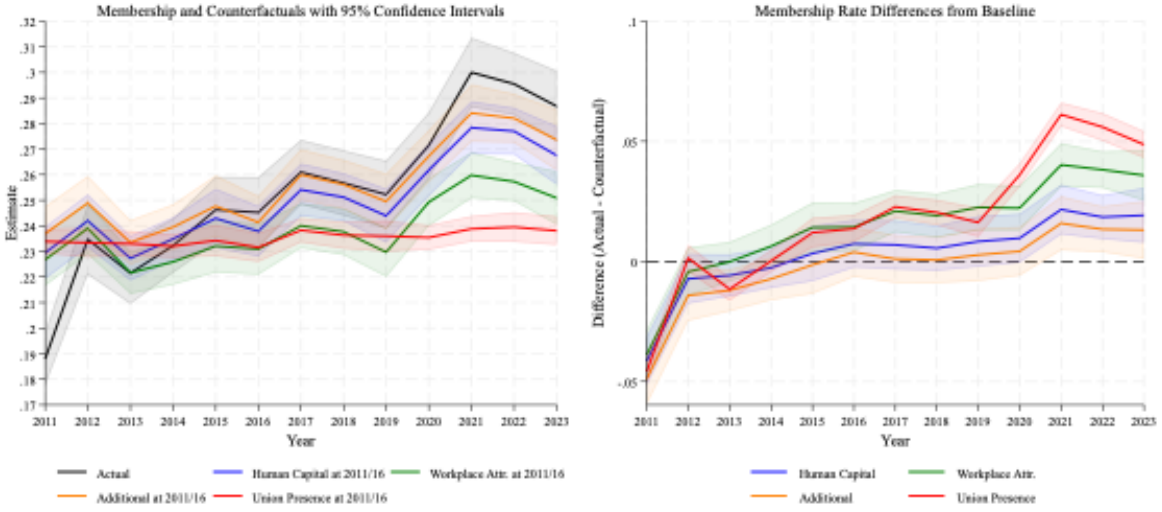
Supplementary file S.7.1. Union membership (SWLW), 2011-16 baseline

	Actual union membership			Human capital at 2011/16			Workplace attributes at 2011/16			Union presence at 2011/16			Additional variables at 2011/16		
year	Coef	lower 95% CI	upper 95% CI	Coef	Lower 95% CI	upper 95% CI	Coef	lower 95%CI	upper 95%CI	Coef	lower 95% CI	upper 95% CI	Coef	lower 95%CI	upper 95%CI
2011	0.188	0.178	0.198	0.229	0.219	0.240	0.227	0.217	0.237	0.234	0.229	0.239	0.237	0.226	0.248
2012	0.235	0.221	0.249	0.242	0.232	0.252	0.239	0.229	0.249	0.233	0.228	0.239	0.249	0.238	0.260
2013	0.221	0.209	0.234	0.227	0.219	0.236	0.222	0.213	0.230	0.233	0.228	0.238	0.234	0.225	0.242
2014	0.232	0.222	0.243	0.235	0.226	0.243	0.226	0.217	0.235	0.232	0.227	0.237	0.240	0.231	0.248
2015	0.246	0.233	0.259	0.243	0.231	0.255	0.232	0.222	0.242	0.234	0.228	0.240	0.248	0.236	0.260
2016	0.245	0.231	0.259	0.238	0.228	0.248	0.231	0.221	0.241	0.232	0.226	0.237	0.241	0.231	0.252
2017	0.261	0.248	0.274	0.254	0.244	0.264	0.240	0.231	0.249	0.238	0.233	0.243	0.260	0.250	0.270
2018	0.257	0.244	0.270	0.251	0.242	0.261	0.238	0.229	0.247	0.236	0.231	0.242	0.256	0.246	0.266
2019	0.252	0.239	0.266	0.244	0.233	0.255	0.230	0.220	0.239	0.236	0.230	0.242	0.250	0.239	0.260
2020	0.271	0.259	0.284	0.262	0.252	0.272	0.249	0.240	0.259	0.235	0.231	0.240	0.267	0.257	0.277
2021	0.300	0.286	0.314	0.278	0.268	0.289	0.260	0.251	0.269	0.239	0.234	0.244	0.284	0.273	0.295
2022	0.296	0.283	0.308	0.277	0.268	0.286	0.257	0.250	0.265	0.240	0.234	0.245	0.282	0.272	0.292
2023	0.287	0.273	0.301	0.268	0.256	0.279	0.251	0.240	0.261	0.238	0.232	0.244	0.274	0.262	0.286

	Differences			
year	Human capital	Workplace attributes	Additional variables	Union presence
2011	-0.041***	-0.039***	-0.049***	-0.046***
2012	-0.007	-0.004	-0.014***	0.001
2013	-0.006	-0.000	-0.012***	-0.012***
2014	-0.003	0.006	-0.007	0.000
2015	0.003	0.014***	-0.001	0.012***
2016	0.007	0.014***	0.004	0.014***
2017	0.007	0.021***	0.001	0.023***
2018	0.006	0.019***	0.001	0.020***
2019	0.008	0.023***	0.003	0.016***
2020	0.010	0.022***	0.004	0.036***
2021	0.022***	0.040***	0.016***	0.061***
2022	0.018***	0.038***	0.013***	0.056***
2023	0.019***	0.036***	0.013***	0.049***

*Note: *** indicates significance at 95%CI.*

Union membership

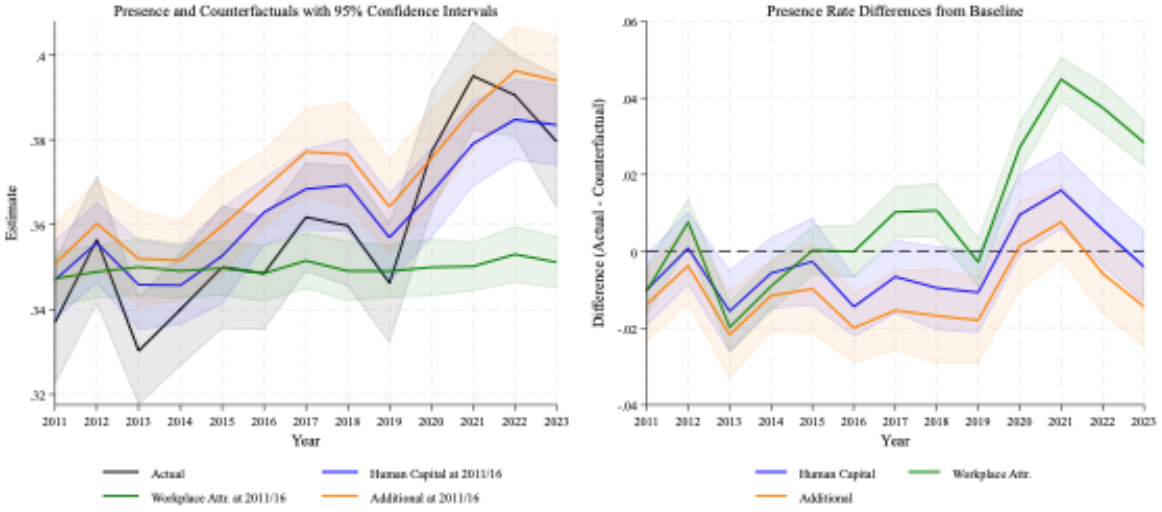


Supplementary file S.7.2. Union Presence (SWLW), 2011-16 baseline

	Actual union presence			Human capital at 2011/16			Workplace attributes at 2011/16			Additional variables at 2011/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	upper 95%CI	Coef	lower 95%CI	upper 95%CI	Coef	lower 95%CI	upper 95%CI
2011	0.337	0.322	0.352	0.347	0.338	0.356	0.347	0.341	0.354	0.351	0.341	0.361
2012	0.356	0.341	0.372	0.356	0.346	0.365	0.349	0.343	0.355	0.360	0.350	0.370
2013	0.330	0.318	0.343	0.346	0.335	0.357	0.350	0.343	0.357	0.352	0.341	0.363
2014	0.340	0.327	0.353	0.346	0.336	0.355	0.349	0.343	0.356	0.352	0.342	0.361
2015	0.350	0.335	0.365	0.353	0.341	0.364	0.350	0.343	0.356	0.360	0.348	0.371
2016	0.349	0.335	0.362	0.363	0.355	0.371	0.349	0.342	0.355	0.368	0.359	0.377
2017	0.362	0.349	0.375	0.368	0.359	0.378	0.351	0.345	0.358	0.377	0.367	0.387
2018	0.360	0.345	0.374	0.369	0.358	0.380	0.349	0.342	0.356	0.377	0.364	0.389
2019	0.346	0.332	0.360	0.357	0.346	0.368	0.349	0.343	0.355	0.364	0.353	0.375
2020	0.377	0.363	0.391	0.367	0.357	0.378	0.350	0.343	0.357	0.376	0.364	0.387
2021	0.395	0.382	0.408	0.379	0.369	0.389	0.350	0.344	0.356	0.387	0.377	0.397
2022	0.391	0.381	0.400	0.385	0.375	0.394	0.353	0.346	0.360	0.396	0.386	0.407
2023	0.380	0.364	0.395	0.383	0.374	0.393	0.351	0.345	0.357	0.394	0.383	0.404

	Difference actual/counterfactual		
year	Human capital	Workplace attributes	Additional variables
2011	-0.010***	-0.010***	-0.014***
2012	0.001	0.008***	-0.004
2013	-0.016***	-0.020***	-0.022***
2014	-0.006	-0.009***	-0.012***
2015	-0.003	0.000	-0.010
2016	-0.014***	-0.000	-0.020***
2017	-0.007	0.010***	-0.015***
2018	-0.010	0.011***	-0.017***
2019	-0.011***	-0.003	-0.018***
2020	0.010	0.027***	0.001
2021	0.016***	0.045***	0.008
2022	0.006	0.038***	-0.006
2023	-0.004	0.028***	-0.014***

Union presence

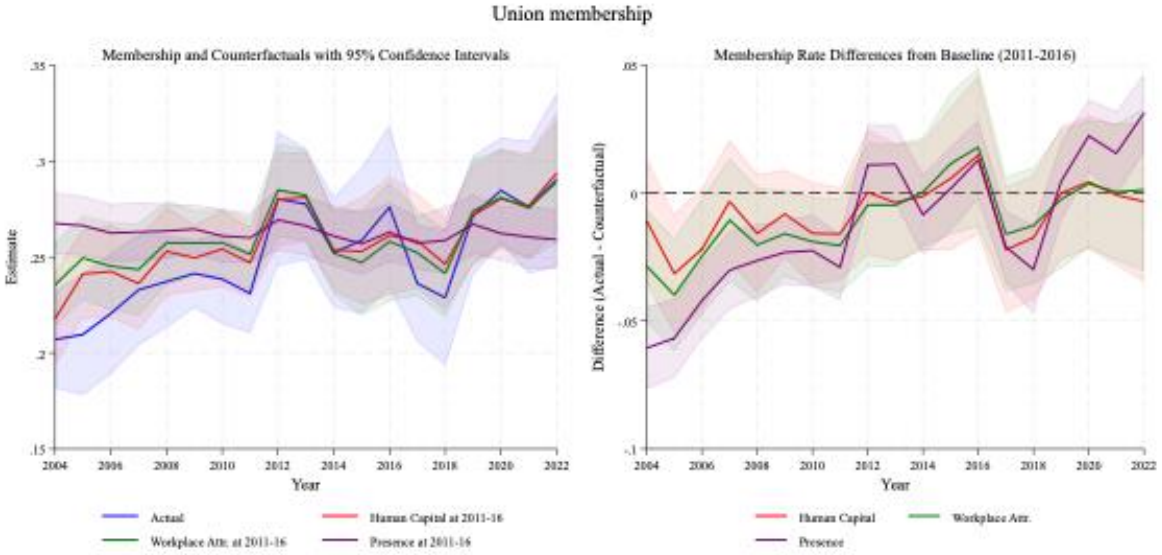


Supplementary file S.7.3. Union membership (JHPS), 2011-2016 baseline, private sector (weighted)

	Actual union membership			Human capital at 2004/12			Union presence at 2004/12			Workplace attributes at 2004/12		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.207	0.181	0.233	0.218	0.193	0.242	0.268	0.251	0.284	0.236	0.214	0.258
2005	0.210	0.178	0.241	0.241	0.218	0.264	0.266	0.251	0.282	0.250	0.227	0.272
2006	0.221	0.189	0.252	0.242	0.218	0.267	0.263	0.247	0.278	0.245	0.222	0.268
2007	0.233	0.204	0.262	0.236	0.212	0.260	0.263	0.248	0.278	0.244	0.219	0.268
2008	0.237	0.213	0.261	0.253	0.230	0.276	0.264	0.249	0.278	0.257	0.235	0.280
2009	0.241	0.224	0.259	0.250	0.232	0.267	0.265	0.252	0.277	0.257	0.240	0.274
2010	0.238	0.215	0.262	0.254	0.234	0.274	0.261	0.247	0.275	0.257	0.240	0.275
2011	0.231	0.210	0.252	0.247	0.229	0.265	0.260	0.247	0.273	0.252	0.233	0.270
2012	0.280	0.245	0.315	0.280	0.256	0.304	0.269	0.253	0.285	0.285	0.260	0.309
2013	0.278	0.249	0.307	0.281	0.258	0.304	0.266	0.251	0.282	0.282	0.258	0.306
2014	0.252	0.223	0.281	0.254	0.233	0.275	0.261	0.245	0.277	0.252	0.231	0.273
2015	0.259	0.221	0.297	0.253	0.225	0.281	0.257	0.240	0.273	0.247	0.219	0.275
2016	0.276	0.233	0.319	0.261	0.230	0.292	0.263	0.248	0.278	0.258	0.227	0.289
2017	0.236	0.206	0.267	0.258	0.234	0.283	0.257	0.243	0.271	0.252	0.230	0.275
2018	0.229	0.193	0.264	0.246	0.222	0.270	0.259	0.241	0.276	0.242	0.219	0.264
2019	0.272	0.240	0.303	0.272	0.246	0.298	0.267	0.252	0.283	0.274	0.247	0.301
2020	0.285	0.257	0.312	0.280	0.254	0.306	0.262	0.248	0.276	0.281	0.256	0.306
2021	0.276	0.241	0.311	0.277	0.249	0.304	0.260	0.244	0.277	0.276	0.249	0.302
2022	0.290	0.245	0.336	0.294	0.262	0.325	0.259	0.244	0.274	0.289	0.257	0.321

	Difference actual/counterfactual		
year	diff_hc_str	diff_wa_str	diff_pres_str
2004	-0.011	-0.029***	-0.061***
2005	-0.032***	-0.040***	-0.057***
2006	-0.022	-0.025***	-0.042***
2007	-0.003	-0.011	-0.030***
2008	-0.016	-0.020	-0.026***
2009	-0.008	-0.016	-0.023***
2010	-0.016	-0.019***	-0.023***
2011	-0.016	-0.021***	-0.029***
2012	0.000	-0.005	0.011
2013	-0.004	-0.005	0.011
2014	-0.001	0.000	-0.009
2015	0.006	0.011	0.002
2016	0.015	0.018	0.013
2017	-0.022	-0.016	-0.021***
2018	-0.017	-0.013	-0.030***
2019	-0.000	-0.002	0.005
2020	0.004	0.004	0.022***
2021	-0.001	0.000	0.016

2022	-0.003	0.001	0.031***

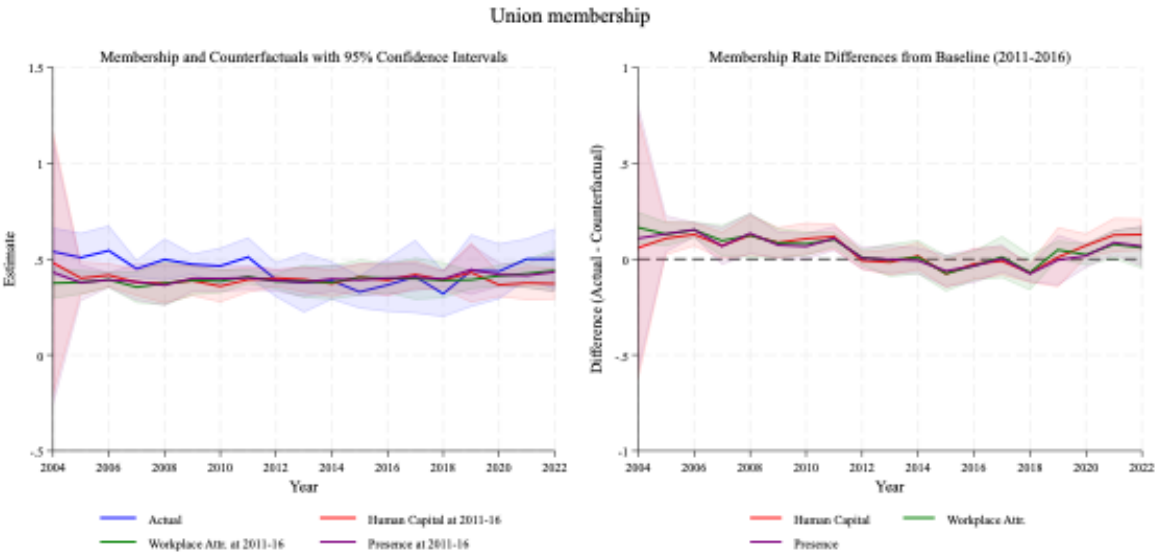


Supplementary file S.7.4. Union membership (JHPS), 2011-2016 baseline, public sector (weighted)

	Actual union membership			Human capital at 2004/16			Union presence at 2004/16			Workplace attributes at 2004/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.539	0.413	0.664	0.480	-0.214	1.174	0.431	-0.268	1.130	0.375	0.292	0.457
2005	0.508	0.379	0.637	0.400	0.313	0.488	0.377	0.281	0.472	0.378	0.315	0.442
2006	0.544	0.412	0.675	0.416	0.354	0.478	0.391	0.350	0.432	0.392	0.349	0.435
2007	0.449	0.402	0.496	0.378	0.307	0.450	0.381	0.283	0.480	0.353	0.271	0.436
2008	0.498	0.387	0.608	0.374	0.269	0.479	0.364	0.256	0.471	0.374	0.258	0.490
2009	0.473	0.416	0.529	0.387	0.306	0.468	0.400	0.328	0.471	0.389	0.312	0.466
2010	0.464	0.369	0.559	0.358	0.274	0.443	0.398	0.329	0.467	0.385	0.321	0.448
2011	0.510	0.406	0.614	0.393	0.325	0.461	0.402	0.338	0.467	0.408	0.369	0.446
2012	0.393	0.301	0.484	0.401	0.354	0.448	0.388	0.330	0.447	0.384	0.342	0.426
2013	0.377	0.220	0.534	0.394	0.326	0.462	0.379	0.303	0.455	0.384	0.297	0.471
2014	0.388	0.288	0.488	0.372	0.300	0.444	0.397	0.328	0.465	0.378	0.289	0.467
2015	0.329	0.242	0.416	0.406	0.334	0.477	0.391	0.306	0.475	0.404	0.309	0.499
2016	0.365	0.225	0.505	0.389	0.307	0.472	0.401	0.311	0.490	0.400	0.322	0.477
2017	0.408	0.216	0.601	0.419	0.345	0.493	0.406	0.334	0.478	0.398	0.288	0.508
2018	0.319	0.197	0.441	0.390	0.338	0.442	0.396	0.351	0.440	0.389	0.295	0.483
2019	0.440	0.250	0.629	0.430	0.273	0.587	0.445	0.313	0.577	0.392	0.343	0.441
2020	0.436	0.290	0.582	0.365	0.302	0.429	0.419	0.355	0.482	0.413	0.355	0.470
2021	0.500	0.392	0.608	0.375	0.286	0.464	0.414	0.349	0.479	0.424	0.348	0.500
2022	0.500	0.340	0.659	0.372	0.288	0.456	0.433	0.327	0.539	0.440	0.329	0.551

	Difference actual/counterfactual		
year	Human capital	Workplace attributes	Union presence
2004	0.059	0.164***	0.108
2005	0.108***	0.129***	0.131***
2006	0.128***	0.151***	0.153***
2007	0.071	0.095***	0.067
2008	0.124***	0.124***	0.134***
2009	0.085***	0.083***	0.073***
2010	0.106***	0.079***	0.066
2011	0.117***	0.102***	0.108***
2012	-0.008	0.009	0.005
2013	-0.017	-0.007	-0.002
2014	0.016	0.010	-0.009
2015	-0.077***	-0.075	-0.062
2016	-0.025	-0.035	-0.036
2017	-0.011	0.011	0.003
2018	-0.071***	-0.070	-0.077***
2019	0.010	0.048	-0.005
2020	0.070***	0.023	0.017
2021	0.125***	0.076***	0.086***

2022	0.128***	0.059	0.067

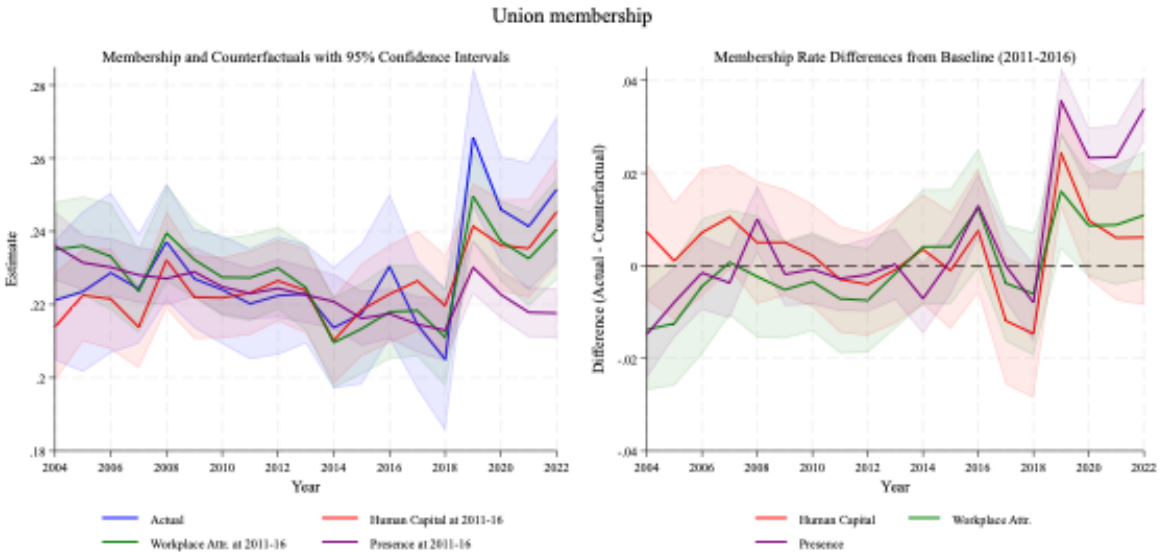


Supplementary file S.7.5. Union membership (JHPS), 2011-2016 baseline, private sector (unweighted)

	Actual union membership			Human capital at 2004/12			Union presence at 2004/12			Workplace attributes at 2004/12		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.221	0.205	0.238	0.214	0.199	0.229	0.236	0.227	0.245	0.235	0.222	0.248
2005	0.224	0.202	0.246	0.223	0.210	0.235	0.231	0.224	0.239	0.236	0.223	0.249
2006	0.229	0.207	0.251	0.222	0.208	0.235	0.230	0.222	0.238	0.233	0.218	0.248
2007	0.224	0.209	0.239	0.214	0.203	0.225	0.228	0.220	0.236	0.224	0.212	0.235
2008	0.237	0.221	0.253	0.232	0.219	0.245	0.227	0.220	0.234	0.240	0.226	0.253
2009	0.227	0.214	0.241	0.222	0.211	0.234	0.229	0.222	0.236	0.232	0.222	0.243
2010	0.224	0.209	0.239	0.222	0.211	0.233	0.225	0.217	0.232	0.227	0.217	0.238
2011	0.220	0.205	0.235	0.223	0.212	0.235	0.223	0.216	0.230	0.227	0.216	0.239
2012	0.222	0.206	0.239	0.226	0.215	0.238	0.224	0.216	0.232	0.230	0.219	0.241
2013	0.223	0.209	0.237	0.224	0.212	0.235	0.223	0.215	0.230	0.225	0.213	0.236
2014	0.214	0.197	0.230	0.210	0.198	0.222	0.221	0.213	0.228	0.210	0.197	0.222
2015	0.217	0.198	0.237	0.219	0.206	0.231	0.216	0.209	0.224	0.213	0.201	0.226
2016	0.230	0.211	0.250	0.223	0.209	0.236	0.217	0.211	0.224	0.218	0.205	0.231
2017	0.215	0.197	0.232	0.226	0.213	0.240	0.215	0.207	0.222	0.218	0.206	0.231
2018	0.205	0.185	0.224	0.220	0.206	0.234	0.213	0.205	0.221	0.211	0.198	0.224
2019	0.266	0.247	0.285	0.241	0.230	0.253	0.230	0.223	0.237	0.250	0.237	0.262
2020	0.246	0.232	0.260	0.236	0.224	0.249	0.223	0.216	0.229	0.237	0.226	0.248
2021	0.241	0.224	0.259	0.235	0.222	0.249	0.218	0.211	0.225	0.233	0.220	0.246
2022	0.251	0.232	0.271	0.245	0.231	0.260	0.218	0.211	0.225	0.241	0.227	0.254

	Difference actual/counterfactual		
year	diff_hc_str	diff_wa_str	diff_pres_str
2004	0.007	-0.014***	-0.015***
2005	0.001	-0.012	-0.008***
2006	0.007	-0.004	-0.002
2007	0.010	0.001	-0.004
2008	0.005	-0.002	0.010***
2009	0.005	-0.005	-0.002
2010	0.002	-0.003	-0.001
2011	-0.003	-0.007	-0.003
2012	-0.004	-0.008	-0.002
2013	-0.001	-0.002	0.000
2014	0.004	0.004	-0.007
2015	-0.001	0.004	0.001
2016	0.008	0.012	0.013***
2017	-0.012	-0.004	-0.000
2018	-0.015***	-0.006	-0.008
2019	0.024***	0.016***	0.036***
2020	0.010	0.009	0.023***
2021	0.006	0.009	0.023***

2022	0.006	0.011	0.034***

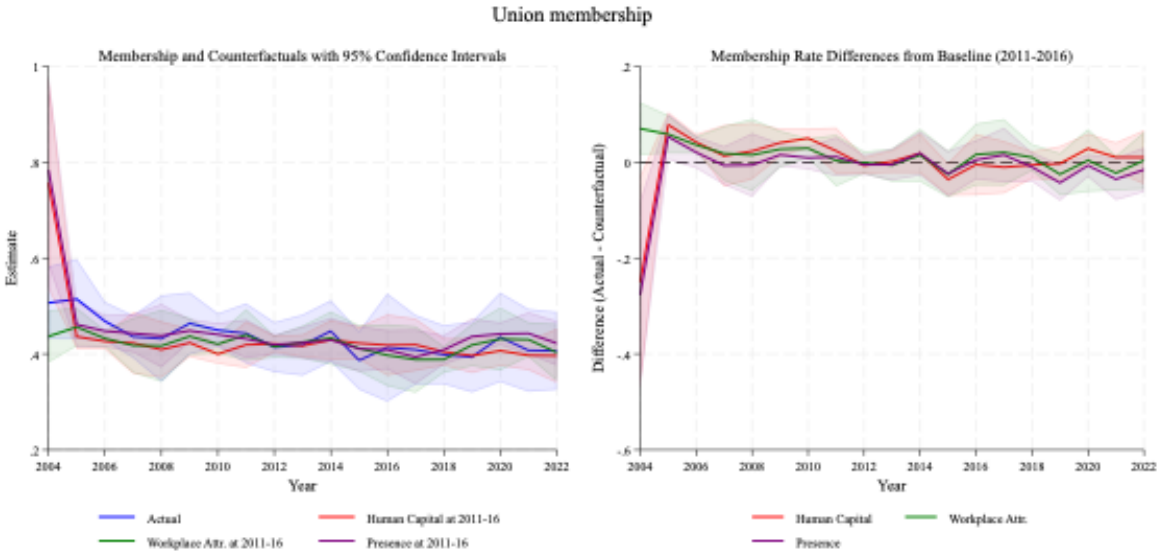


Supplementary file S.7.6. Union membership (JHPS), 2011-2016 baseline, public sector (unweighted)

	Actual union membership			Human capital at 2011/12			Union presence at 2011/12			Workplace attributes at 2011/12		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.507	0.431	0.582	0.757	0.535	0.978	0.783	0.586	0.981	0.437	0.382	0.491
2005	0.514	0.431	0.598	0.436	0.410	0.463	0.461	0.414	0.509	0.456	0.416	0.496
2006	0.468	0.428	0.509	0.426	0.410	0.443	0.448	0.414	0.481	0.432	0.415	0.450
2007	0.436	0.391	0.481	0.423	0.358	0.487	0.443	0.403	0.483	0.418	0.360	0.475
2008	0.432	0.342	0.522	0.409	0.350	0.468	0.438	0.372	0.504	0.417	0.342	0.492
2009	0.464	0.399	0.529	0.423	0.394	0.453	0.448	0.424	0.473	0.437	0.398	0.475
2010	0.450	0.414	0.485	0.400	0.379	0.420	0.440	0.416	0.465	0.421	0.400	0.441
2011	0.443	0.380	0.506	0.419	0.370	0.468	0.431	0.391	0.472	0.440	0.386	0.494
2012	0.414	0.362	0.467	0.421	0.403	0.439	0.419	0.399	0.440	0.415	0.392	0.439
2013	0.418	0.354	0.482	0.417	0.393	0.441	0.423	0.390	0.457	0.425	0.390	0.459
2014	0.448	0.383	0.512	0.429	0.388	0.471	0.429	0.383	0.475	0.433	0.377	0.489
2015	0.387	0.325	0.448	0.422	0.388	0.457	0.411	0.363	0.458	0.412	0.363	0.460
2016	0.413	0.300	0.526	0.418	0.354	0.482	0.409	0.368	0.450	0.397	0.333	0.462
2017	0.409	0.336	0.482	0.419	0.365	0.474	0.394	0.337	0.451	0.388	0.319	0.458
2018	0.398	0.337	0.460	0.404	0.376	0.433	0.409	0.378	0.439	0.388	0.360	0.416
2019	0.394	0.320	0.468	0.396	0.360	0.433	0.436	0.398	0.474	0.419	0.374	0.463
2020	0.435	0.341	0.528	0.407	0.375	0.438	0.442	0.418	0.466	0.431	0.365	0.497
2021	0.407	0.321	0.494	0.397	0.366	0.428	0.443	0.399	0.487	0.430	0.394	0.466
2022	0.407	0.325	0.488	0.396	0.340	0.453	0.422	0.376	0.469	0.403	0.343	0.463

	Difference actual/counterfactual		
year	diff_hc_str	diff_wa_str	diff_pres_str
2004	-0.250***	0.070***	-0.277***
2005	0.078***	0.058***	0.053***
2006	0.042***	0.036***	0.021
2007	0.013	0.018	-0.007
2008	0.023	0.015	-0.006
2009	0.041***	0.027	0.015
2010	0.050***	0.029***	0.009
2011	0.024	0.003	0.011
2012	-0.007	-0.001	-0.005
2013	0.001	-0.006	-0.005
2014	0.018	0.015	0.018
2015	-0.036***	-0.025	-0.024
2016	-0.005	0.016	0.005
2017	-0.010	0.020	0.015
2018	-0.006	0.010	-0.010
2019	-0.003	-0.025	-0.043***
2020	0.028	0.004	-0.007
2021	0.010	-0.023	-0.035

2022	0.010	0.003	-0.016

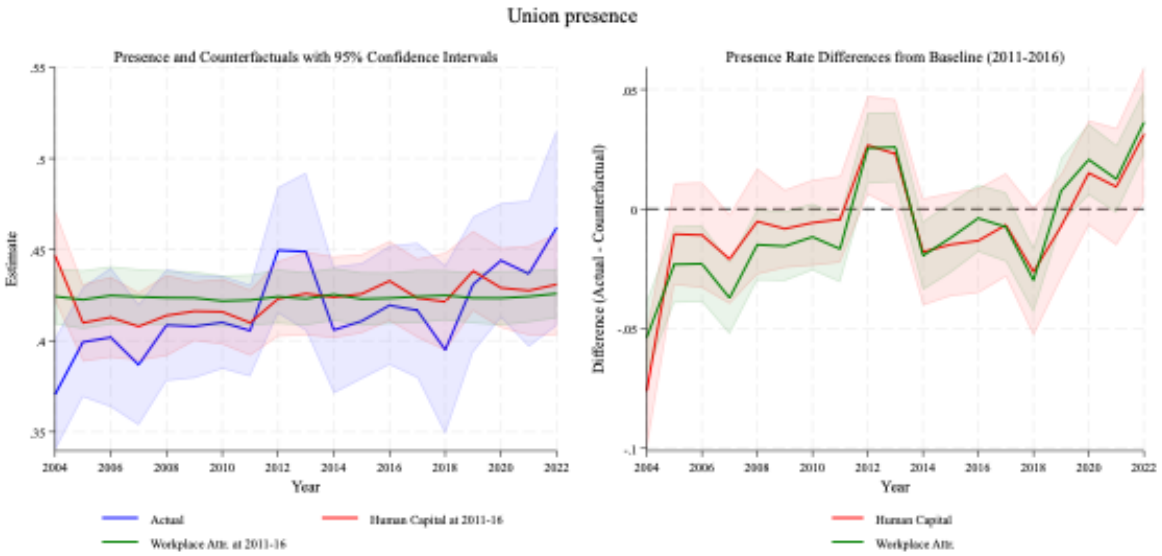


Supplementary file S.7.7. Union presence (JHPS), 2011-2016 baseline, private sector (weighted)

	Actual union membership			Human capital at 2011/16			Workplace attributes at 2011/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.332	0.301	0.363	0.438	0.412	0.464	0.394	0.378	0.411
2005	0.362	0.329	0.395	0.374	0.349	0.398	0.392	0.376	0.409
2006	0.362	0.327	0.398	0.378	0.352	0.404	0.395	0.378	0.411
2007	0.356	0.322	0.389	0.376	0.358	0.394	0.393	0.377	0.409
2008	0.379	0.346	0.412	0.386	0.365	0.406	0.393	0.377	0.408
2009	0.376	0.351	0.401	0.383	0.364	0.402	0.392	0.377	0.408
2010	0.382	0.355	0.410	0.383	0.363	0.403	0.391	0.376	0.406
2011	0.373	0.345	0.401	0.378	0.358	0.398	0.391	0.376	0.406
2012	0.418	0.384	0.451	0.388	0.365	0.412	0.393	0.378	0.408
2013	0.419	0.387	0.451	0.394	0.373	0.416	0.391	0.375	0.408
2014	0.378	0.345	0.410	0.393	0.373	0.413	0.394	0.378	0.410
2015	0.377	0.339	0.414	0.396	0.373	0.419	0.391	0.376	0.407
2016	0.387	0.344	0.429	0.402	0.378	0.426	0.391	0.375	0.407
2017	0.385	0.348	0.421	0.394	0.374	0.414	0.392	0.377	0.408
2018	0.366	0.331	0.400	0.391	0.368	0.415	0.393	0.378	0.409
2019	0.404	0.369	0.440	0.409	0.384	0.435	0.392	0.377	0.407
2020	0.420	0.383	0.458	0.400	0.377	0.422	0.392	0.376	0.408
2021	0.415	0.378	0.452	0.403	0.381	0.425	0.393	0.377	0.409
2022	0.440	0.394	0.486	0.404	0.378	0.430	0.394	0.379	0.410

	Difference actual/counterfactual	
year	Human capital	Workplace attributes
2004	-0.106***	-0.063***
2005	-0.012	-0.031***
2006	-0.016	-0.032***
2007	-0.020***	-0.037***
2008	-0.006	-0.013
2009	-0.007	-0.017***
2010	-0.000	-0.009
2011	-0.005	-0.018***
2012	0.029***	0.025***
2013	0.025***	0.027***
2014	-0.015	-0.016
2015	-0.019	-0.015
2016	-0.015	-0.004
2017	-0.009	-0.008
2018	-0.026***	-0.028***
2019	-0.005	0.013
2020	0.021	0.028***
2021	0.011	0.022***

2022	0.036***	0.046***

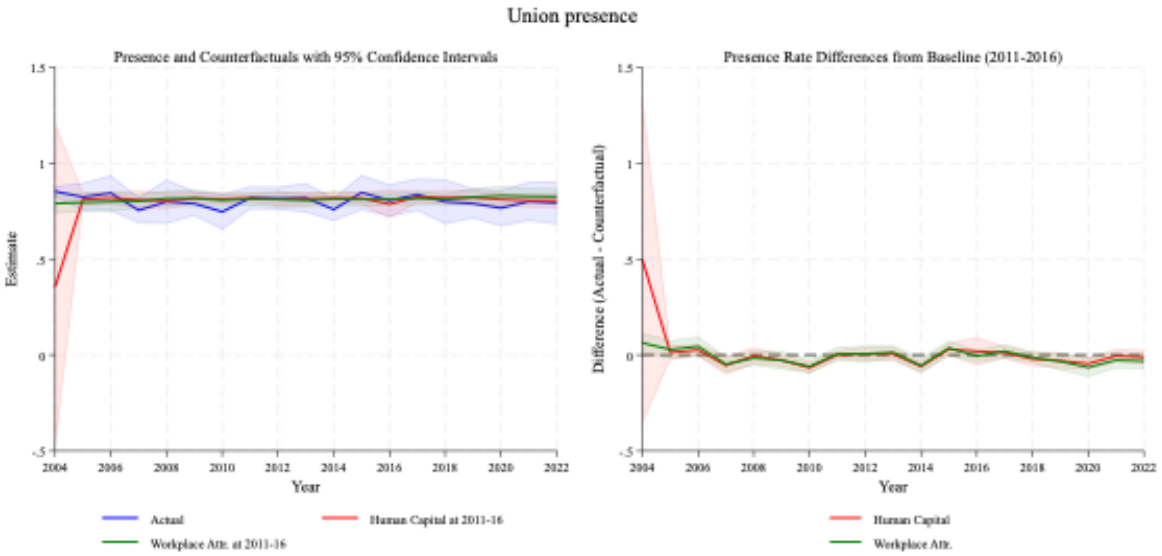


Supplementary file S.7.8. Union Presence (JHPS), 2011-2016 baseline, public sector (weighted)

	Actual union membership			Human capital at 2011/16			Workplace attributes at 2011/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.852	0.823	0.882	0.355	-0.499	1.210	0.790	0.737	0.842
2005	0.824	0.750	0.897	0.811	0.772	0.850	0.796	0.747	0.844
2006	0.844	0.751	0.937	0.818	0.785	0.851	0.800	0.748	0.851
2007	0.754	0.686	0.822	0.809	0.761	0.857	0.802	0.762	0.841
2008	0.799	0.684	0.915	0.804	0.760	0.847	0.816	0.776	0.856
2009	0.789	0.725	0.853	0.817	0.784	0.850	0.817	0.769	0.865
2010	0.747	0.652	0.841	0.813	0.784	0.843	0.806	0.770	0.842
2011	0.819	0.759	0.878	0.818	0.796	0.841	0.814	0.777	0.850
2012	0.817	0.757	0.877	0.812	0.775	0.849	0.811	0.768	0.855
2013	0.819	0.742	0.897	0.815	0.779	0.851	0.806	0.769	0.842
2014	0.759	0.698	0.820	0.819	0.789	0.848	0.814	0.771	0.856
2015	0.847	0.755	0.939	0.817	0.783	0.851	0.811	0.772	0.851
2016	0.805	0.721	0.890	0.787	0.713	0.860	0.812	0.780	0.844
2017	0.836	0.750	0.921	0.824	0.792	0.856	0.817	0.780	0.854
2018	0.799	0.682	0.916	0.820	0.783	0.857	0.812	0.782	0.841
2019	0.790	0.711	0.868	0.820	0.781	0.859	0.823	0.776	0.871
2020	0.766	0.671	0.862	0.811	0.778	0.845	0.831	0.780	0.881
2021	0.800	0.699	0.902	0.805	0.768	0.842	0.827	0.784	0.870
2022	0.793	0.680	0.905	0.805	0.768	0.843	0.825	0.783	0.868

	Difference actual/counterfactual	
year	Human capital	Workplace attributes
2004	0.497	0.063***
2005	0.013	0.028
2006	0.026	0.044
2007	-0.055***	-0.048***
2008	-0.004	-0.017
2009	-0.028	-0.028
2010	-0.067***	-0.060***
2011	0.000	0.005
2012	0.004	0.006
2013	0.004	0.013
2014	-0.060***	-0.055***
2015	0.030	0.036
2016	0.019	-0.006
2017	0.012	0.019
2018	-0.021	-0.013
2019	-0.031	-0.034
2020	-0.045***	-0.064***
2021	-0.005	-0.027

2022	-0.013	-0.033



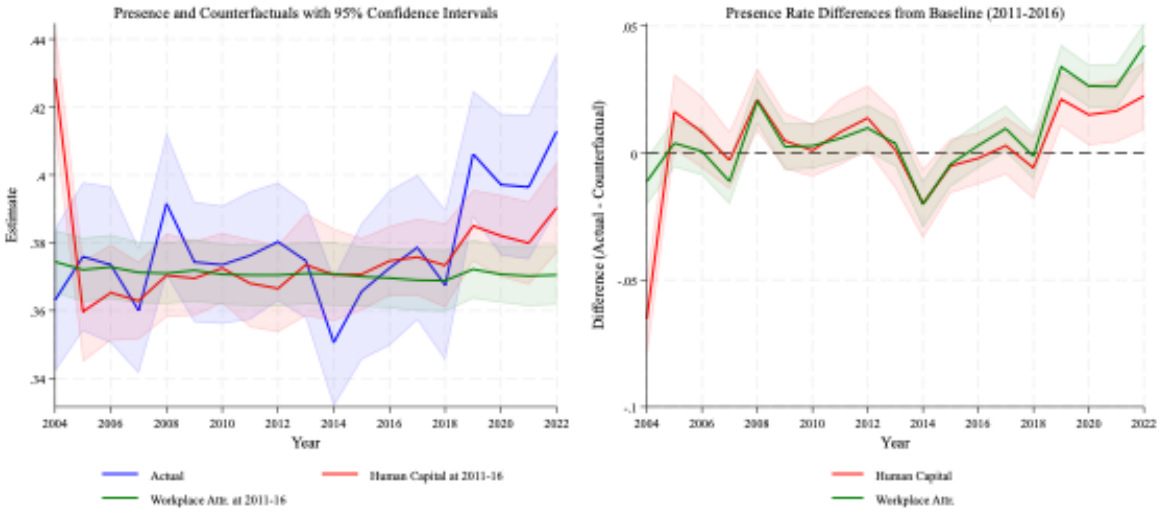
Supplementary file S.7.9. Union Presence (JHPS), 2011-2016 baseline, private sector (unweighted)

	Actual union membership			Human capital at 2011/16			Workplace attributes at 2011/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.363	0.342	0.384	0.428	0.412	0.445	0.374	0.365	0.384
2005	0.376	0.354	0.398	0.360	0.345	0.375	0.372	0.363	0.382
2006	0.373	0.350	0.397	0.365	0.351	0.379	0.373	0.363	0.382
2007	0.360	0.341	0.379	0.363	0.352	0.374	0.371	0.362	0.380
2008	0.391	0.370	0.413	0.370	0.358	0.383	0.371	0.362	0.380
2009	0.374	0.357	0.392	0.370	0.358	0.381	0.372	0.363	0.381
2010	0.374	0.356	0.391	0.372	0.362	0.383	0.371	0.362	0.380
2011	0.376	0.357	0.395	0.368	0.355	0.381	0.370	0.361	0.380
2012	0.380	0.363	0.398	0.367	0.354	0.379	0.370	0.361	0.380
2013	0.375	0.358	0.392	0.374	0.358	0.389	0.371	0.362	0.380
2014	0.351	0.332	0.370	0.371	0.357	0.384	0.371	0.361	0.380
2015	0.366	0.345	0.386	0.371	0.360	0.381	0.370	0.361	0.379
2016	0.373	0.350	0.395	0.375	0.364	0.385	0.370	0.361	0.378
2017	0.379	0.357	0.400	0.376	0.364	0.387	0.369	0.360	0.378
2018	0.367	0.345	0.390	0.373	0.361	0.386	0.369	0.360	0.378
2019	0.406	0.388	0.425	0.385	0.374	0.396	0.372	0.363	0.381
2020	0.397	0.376	0.418	0.382	0.370	0.394	0.371	0.362	0.379
2021	0.396	0.375	0.418	0.380	0.368	0.392	0.370	0.361	0.379
2022	0.413	0.390	0.436	0.390	0.377	0.404	0.371	0.362	0.379

	Difference actual/counterfactual	
year	Human capital	Workplace attributes
2004	-0.065***	-0.011***
2005	0.016***	0.004
2006	0.008	0.001
2007	-0.003	-0.011***
2008	0.021***	0.021***
2009	0.005	0.002
2010	0.001	0.003
2011	0.008	0.006
2012	0.014***	0.010***
2013	0.001	0.004
2014	-0.020***	-0.020***
2015	-0.005	-0.004
2016	-0.002	0.003
2017	0.003	0.010***
2018	-0.006	-0.001
2019	0.021***	0.034***
2020	0.015***	0.026***
2021	0.017***	0.026***

2022	0.022***	0.042***

Union presence

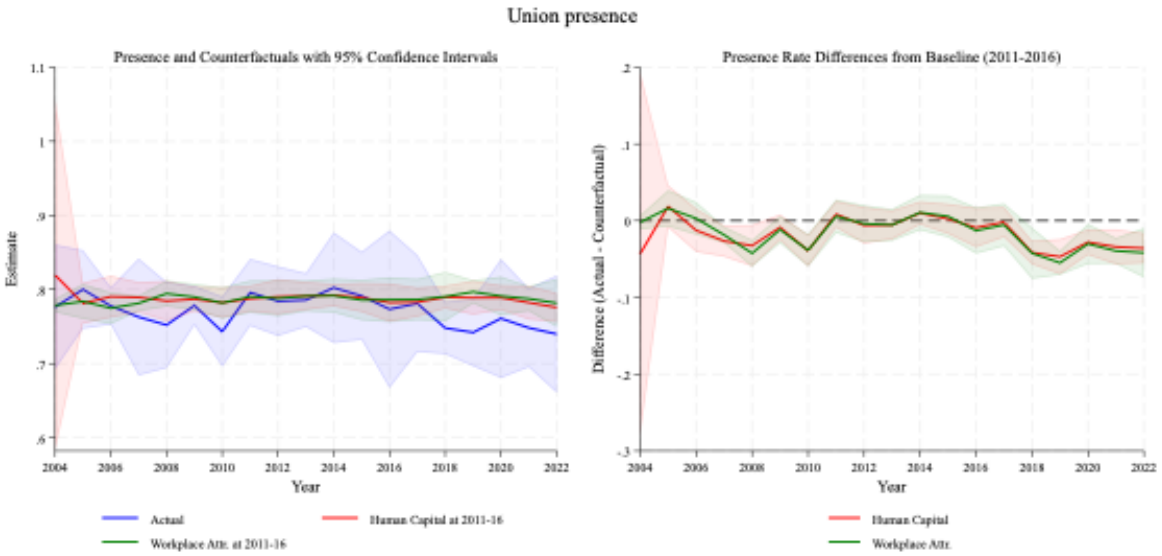


Supplementary file S.7.10. Union Presence (JHPS), 2011-2016 baseline, public sector (unweighted)

	Actual union membership			Human capital at 2011/16			Workplace attributes at 2011/16		
year	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI	Coef	lower 95%CI	Upper 95%CI
2004	0.776	0.692	0.861	0.820	0.582	1.057	0.778	0.769	0.788
2005	0.800	0.747	0.853	0.781	0.754	0.809	0.784	0.760	0.808
2006	0.778	0.752	0.803	0.790	0.762	0.819	0.775	0.753	0.796
2007	0.763	0.684	0.842	0.789	0.769	0.810	0.781	0.771	0.792
2008	0.752	0.694	0.810	0.784	0.757	0.812	0.794	0.777	0.812
2009	0.778	0.752	0.805	0.787	0.770	0.804	0.790	0.772	0.808
2010	0.743	0.696	0.791	0.782	0.762	0.803	0.782	0.761	0.803
2011	0.796	0.751	0.841	0.788	0.770	0.805	0.790	0.768	0.812
2012	0.784	0.737	0.831	0.790	0.766	0.814	0.788	0.764	0.812
2013	0.786	0.749	0.822	0.791	0.772	0.810	0.791	0.770	0.812
2014	0.802	0.728	0.877	0.792	0.777	0.807	0.792	0.769	0.815
2015	0.791	0.732	0.851	0.789	0.769	0.809	0.786	0.758	0.813
2016	0.773	0.667	0.880	0.782	0.757	0.808	0.786	0.756	0.816
2017	0.781	0.715	0.847	0.783	0.763	0.803	0.786	0.758	0.814
2018	0.748	0.713	0.783	0.790	0.774	0.805	0.790	0.757	0.824
2019	0.742	0.696	0.788	0.789	0.766	0.812	0.797	0.781	0.813
2020	0.761	0.680	0.841	0.789	0.772	0.806	0.791	0.765	0.817
2021	0.748	0.695	0.801	0.782	0.759	0.805	0.788	0.771	0.805
2022	0.740	0.660	0.819	0.776	0.756	0.795	0.782	0.749	0.814

	Difference actual/counterfactual	
year	Human capital	Workplace attributes
2004	-0.043	-0.002
2005	0.019	0.016
2006	-0.013	0.003
2007	-0.027***	-0.019***
2008	-0.032***	-0.042***
2009	-0.009	-0.012
2010	-0.039***	-0.039***
2011	0.008	0.006
2012	-0.006	-0.004
2013	-0.005	-0.005
2014	0.010	0.011
2015	0.002	0.006
2016	-0.009	-0.013
2017	-0.002	-0.005
2018	-0.042***	-0.042***
2019	-0.047***	-0.055***
2020	-0.028***	-0.030***
2021	-0.034***	-0.039***

2022	-0.036***	-0.042***



Supplementary file S.8. Blinder-Oaxaca Decomposition of union membership and presence – 2011-16 vs 2017-2023, linear and logit, SWLW

Supplementary file S.8.1. Union membership

	Linear	Logit
	membership	membership
overall		
group_1 (2017-23)	0.290***	0.290***
	[0.284,0.296]	[0.286,0.294]
group_2 (2011-16)	0.237***	0.237***
	[0.231,0.243]	[0.232,0.241]
difference	0.0535***	0.0535***
	[0.0452,0.0617]	[0.0473,0.0596]
explained	0.0268***	0.0245***
	[0.0204,0.0332]	[0.0203,0.0286]
unexplained	0.0267***	0.0290***
	[0.0213,0.0321]	[0.0234,0.0346]
explained		
human capital	-0.000986	-0.000715
	[-0.00228,0.000303]	[-0.00257,0.00114]
workplace attributes	0.00418***	0.00435***
	[0.00264,0.00573]	[0.00263,0.00607]
union presence	0.0235***	0.0207***
	[0.0175,0.0294]	[0.0167,0.0246]
additional	0.0000977	0.000159
	[-0.000169,0.000364]	[-0.000225,0.000543]
unexplained		
human capital	0.0144	0.0122
	[-0.00130,0.0301]	[-0.00157,0.0260]
workplace attributes	-0.0210	-0.0245
	[-0.0565,0.0145]	[-0.0524,0.00346]
union presence	0.0284***	-0.00232
	[0.0222,0.0346]	[-0.00753,0.00288]
additional	-0.00261	-0.00165
	[-0.0115,0.00630]	[-0.00835,0.00505]
Constant	0.00749	0.0453**
	[-0.0331,0.0481]	[0.0121,0.0785]
Observations	43724	43724

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.8.2. Union presence

	(1)	(2)
	presence	presence
overall		
group_1 (2017-23)	0.392***	0.392***
	[0.386,0.398]	[0.386,0.398]
group_2 (2011-16)	0.356***	0.356***

	[0.349,0.363]	[0.350,0.362]
difference	0.0360***	0.0360***
	[0.0269,0.0451]	[0.0273,0.0447]
explained	0.0243***	0.0227***
	[0.0189,0.0296]	[0.0180,0.0274]
unexplained	0.0117**	0.0133**
	[0.00425,0.0192]	[0.00532,0.0213]
explained		
human capital	0.00203**	0.00172*
	[0.000489,0.00357]	[0.000260,0.00318]
workplace attributes	0.0222***	0.0210***
	[0.0175,0.0270]	[0.0168,0.0251]
additional	0.00000891	0.0000102
	[-0.000381,0.000399]	[-0.000383,0.000404]
unexplained		
human capital	-0.0249*	-0.0159*
	[-0.0479,-0.00192]	[-0.0297,-0.00205]
workplace attributes	-0.0194	-0.00378
	[-0.0687,0.0299]	[-0.0290,0.0214]
additional	-0.00505	-0.00233
	[-0.0175,0.00744]	[-0.00925,0.00460]
Constant	0.0611*	0.0353*
	[0.00418,0.118]	[0.00198,0.0686]
Observations	43724	43724

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.9. Blinder-Oaxaca Decomposition of union membership and presence – 2011-16 vs 2017-2022, linear and logit, JHPS – private sector, weighted

Supplementary file S.9.1. Union membership

	(1)	(2)
	membership	membership
overall		
group_1 (2017-22)	0.265***	0.265***
	[0.251,0.280]	[0.253,0.278]
group_2 (2011-16)	0.263***	0.263***
	[0.250,0.275]	[0.253,0.274]
difference	0.00264	0.00196
	[-0.0168,0.0221]	[-0.0145,0.0184]
explained	0.00735	0.00768
	[-0.00748,0.0222]	[-0.00374,0.0191]
unexplained	-0.00471	-0.00572
	[-0.0174,0.00796]	[-0.0178,0.00638]
explained		

human capital	-0.00147	-0.00551
	[-0.00496,0.00201]	[-0.0209,0.00983]
workplace attributes	0.000278	-0.000743
	[-0.00195,0.00251]	[-0.00594,0.00445]
union presence	0.00854	0.0139**
	[-0.00512,0.0222]	[0.00379,0.0241]
unexplained		
human capital	0.0278*	0.122
	[0.000464,0.0552]	[-3.945,4.189]
workplace attributes	0.120	0.233
	[-0.153,0.393]	[-7.555,8.021]
union presence	-0.0138	-0.0322
	[-0.0281,0.000521]	[-1.223,1.159]
Constant	-0.139	-0.328
	[-0.414,0.136]	[-10.98,10.32]
Observations	27663	27639

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.9.2. Union presence

	(1)	(2)
	presence	presence
overall		
group_1 (2017-22)	0.406***	0.406***
	[0.389,0.422]	[0.390,0.422]
group_2 (2011-16)	0.392***	0.392***
	[0.377,0.406]	[0.378,0.406]
difference	0.0137	0.0137
	[-0.00807,0.0355]	[-0.00775,0.0352]
explained	0.00847	0.00908
	[-0.00283,0.0198]	[-0.00173,0.0199]
unexplained	0.00527	0.00465
	[-0.0135,0.0240]	[-0.0141,0.0234]
explained		
human capital	0.000467	0.000450
	[-0.00174,0.00268]	[-0.00187,0.00277]
workplace attributes	0.00800	0.00863
	[-0.00307,0.0191]	[-0.00193,0.0192]
unexplained		
human capital	0.0193	0.0156
	[-0.0241,0.0627]	[-0.0262,0.0574]
workplace attributes	-0.183	-0.106
	[-0.427,0.0614]	[-0.360,0.148]
Constant	0.169	0.0953
	[-0.0808,0.418]	[-0.153,0.343]
Observations	27663	27663

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.10. Blinder-Oaxaca Decomposition of union membership and presence – 2011-16 vs 2017-2022, linear and logit, JHPS – private sector, unweighted

Supplementary file S.10.1. Union membership

	(1)	(2)
	membership	membership
overall		
group_1 (2017-22)	0.238***	0.238***
	[0.231,0.246]	[0.232,0.245]
group_2 (2011-16)	0.221***	0.221***
	[0.214,0.228]	[0.216,0.227]
difference	0.0174***	0.0171***
	[0.00743,0.0274]	[0.00817,0.0260]
explained	0.0119***	0.00862**
	[0.00484,0.0190]	[0.00251,0.0147]
unexplained	0.00547	0.00844*
	[-0.00162,0.0126]	[0.00171,0.0152]
explained		
human capital	-0.00157	-0.00149
	[-0.00349,0.000357]	[-0.00329,0.000320]
workplace attributes	0.000490	0.000300
	[-0.000494,0.00148]	[-0.000636,0.00124]
union presence	0.0130***	0.00980***
	[0.00655,0.0195]	[0.00421,0.0154]
unexplained		
human capital	0.0109	0.00568
	[-0.00667,0.0286]	[-0.00740,0.0188]
workplace attributes	-0.0362	0.00482
	[-0.219,0.146]	[-0.0815,0.0911]
union presence	0.00314	-0.00221
	[-0.00467,0.0110]	[-0.00790,0.00348]
Constant	0.0276	0.000164
	[-0.156,0.211]	[-0.0886,0.0889]
Observations	27663	27639

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.10.2. Union presence

	(1)	(2)
	presence	presence
overall		
group_1 (2017-22)	0.394***	0.394***

	[0.385,0.402]	[0.385,0.402]
group_2 (2011-16)	0.370***	0.370***
	[0.363,0.378]	[0.363,0.378]
difference	0.0232***	0.0232***
	[0.0117,0.0347]	[0.0119,0.0345]
explained	0.00988**	0.00928**
	[0.00380,0.0160]	[0.00362,0.0149]
unexplained	0.0133**	0.0139**
	[0.00340,0.0232]	[0.00393,0.0239]
explained		
human capital	-0.000517	-0.000499
	[-0.00163,0.000595]	[-0.00156,0.000567]
workplace attributes	0.0104***	0.00978***
	[0.00450,0.0163]	[0.00430,0.0153]
unexplained		
human capital	-0.00330	-0.00342
	[-0.0295,0.0229]	[-0.0221,0.0153]
workplace attributes	0.0313	0.0252
	[-0.253,0.316]	[-0.168,0.218]
Constant	-0.0147	-0.00789
	[-0.301,0.272]	[-0.202,0.186]
Observations	27663	27663

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.11. Blinder-Oaxaca Decomposition of union membership and presence – 2011-16 vs 2017-2022, linear and logit, JHPS – public sector, weighted

Supplementary file S.11.1. Union membership

	(1)	(2)
	membership	membership
overall		
group_1 (2017-22)	0.432***	0.411***
	[0.363,0.501]	[0.322,0.501]
group_2 (2011-16)	0.393***	0.395***
	[0.340,0.446]	[0.338,0.453]
difference	0.0394	0.0159
	[-0.0475,0.126]	[-0.0901,0.122]
explained	0.0159	0.000116
	[-0.0251,0.0569]	[-0.0605,0.0608]
unexplained	0.0235	0.0158
	[-0.0558,0.103]	[-0.0681,0.0996]

explained		
human capital	0.0217*	-0.000284
	[0.00102,0.0424]	[-0.150,0.149]
workplace attributes	0.000163	0.000188
	[-0.0220,0.0223]	[-0.0986,0.0990]
union presence	-0.00598	0.000212
	[-0.0301,0.0181]	[-0.111,0.112]
unexplained		
human capital	0.0110	0.00302
	[-0.154,0.176]	[-0.0300,0.0360]
workplace attributes	-0.575***	-0.0961
	[-0.741,-0.408]	[-0.662,0.470]
union presence	0.0719	-0.0692
	[-0.0128,0.157]	[-0.481,0.343]
Constant	0.515***	0.178
	[0.254,0.777]	[-0.864,1.220]
Observations	1966	1935

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.11.2. Union presence

	(1)	(2)
	presence	presence
overall		
group_1 (2017-22)	0.797***	0.788***
	[0.784,0.810]	[0.748,0.829]
group_2 (2011-16)	0.811***	0.814***
	[0.798,0.824]	[0.774,0.853]
difference	-0.0143	-0.0253
	[-0.0330,0.00444]	[-0.0816,0.0310]
explained	0.0219**	0.0140
	[0.00559,0.0382]	[-0.000273,0.0282]
unexplained	-0.0362***	-0.0392
	[-0.0458,-0.0266]	[-0.0935,0.0151]
explained		
human capital	0.0204***	0.0305**
	[0.00928,0.0315]	[0.00886,0.0521]

workplace attributes	0.00152	-0.0165
	[-0.0134,0.0164]	[-0.0448,0.0117]
unexplained		
human capital	-0.0175**	-0.00895
	[-0.0283,-0.00667]	[-0.207,0.189]
workplace attributes	-0.372***	0.378
	[-0.375,-0.368]	[-0.0634,0.819]
Constant	0.353	-0.408
	[0.353,0.353]	[-0.858,0.0414]
Observations	1966	1920

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.12. Blinder-Oaxaca Decomposition of union membership and presence – 2011-16 vs 2017-2022, linear and logit, JHPS – public sector, unweighted

Supplementary file S.12.1. Union membership

	(1)	(2)
	membership	membership
overall		
group_1 (2017-22)	0.410***	0.393***
	[0.377,0.443]	[0.353,0.433]
group_2 (2011-16)	0.421***	0.422***
	[0.392,0.450]	[0.390,0.453]
difference	-0.0115	-0.0289
	[-0.0555,0.0324]	[-0.0795,0.0216]
explained	-0.00915	-0.0193
	[-0.0344,0.0161]	[-0.0543,0.0158]
unexplained	-0.00238	-0.00968
	[-0.0391,0.0343]	[-0.0450,0.0256]
explained		
human capital	0.00688	0.00404
	[-0.00811,0.0219]	[-0.00636,0.0144]
workplace attributes	0.000230	-0.00515
	[-0.00610,0.00656]	[-0.0108,0.000516]
union presence	-0.0163	-0.0182
	[-0.0336,0.00112]	[-0.0459,0.00959]

unexplained		
human capital	-0.0302	-0.0171
	[-0.144,0.0841]	[-0.0754,0.0411]
workplace attributes	-0.630***	0.00554
	[-0.784,-0.476]	[-0.0511,0.0622]
union presence	0.0240	0.0256
	[-0.0259,0.0739]	[-0.0550,0.106]
Constant	0.634***	-0.0237
	[0.480,0.788]	[-0.120,0.0723]
Observations	1966	1935

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.12.2. Union presence

	(1)	(2)
	presence	presence
overall		
group_1 (2017-22)	0.754***	0.746***
	[0.725,0.783]	[0.716,0.776]
group_2 (2011-16)	0.789***	0.787***
	[0.765,0.813]	[0.763,0.811]
difference	-0.0352	-0.0408*
	[-0.0727,0.00233]	[-0.0790,-0.00247]
explained	-0.00181	-0.00366
	[-0.0114,0.00783]	[-0.0126,0.00528]
unexplained	-0.0334	-0.0371
	[-0.0701,0.00332]	[-0.0751,0.000897]
explained		
human capital	0.00189	0.00121
	[-0.00602,0.00980]	[-0.00222,0.00464]
workplace attributes	-0.00369	-0.00487
	[-0.00951,0.00212]	[-0.0121,0.00240]
unexplained		
human capital	-0.00340	-0.0104
	[-0.138,0.131]	[-0.157,0.137]
workplace attributes	-1.054***	-0.0859
	[-1.224,-0.884]	[-0.521,0.349]

Constant	1.024***	0.0592
	[0.828,1.220]	[-0.401,0.520]
Observations	1966	1920

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.13. Blinder Oaxaca full decomposition results (linear)
Supplementary file S.13.1. SWLW

	(1)	(2)
	membership	presence
overall		
group_1 (2017-23)	0.290***	0.392***
	[0.284,0.296]	[0.386,0.398]
group_2 (2011-16)	0.237***	0.356***
	[0.231,0.243]	[0.349,0.363]
difference	0.0535***	0.0360***
	[0.0452,0.0617]	[0.0269,0.0451]
explained	0.0268***	0.0243***
	[0.0204,0.0332]	[0.0189,0.0296]
unexplained	0.0267***	0.0117**
	[0.0213,0.0321]	[0.00425,0.0192]
explained		
degree	-0.000528***	0.000284*
	[-0.000770,-0.000286]	[0.0000443,0.000524]
marriage	-0.0000698	-0.000515***
	[-0.000189,0.0000490]	[-0.000804,-0.000226]
age2034	-0.000871***	-0.00154***
	[-0.00127,-0.000471]	[-0.00224,-0.000845]
age5069	-0.000396**	-0.000555**
	[-0.000684,-0.000109]	[-0.000956,-0.000154]
female	0.0000812	-0.000120
	[-0.0000259,0.000188]	[-0.000278,0.0000382]
tenure_cat== 1.0000	-0.000114*	-0.000378**
	[-0.000225,-0.00000333]	[-0.000663,-0.0000926]
tenure_cat== 2.0000	0.000367***	0.000887***
	[0.000167,0.000567]	[0.000481,0.00129]
tenure_cat== 3.0000	0.000505***	0.00120***
	[0.000260,0.000749]	[0.000684,0.00171]
tenure_cat== 4.0000	0.00000902	0.000499
	[-0.0000397,0.0000577]	[-0.000137,0.00113]

tenure_cat== 5.0000	0.0000285	-0.000520
	[-0.0000331,0.0000901]	[-0.00126,0.000222]
tenure_cat== 6.0000	-0.000544***	0.00296***
	[-0.000829,-0.000258]	[0.00188,0.00404]
jobposition_parttime	-0.0000105	-0.00000197
	[-0.000789,0.000768]	[-0.000148,0.000144]
jobposition_contract	0.000745*	0.0000279
	[0.0000847,0.00140]	[-0.0000678,0.000124]
jobposition_dispatchedandother	-0.000188	-0.000193
	[-0.000667,0.000292]	[-0.000686,0.000300]
occupation== 2.0000	-0.00349***	-0.000394**
	[-0.00539,-0.00159]	[-0.000692,-0.0000958]
occupation== 3.0000	-0.00239*	-0.0000956
	[-0.00432,-0.000455]	[-0.000272,0.0000811]
occupation== 4.0000	0.00182*	0.000251
	[0.000151,0.00349]	[-0.00000715,0.000510]
occupation== 5.0000	0.00229**	0.000227*
	[0.000699,0.00387]	[0.000000134,0.000454]
occupation== 6.0000	0.0000693	-0.0000234
	[-0.000357,0.000496]	[-0.000168,0.000121]
occupation== 7.0000	0.00498***	0.000107
	[0.00329,0.00667]	[-0.000219,0.000433]
firmsize== 1.0000	0.000498*	0.0102***
	[0.0000586,0.000938]	[0.00805,0.0124]
firmsize== 2.0000	0.0000713	0.00107
	[-0.0000410,0.000184]	[-0.000310,0.00245]
firmsize== 3.0000	-0.0000176	-0.0000880
	[-0.000142,0.000107]	[-0.000708,0.000532]
firmsize== 5.0000	-0.000132	0.000559*
	[-0.000276,0.0000111]	[0.0000799,0.00104]

firmsize== 6.0000	-0.0000450	0.00149**
	[-0.000172,0.0000823]	[0.000472,0.00251]
firmsize== 7.0000	0.000599**	0.00805***
	[0.000220,0.000978]	[0.00541,0.0107]
f_industry== 2.0000	0.0000636	-0.00152***
	[-0.000113,0.000240]	[-0.00239,-0.000646]
f_industry== 3.0000	0.0000566	0.000244*
	[-0.0000280,0.000141]	[0.0000198,0.000469]
f_industry== 4.0000	-0.0000632	-0.000206
	[-0.000164,0.0000372]	[-0.000427,0.0000155]
f_industry== 5.0000	-0.00000369	0.00125***
	[-0.000148,0.000141]	[0.000595,0.00190]
f_industry== 6.0000	-0.0000103	-0.0000210
	[-0.0000673,0.0000467]	[-0.000106,0.0000644]
f_industry== 7.0000	0.0000747	0.000471
	[-0.0000333,0.000183]	[-0.0000346,0.000977]
f_industry== 8.0000	0.00000296	-0.000142
	[-0.0000301,0.0000360]	[-0.000380,0.0000947]
f_industry== 10.0000	-0.000122	-0.000440**
	[-0.000285,0.0000421]	[-0.000733,-0.000146]
f_industry== 11.0000	-0.0000633	-0.0000305
	[-0.000161,0.0000341]	[-0.000107,0.0000456]
f_industry== 13.0000	0.000185	0.000893***
	[-0.0000979,0.000468]	[0.000397,0.00139]
f_industry== 15.0000	-0.000186*	0.000330*
	[-0.000346,-0.0000265]	[0.0000755,0.000584]
presence	0.0235***	
	[0.0175,0.0294]	
tokyo	-0.0000596	-0.000113
	[-0.000160,0.0000404]	[-0.000298,0.0000724]
wave	0.000157	0.000122
	[-0.0000898,0.000404]	[-0.000221,0.000465]

unexplained		
degree	-0.00599	-0.0134**
	[-0.0124,0.000408]	[-0.0226,-0.00426]
marriage	0.00259	0.00613
	[-0.00341,0.00859]	[-0.00249,0.0148]
age2034	0.00857***	0.00846**
	[0.00441,0.0127]	[0.00221,0.0147]
age5069	0.000968	-0.00589*
	[-0.00298,0.00492]	[-0.0112,-0.000546]
female	0.00362	-0.00246
	[-0.00175,0.00899]	[-0.0103,0.00542]
tenure_cat== 1.0000	0.00158	-0.00153
	[-0.00162,0.00478]	[-0.00637,0.00331]
tenure_cat== 2.0000	-0.000561	0.000287
	[-0.00286,0.00174]	[-0.00313,0.00371]
tenure_cat== 3.0000	-0.000394	-0.00250
	[-0.00220,0.00141]	[-0.00506,0.0000579]
tenure_cat== 4.0000	-0.0000728	-0.00464***
	[-0.00180,0.00165]	[-0.00682,-0.00245]
tenure_cat== 5.0000	0.0000702	-0.00136
	[-0.00149,0.00163]	[-0.00321,0.000483]
tenure_cat== 6.0000	-0.000584	-0.00160
	[-0.00260,0.00143]	[-0.00390,0.000696]
jobposition_parttime	0.00266	-0.00366
	[-0.000254,0.00557]	[-0.00789,0.000565]
jobposition_contract	0.00120	-0.00194
	[-0.000440,0.00285]	[-0.00415,0.000276]
jobposition_dispatchedandother	0.000761	-0.000802
	[-0.000374,0.00190]	[-0.00253,0.000926]
occupation== 2.0000	-0.00182	-0.00500
	[-0.00674,0.00309]	[-0.0108,0.000763]

occupation== 3.0000	0.000180	-0.00808
	[-0.00752,0.00788]	[-0.0170,0.000850]
occupation== 4.0000	0.000224	-0.00347
	[-0.00355,0.00399]	[-0.00804,0.00111]
occupation== 5.0000	0.00210	-0.00156
	[-0.00137,0.00558]	[-0.00600,0.00288]
occupation== 6.0000	0.000478	0.00000413
	[-0.0000311,0.000987]	[-0.000730,0.000738]
occupation== 7.0000	0.000396	-0.00190
	[-0.00332,0.00411]	[-0.00645,0.00265]
firmsize== 1.0000	-0.00106	0.00162
	[-0.00586,0.00375]	[-0.00597,0.00920]
firmsize== 2.0000	0.000734	-0.000738
	[-0.00319,0.00466]	[-0.00693,0.00545]
firmsize== 3.0000	0.00000826	-0.000578
	[-0.00366,0.00368]	[-0.00640,0.00525]
firmsize== 5.0000	-0.0000174	-0.000338
	[-0.00245,0.00241]	[-0.00405,0.00338]
firmsize== 6.0000	-0.00278	-0.00353
	[-0.00584,0.000269]	[-0.00811,0.00105]
firmsize== 7.0000	-0.00666*	-0.00203
	[-0.0128,-0.000571]	[-0.0107,0.00661]
f_industry== 2.0000	-0.00367	-0.00118
	[-0.00938,0.00204]	[-0.00919,0.00683]
f_industry== 3.0000	0.0000101	0.000293
	[-0.000737,0.000757]	[-0.000662,0.00125]
f_industry== 4.0000	-0.00121	0.000279
	[-0.00369,0.00128]	[-0.00326,0.00382]
f_industry== 5.0000	-0.00252*	-0.000759
	[-0.00451,-0.000522]	[-0.00349,0.00197]
f_industry== 6.0000	-0.00198	0.00228
	[-0.00527,0.00131]	[-0.00245,0.00700]

f_industry== 7.0000	0.000177	0.00264
	[-0.00202,0.00238]	[-0.000225,0.00551]
f_industry== 8.0000	0.000762	0.000939
	[-0.000212,0.00174]	[-0.000504,0.00238]
f_industry== 10.0000	-0.00158	0.000815
	[-0.00341,0.000262]	[-0.00189,0.00352]
f_industry== 11.0000	-0.000417	0.000706
	[-0.00143,0.000594]	[-0.000811,0.00222]
f_industry== 13.0000	-0.00216	0.00115
	[-0.00661,0.00229]	[-0.00533,0.00764]
f_industry== 15.0000	-0.000198	-0.000936
	[-0.00156,0.00117]	[-0.00273,0.000856]
presence	0.0284***	
	[0.0222,0.0346]	
tokyo	0.000945	0.00370
	[-0.00644,0.00833]	[-0.00664,0.0140]
wave	-0.00356	-0.00875*
	[-0.00859,0.00148]	[-0.0158,-0.00173]
Constant	0.00749	0.0611*
	[-0.0331,0.0481]	[0.00418,0.118]
Observations	43724	43724

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.13.2. JHPS, private sector (weighted)

	(1)	(2)
	membership	presence
overall		
group_1 (2017-22)	0.265***	0.406***
	[0.251,0.280]	[0.389,0.422]
group_2 (2011-16)	0.263***	0.392***
	[0.250,0.275]	[0.377,0.406]
difference	0.00264	0.0137
	[-0.0168,0.0221]	[-0.00807,0.0355]

explained	0.00735	0.00847
	[-0.00748,0.0222]	[-0.00283,0.0198]
unexplained	-0.00471	0.00527
	[-0.0174,0.00796]	[-0.0135,0.0240]
explained		
degree	-0.00181***	-0.000264
	[-0.00285,-0.000783]	[-0.00134,0.000817]
marriage	0.0000311	0.000105
	[-0.000135,0.000197]	[-0.000204,0.000415]
age2034	-0.00149**	-0.000899
	[-0.00259,-0.000401]	[-0.00196,0.000158]
age5069	-0.00107*	0.000665
	[-0.00200,-0.000127]	[-0.0000925,0.00142]
gender_Female	0.00102*	0.000824
	[0.000109,0.00194]	[-0.0000847,0.00173]
jobposition_contract worker	0.00182	0.0000178
	[-0.000487,0.00412]	[-0.000284,0.000319]
jobposition_part-time	0.0000271	0.0000177
	[-0.00210,0.00215]	[-0.00137,0.00141]
firmsize_1	-0.000174	0.00114
	[-0.000452,0.000105]	[-0.000458,0.00274]
firmsize_2	-0.000206	0.00148
	[-0.000561,0.000148]	[-0.000609,0.00356]
firmsize_4	-0.000404	-0.00260
	[-0.000971,0.000164]	[-0.00570,0.000499]
firmsize_5	0.00134	0.00791
	[-0.000151,0.00284]	[-0.000570,0.0164]
firmsize_6	0	0
	[0,0]	[0,0]
firmsize_9	-0.000194	-0.000471
	[-0.000557,0.000169]	[-0.00119,0.000248]
industry_1	0.0000641	-0.0000892

	[-0.000175,0.000303]	[-0.000414,0.000235]
industry_2	-0.000152	0.000255
	[-0.000448,0.000144]	[-0.000163,0.000672]
industry_4	-0.000110	0.0000570
	[-0.00209,0.00187]	[-0.000974,0.00109]
industry_5	0.000818	-0.000159
	[-0.00221,0.00385]	[-0.000903,0.000586]
industry_6	-0.00110	0.00100
	[-0.00326,0.00105]	[-0.000911,0.00291]
industry_7	-0.000724	0.000562
	[-0.00205,0.000600]	[-0.000514,0.00164]
industry_8	0.0000325	0.0000152
	[-0.00155,0.00162]	[-0.000727,0.000757]
industry_9	-0.0000147	0.0000861
	[-0.000132,0.000103]	[-0.000476,0.000649]
industry_10	-0.0000124	-0.00000398
	[-0.00236,0.00233]	[-0.000757,0.000749]
industry_11	-0.000667	0.000891
	[-0.00160,0.000269]	[-0.000206,0.00199]
industry_12	0.000273	-0.000313
	[-0.000426,0.000971]	[-0.00109,0.000465]
industry_13	-0.00127*	-0.00000676
	[-0.00254,-0.00000187]	[-0.000750,0.000736]
industry_14	0.00416*	-0.00531*
	[0.00000957,0.00832]	[-0.00944,-0.00119]
industry_15	0.000714	0.00107
	[-0.000733,0.00216]	[-0.000469,0.00260]
industry_16	-0.00186	0.00233
	[-0.00437,0.000650]	[-0.000453,0.00512]
industry_17	0.0000144	0.0000141
	[-0.000702,0.000731]	[-0.000687,0.000715]

industry_99	-0.000255	0.000151
	[-0.000653,0.000144]	[-0.000234,0.000535]
presence	0.00854	
	[-0.00512,0.0222]	
unexplained		
degree	0.00659	0.00737
	[-0.00610,0.0193]	[-0.0116,0.0264]
marriage	0.00129	-0.0118
	[-0.0152,0.0178]	[-0.0365,0.0129]
age2034	0.00442	0.0142*
	[-0.00400,0.0128]	[0.000275,0.0281]
age5069	-0.000456	-0.00881
	[-0.0102,0.00929]	[-0.0223,0.00464]
gender_Female	0.0143*	0.0162
	[0.000364,0.0282]	[-0.00301,0.0355]
jobposition_contract worker	0.000137	0.000401
	[-0.00460,0.00488]	[-0.00546,0.00626]
jobposition_part-time	0.00157	0.00165
	[-0.00682,0.00996]	[-0.00978,0.0131]
firmsize_1	0.00167*	-0.000354
	[0.0000657,0.00328]	[-0.00246,0.00175]
firmsize_2	0.00169	-0.00548
	[-0.00454,0.00791]	[-0.0158,0.00479]
firmsize_4	0.00500	-0.000777
	[-0.00394,0.0139]	[-0.0153,0.0138]
firmsize_5	0.0107	-0.00563
	[-0.00248,0.0239]	[-0.0238,0.0125]
firmsize_6	0	0
	[0,0]	[0,0]
firmsize_9	0.000333	-0.00164
	[-0.000658,0.00132]	[-0.00348,0.000201]
industry_1	0.000128	-0.000811
	[-0.00100,0.00126]	[-0.00194,0.000313]

industry_2	0.000156	-0.000243
	[-0.000228,0.000540]	[-0.000640,0.000155]
industry_4	0.00860	-0.0126
	[-0.0139,0.0311]	[-0.0332,0.00788]
industry_5	0.0260	-0.0321
	[-0.0260,0.0779]	[-0.0786,0.0145]
industry_6	0.0107	-0.0347
	[-0.0334,0.0549]	[-0.0745,0.00498]
industry_7	0.00690	-0.00426
	[-0.00307,0.0169]	[-0.0136,0.00511]
industry_8	0.00880	-0.000991
	[-0.00615,0.0238]	[-0.0146,0.0126]
industry_9	-0.000700	-0.000689
	[-0.00352,0.00212]	[-0.00348,0.00211]
industry_10	0.00396	-0.0133
	[-0.0173,0.0252]	[-0.0327,0.00610]
industry_11	0.00252	-0.00231
	[-0.00365,0.00869]	[-0.00821,0.00358]
industry_12	0.00191	-0.00203
	[-0.00361,0.00742]	[-0.00720,0.00315]
industry_13	0.000543	-0.00181
	[-0.00217,0.00326]	[-0.00487,0.00126]
industry_14	0.0159	-0.0294
	[-0.0285,0.0603]	[-0.0693,0.0106]
industry_15	0.00586	-0.0140
	[-0.00957,0.0213]	[-0.0281,0.0000458]
industry_16	0.00745	-0.0167
	[-0.0217,0.0366]	[-0.0428,0.00949]
industry_17	0.00118	-0.00248
	[-0.00255,0.00491]	[-0.00602,0.00106]
industry_99	0.000528	-0.000261

	[-0.000272,0.00133]	[-0.00134,0.000816]
presence	-0.0138	
	[-0.0281,0.000521]	
Constant	-0.139	0.169
	[-0.414,0.136]	[-0.0808,0.418]
Observations	27663	27663

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Supplementary file S.13.3. JHPS, private sector (unweighted)

	(1)	(2)
	membership	presence
overall		
group_1 (2017-22)	0.238***	0.394***
	[0.231,0.246]	[0.385,0.402]
group_2 (2011-16)	0.221***	0.370***
	[0.214,0.228]	[0.363,0.378]
difference	0.0174***	0.0232***
	[0.00743,0.0274]	[0.0117,0.0347]
explained	0.0119***	0.00988**
	[0.00484,0.0190]	[0.00380,0.0160]
unexplained	0.00547	0.0133**
	[-0.00162,0.0126]	[0.00340,0.0232]
explained		
degree	-0.00213***	0.000776**
	[-0.00274,-0.00153]	[0.000196,0.00136]
marriage	0.000129	-0.000761***
	[-0.0000741,0.000331]	[-0.00120,-0.000323]
age2034	-0.000212	-0.000204
	[-0.000602,0.000177]	[-0.000583,0.000175]
age5069	-0.00142***	-0.000183
	[-0.00204,-0.000795]	[-0.000493,0.000128]
gender_Female	0.00149***	-0.000170
	[0.000880,0.00209]	[-0.000585,0.000244]
jobposition_contract worker	0.000645	0.0000477

	[-0.000635,0.00193]	[-0.0000690,0.000164]
jobposition_part-time	-0.0000670	-0.0000232
	[-0.00150,0.00136]	[-0.000519,0.000472]
firmsize_1	-0.000106	0.00132***
	[-0.000214,0.000000795]	[0.000614,0.00203]
firmsize_2	0.0000191	0.00182***
	[-0.000125,0.000163]	[0.000839,0.00281]
firmsize_4	-0.00000441	-0.000197
	[-0.0000442,0.0000354]	[-0.00191,0.00151]
firmsize_5	0.00111***	0.0106***
	[0.000545,0.00168]	[0.00585,0.0154]
firmsize_6	0	0
	[0,0]	[0,0]
firmsize_9	-0.0000148	-0.000424*
	[-0.000170,0.000141]	[-0.000759,-0.0000900]
industry_1	0.0000312	-0.0000234
	[-0.0000964,0.000159]	[-0.000125,0.0000784]
industry_2	0.0000136	-0.0000378
	[-0.0000365,0.0000637]	[-0.000148,0.0000723]
industry_4	-0.000495	0.000285
	[-0.00115,0.000160]	[-0.000362,0.000932]
industry_5	-0.000796	-0.000273
	[-0.00184,0.000243]	[-0.00117,0.000626]
industry_6	0.0000103	-0.00000308
	[-0.000778,0.000799]	[-0.000240,0.000234]
industry_7	-0.000337	0.000465
	[-0.000852,0.000177]	[-0.000219,0.00115]
industry_8	-0.000507	-0.000995
	[-0.00113,0.000112]	[-0.00205,0.0000557]
industry_9	-0.0000161	0.000146
	[-0.000127,0.0000947]	[-0.000148,0.000440]

industry_10	-0.000379	-0.000332
	[-0.00117,0.000414]	[-0.00106,0.000392]
industry_11	-0.000108	0.000264
	[-0.000361,0.000144]	[-0.000237,0.000765]
industry_12	-0.0000145	-0.000000425
	[-0.000290,0.000261]	[-0.0000192,0.0000184]
industry_13	-0.000370	-0.000676*
	[-0.000741,0.00000144]	[-0.00123,-0.000127]
industry_14	0.00218	-0.00345*
	[-0.0000764,0.00443]	[-0.00643,-0.000469]
industry_15	0.0000856	0.00138*
	[-0.000490,0.000662]	[0.000197,0.00256]
industry_16	0.0000286	-0.0000355
	[-0.000486,0.000543]	[-0.000676,0.000605]
industry_17	0.000225	0.000494
	[-0.000131,0.000581]	[-0.000240,0.00123]
industry_99	-0.0000648	0.0000568
	[-0.000238,0.000108]	[-0.000103,0.000217]
presence	0.0130***	
	[0.00655,0.0195]	
unexplained		
degree	0.00790*	-0.00382
	[0.000731,0.0151]	[-0.0139,0.00630]
marriage	0.00293	-0.00618
	[-0.00836,0.0142]	[-0.0230,0.0106]
age2034	0.00269	0.00503
	[-0.000758,0.00613]	[-0.000173,0.0102]
age5069	-0.00316	-0.0121**
	[-0.00946,0.00314]	[-0.0207,-0.00343]
gender_Female	-0.00123	0.00547
	[-0.00922,0.00676]	[-0.00645,0.0174]
jobposition_contract worker	0.00220	0.00113
	[-0.000625,0.00503]	[-0.00269,0.00494]

jobposition_part-time	-0.000379	0.00713
	[-0.00538,0.00462]	[-0.000272,0.0145]
firmsize_1	0.00107*	-0.000814
	[0.000201,0.00193]	[-0.00219,0.000559]
firmsize_2	-0.000722	-0.00163
	[-0.00389,0.00245]	[-0.00698,0.00371]
firmsize_4	-0.000328	-0.00289
	[-0.00495,0.00429]	[-0.0105,0.00468]
firmsize_5	0.000856	-0.00809
	[-0.00642,0.00813]	[-0.0182,0.00198]
firmsize_6	0	0
	[0,0]	[0,0]
firmsize_9	-0.000123	-0.000583
	[-0.000609,0.000364]	[-0.00147,0.000307]
industry_1	-0.000298	0.000134
	[-0.00116,0.000567]	[-0.00123,0.00150]
industry_2	0.000156	0.0000509
	[-0.000156,0.000468]	[-0.000494,0.000596]
industry_4	-0.00197	0.00322
	[-0.0146,0.0106]	[-0.0164,0.0228]
industry_5	-0.00404	0.00429
	[-0.0389,0.0308]	[-0.0499,0.0585]
industry_6	-0.00615	0.0101
	[-0.0369,0.0246]	[-0.0378,0.0581]
industry_7	-0.00166	0.00217
	[-0.00949,0.00617]	[-0.0100,0.0144]
industry_8	-0.00226	0.00377
	[-0.0109,0.00641]	[-0.00949,0.0170]
industry_9	-0.00131	0.00104
	[-0.00333,0.000711]	[-0.00209,0.00418]
industry_10	-0.00222	0.00509

	[-0.0143,0.00984]	[-0.0136,0.0238]
industry_11	-0.00274	0.00140
	[-0.00810,0.00262]	[-0.00691,0.00970]
industry_12	-0.000279	0.00191
	[-0.00396,0.00340]	[-0.00373,0.00756]
industry_13	-0.000731	0.000280
	[-0.00218,0.000720]	[-0.00182,0.00238]
industry_14	-0.00573	0.00678
	[-0.0363,0.0248]	[-0.0407,0.0543]
industry_15	-0.00176	0.0000841
	[-0.0116,0.00813]	[-0.0153,0.0154]
industry_16	-0.00587	0.00477
	[-0.0263,0.0145]	[-0.0270,0.0366]
industry_17	-0.000178	0.000117
	[-0.00287,0.00252]	[-0.00397,0.00420]
industry_99	0.0000655	0.0000382
	[-0.000469,0.000600]	[-0.000855,0.000931]
presence	0.00314	
	[-0.00467,0.0110]	
Constant	0.0276	-0.0147
	[-0.156,0.211]	[-0.301,0.272]
Observations	27663	27663

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$