Wage Spillovers across Sectors: Evidence from a Localized Public-Sector Wage Cut*

Tsuyoshi Goto† Atsushi Yamagishi‡

May 14, 2025

Abstract

We study how institutional wage reforms in one sector spill over to other sectors by analyzing the public sector. We leverage the Japanese policy reform that cut public-sector wages only in certain municipalities and the institutional setting in which only young workers are eligible for public-sector jobs. We find that a 1% public-sector wage cut reduces the private-sector wages of young workers by 0.3%. This spillover elasticity is greater when public-sector jobs are more important as workers' outside options. We also find that the migration outflow of young workers, consistent with the decline in their welfare in spatial equilibrium.

JEL classification: H72, J31, J38, R13, R50.

Keywords: spillover, wage reform, public sector, local labor market, Japan.

*We thank Mark Bamba, John Sturm Becko, Javier Birchenall, Zachary Bleemer, Leah Boustan, Ellora Derenoncourt, Taiyo Fukai, Masayoshi Hayashi, Shunsuke Hori, Ryo Kambayashi, Satoshi Kasamatsu, Daiji Kawaguchi, Keisuke Kawata, Wookun Kim, Nobuhiro Kiyotaki, Miki Kohara, Hideto Koizumi, Ayako Kondo, Dmitri Koustas, Yuta Kuroda, Mariko Nakagawa, Kentaro Nakajima, Hayato Nishi, Fumio Ohtake, Steve Redding, Karthik Sastry, Yasuhiro Sato, Hitoshi Shigeoka, Yuta Takahashi, Katsuya Takii, Kazuhiro Teramoto, Kensuke Teshima, Catherine van der List, David Weinstein, Jiro Yoshida, Xuanli Zhu, Owen Zidar, and numerous seminar and conference participants for their helpful comments. We acknowledge the data provided by the Ministry of Health, Labour and Welfare and the Ministry of Internal Affairs and Communications. This work was supported by Nomura Foundation and JSPS KAKENHI Grant Numbers JP20K22085 and JP24K16382. Yamagishi appreciates the financial support from Hitotsubashi University, Princeton University, the Funai Foundation for Information Technology, and JSPS KAKENHI Grant Number JP25K00629. All remaining errors are ours.

†Graduate School of Social Sciences, Chiba University. E-mail: t.goto@chiba-u.jp.

‡*Corresponding author*: Institute of Economic Research, Hitotsubashi University; Center for Real Estate Innovation, The University of Tokyo; Global Japan Lab, Princeton University. E-mail: a.yamagishi@r.hit-u.ac.jp.

1 Introduction

Institutional rules in a labor market can play a crucial role in determining the wage rate (Boeri and Van Ours 2021). Often, some sectors are particularly influenced by such institutional rules. For example, some sectors or employers may have specific minimum wages (Demir 2023; Derenoncourt and Weil 2025). Another example is the requirement of a uniform wage rate across locations, which many countries adopt in sectors such as healthcare and education (Staiger, Spetz and Phibbs 2010; Willén 2021). Reforms in these institutional rules can substantially change wages in some sectors, and they may even impact sectors not directly covered through spillover effects. Such spillovers should be accounted for when evaluating these reforms.

This paper studies the spillover effects of a public-sector wage cut on private-sector wages as a prominent example of institutional reforms that could induce wage spillovers across sectors. The public sector is an important employer in most countries, and its wage determination is heavily influenced by institutional settings. Among the OECD countries, the average employment share of the public sector is 18%, and the compensation of public employees accounts for, on average, 23% of total government expenditures (OECD 2021). This strong presence of the sector may contribute to spillovers into the private sector. Moreover, it is widely documented that the public-sector wage rate is determined differently than the private-sector wage rate because of institutional rules (Katz and Krueger 1991; Gregory and Borland 1999; Morikawa 2016). Thus, public-sector wage reform provides an interesting case for studying how institutional reforms in one sector affect other sectors, namely, the private sector, through spillover effects. Moreover, the public-sector wage itself is an important policy tool for achieving various objectives, such as gaining votes in the U.S. federal elections (Borjas 1984) and achieving fiscal consolidation after the global financial crisis (Forni and Novta 2014). Therefore, understanding the spillover effects of public-sector wage reforms is indispensable when evaluating policies regarding such reforms.

We leverage the geographic variation in public-sector wages to estimate how public-sector wage reforms affect private-sector wages. A key empirical challenge for identifying the effects of public-sector wages is the endogeneity concern that the public-sector wage may be determined in reference to local private-sector wages, inducing reverse causality. We overcome this endogeneity concern by exploiting a Japanese policy reform that changed the formula for determining public wages in each municipality. Since this reform was introduced to address the long-standing pay gap between private and public wages, which varied across municipalities, the updates in the public-sector wages considered the *level* of the private-sector wages in a local labor market but did not account for its contemporaneous *trend*. Therefore, the policy reform induced exogenous variation in public-sector wages after controlling for municipality fixed effects. Moreover, we exploit the presence of treatment and control groups within each municipality to further mitigate concerns that private-sector wage and population trends may be correlated with confounding region-specific trends. Specifically, we harness the institutional setting in which one must be

under 30 years of age to become a public employee in many local governments, which creates a situation where the spillover effect of public-sector wage reforms is relevant primarily for workers younger than 30. This empirical setting leads us to adopt a triple-difference strategy (Olden and Møen 2022), which exploits both the exogenous local variation in public-sector wages over time and the presence of treatment and control groups within each municipality. This allows us to control for any municipality-specific confounding trends. Moreover, even if older workers are also somewhat affected by the public-sector wage cut, the triple-difference strategy yields a conservative wage spillover elasticity estimate as long as young and older workers are affected in the same direction.

We estimate that a 1% public-sector wage cut reduces the private wages of young workers by 0.3%. While we use a public-sector wage cut to estimate wage spillovers, the magnitude of the spillover elasticity is comparable to wage spillover estimates across different employers in different contexts (e.g., Staiger et al. 2010; Willén 2021). In terms of the mechanism behind the wage spillover, we provide four pieces of evidence consistent with the interpretation that the wage spillover effect is greater when public-sector jobs are more important as outside options in the labor market. First, the wage spillover effect is larger when job mobility between public and private jobs is higher. Second, the wage spillover effect is larger when Japanese institutional setting induces higher job mobility in the labor market. Third, the wage spillover effect is larger once we exclude the three largest metropolitan areas, in which a public-sector job are likely to be a less important outside option due to severe competition among private firms in the labor market (Azar, Huet-Vaughn, Marinescu, Taska and von Wachter 2024). Finally, the wage spillover effect is larger in the areas with a higher share of public-sector workers. These findings reinforce the interpretation that the wage spillover we identify is driven by the competition between the private and public sectors in the labor market. Furthermore, we find the "union effect" in determining the wage spillover elasticity: the wage spillover elasticity is smaller among firms with the high labor union coverage rates. This could be driven by, for instance, downward wage rigidity induced by the bargaining power of labor unions (Hara and Kawaguchi 2008; Davis and Krolikowski 2025), implying that the wage spillover elasticity might be somewhat larger in response to a public-sector wage *increase*.

We also analyze how the young population responds to the public-sector wage cut. This analysis is motivated by simple spatial equilibrium logic à la Rosen (1979) and Roback (1982). Although the decline in private-sector wages among young workers is suggestive of their welfare decline, this finding is still inconclusive because the public-sector wage cut may also have other effects. Despite various possible channels through which public-sector wages affect welfare, if the public-sector wage cut induces a decrease in welfare, it should decrease housing demand in that location and cause migration outflow because people are willing to pay less for living there. Indeed, we empirically find a migration outflow of young workers in response to the public-sector wage cut, suggesting their welfare decline due to the public-sector wage cut. In addition, we investigate how much migration responses affect the wage spillover elasticity.

We provide several supplementary results. First, motivated by evidence that public-sector jobs are more attractive to women (Gomes and Kuehn 2019), we explore the heterogeneous effects on private-sector wages with respect to gender. We find little heterogeneity. Second, by using a spatial econometric model (Halleck Vega and Elhorst 2015) and an analysis based on the commuting zone (Adachi, Fukai, Kawaguchi and Saito 2021), we find that our results are robust to considering the possibility that the public-sector wages of neighboring municipalities might also affect local labor market outcomes. Finally, we illustrate the aggregate impact of the policy reform by calculating the national-level impacts of the 2006-2010 public-sector wage cut on the basis of our estimates, highlighting the economic importance of considering the spillover effects.

By analyzing the spillover effect of the public-sector wage cut on private wages, we provide novel evidence that institutional reforms in one sector can have sizable spillover effects on sectors not directly covered by these reforms. As a broad implication, our results highlight the importance of considering spillover effects when evaluating reforms in institutional wage rules, including minimum wages, anti-union laws, and equal-pay requirements across different geographical areas. More directly, our results elucidate how public-sector wages should be set. For example, public-sector wage cuts that are often adopted to achieve fiscal consolidation may significantly lower private-sector wages and reduce workers' welfare. This spillover effect should be considered a cost of such an austerity measure. Our results are also suggestive of a macroeconomic policy to combat wage stagnation: raising public-sector wages may help resolve wage stagnation through spillover effects. In our context, the Japanese economy over the last 30 years has been characterized by the stagnation of both nominal and real wages (Ito and Hoshi 2020). While a public-sector wage increase is sometimes suggested as a potential measure to increase wage growth (e.g., Bernanke 2017), its effectiveness has not been empirically investigated.[1] Our findings provide some rationale for such a proposal by offering causal evidence that a public-sector wage cut restrains private wages. Moreover, our results imply that welfare may improve, at least for young workers.

This paper is related to four strands of literature. First, our paper contributes to a small but growing body of quasiexperimental evidence on wage spillover effects across sectors or employers.[2] For example, Staiger et al. (2010) and Willén (2021) examined the spillover effects of wage changes caused by the abolition of a nationally uniform wage schedule. Demir (2023) and Derenoncourt and Weil (2025) analyzed the spillover effect of minimum wages that apply only to a subset of employers. Bassier (2022) studied the spillover effects of collective wage

[1] Despite a lack of formal evidence, this possibility has also been noted by some politicians. For example, Goshi Hosono, a member of the House of Representatives and a former Minister of the Environment, stated that "To achieve a wage increase, especially in a rural area, we should increase the public-sector wages to promote the private-sector pay raise" (https://twitter.com/hosono_54/status/1585775663314702336, last accessed on April 15, 2024. The original quote in Japanese has been translated by the authors).

[2] Wage spillovers across sectors have also been analyzed in previous studies, especially in the context of wage bargaining (e.g., Shinkai 1980).

bargaining on sectors not covered by these bargaining rules.

Our paper is distinctive from these wage spillover studies in several important ways. First, we contribute to this literature by providing novel evidence that public-sector wage cuts reduce private-sector wages and induce out-migration in the local labor market.[3] In addition to its own importance, the public sector is an interesting setting for investigating such spillovers because of its large employment share and the crucial role of institutional rules in determining wages. Second, complementing the analysis of Bassier (2022), we find evidence suggesting that competition in the labor market between the public and private sectors is a plausible mechanism behind the wage spillover effect.[4] Third, our study exploits public-sector wage *cut*, rather than wage increase, which has been the primary focus in the literature. This allows us to investigate the potential asymmetry of wage spillover effects. Notably, while we find some evidence that the spillover elasticity is smaller in firms covered by labor unions, the downward wage rigidity does not substantially shrink the wage spillover elasticity as our overall estimate of wage elasticity of 0.3 is close to several estimates in the literature (e.g., Staiger et al. 2010; Willén 2021).[5] Finally, by invoking an idea of spatial equilibrium, we analyze the migration response to investigate whether the public-sector wage cut induced welfare decline or improvement.

Second, our paper contributes to reduced-form studies on the relationship between public and private wages. The majority of studies have documented a positive relationship between public-sector and private-sector wages (e.g., Ehrenberg and Goldstein 1975; Lacroix and Dussault 1984; Gregory and Borland 1999; Lamo, Pérez and Schuknecht 2012; Afonso and Gomes 2014; Abdallah, Coady and Fah Jirasavetakul 2023).[6] While these correlations are suggestive, most studies in this literature do not address the endogeneity of public-sector wages, presumably because their exogenous variation is rare. An important exception is Telegdy (2018), who used a national wage reform in Hungary that uniformly raised public-sector wages across locations. Consistent with our findings, he found that private-sector workers who were more strongly hit by the public wage shock, especially young workers, experienced a wage increase. Our contribution is to exploit the novel exogenous variation in the local public wage itself and causally estimate the elasticity of private wages with respect to public wages. We also find evidence suggesting that labor market competition between the public and private sectors drives wage spillovers. In addition, we examine the role of labor unions and the welfare effect of the public-sector wage cut by invoking a spatial equilibrium idea.

[3]The spillover effect of the public-sector wage cut on private-sector wages and the population is consistent with the wage-setting power of the public sector as an employer, which is sensible given the significant employment share of the public sector and is consistent with experimental evidence by Dal Bó, Finan and Rossi (2013).

[4]Although we use a simple wage bargaining model to motivate our empirical analysis, our empirical results highlight the importance of labor market competition between the public and private sectors, which is also consistent with the oligopsonistic competition framework often invoked in this literature (e.g., Staiger et al. 2010; Bassier 2022; Berger, Herkenhoff and Mongey 2022).

[5]We also find the spillover elasticity is around 0.8 in sectors with most active flows between public and private jobs, which is similar to the estimate of Bassier (2022).

[6]However, some studies do not find a positive relationship (e.g., Auld, Christofides, Swidinsky and Wilton 1980).

Third, our study also relates to studies analyzing the impact of reforms in public wages and employment by fully specifying and calibrating an economic model of the labor market (e.g., Burdett 2012; Gomes 2015, 2018; Bradley, Postel-Vinay and Turon 2017; Bermperoglou, Pappa and Vella 2017; Albrecht, Robayo-Abril and Vroman 2019; Chang, Lin, Traum and Yang 2021; Lu and Kameda 2024). Since we exploit a quasiexperiment, we can estimate the causal impact of public wages without committing to a particular labor market structure. Moreover, our spatial equilibrium framework allows us to infer the qualitative welfare implications of public wage reform from migration responses. Therefore, by estimating the effect on net migration, we can analyze welfare implications without fully specifying the labor market structure.

Finally, while we focus on the spillover effects of public-sector *wages*, a growing number of studies have examined the impact of public-sector *employment* in local labor markets, such as the increase in private-sector jobs in response to an increase in public-sector jobs. (Faggio and Overman 2014; Zou 2018; Faggio 2019; Auricchio, Ciani, Dalmazzo and de Blasio 2020; Jofre-Monseny, Silva and Vázquez-Grenno 2020; Becker, Heblich and Sturm 2021; Guillouzouic, Henry and Monras 2024; Lee, Ko and Kim 2024; Chirakijja 2024; Franklin, Imbert, Abebe and Mejia-Mantilla 2024). Although this burgeoning literature exemplifies substantial academic and policy interest in the public sector, these papers do not analyze the spillovers of public-sector *wages*. In stark contrast, we analyze the spillovers of public-sector *wages* on private-sector wages via a local labor market approach, which we achieve by leveraging a distinctive Japanese public-sector wage cut and institutional setting.

This paper is organized as follows. Section 2 explains the relevant institutional background. Section 3 describes the data and our empirical specification. Section 4 presents our main results concerning the spillover effects on private-sector wages, along with additional evidence regarding the underlying mechanism behind wage spillovers and the role of union bargaining. Section 5 examines the effect of public-sector wage cut on out-migration and discusses its implications. Section 6 presents additional results. Section 7 concludes the study.

2 Empirical setting

This section describes the institutional contexts relevant for our analysis. We start with general background information about the Japanese public sector. We then describe the public-sector wage reform from 2006-2010, which cut public-sector wages in some municipalities but not in other municipalities. Finally, we describe the situation in which the private sector and public sector compete with each other to employ young workers due to institutional settings, while such competition essentially does not exist for older workers. These institutional contexts motivate our empirical strategy in Section 4.

Background information on the Japanese public sector We provide relevant background information about the Japanese public sector. The total number of public officials in Japan was approximately 3.5 million in 2010, constituting approximately 6% of total employment, and

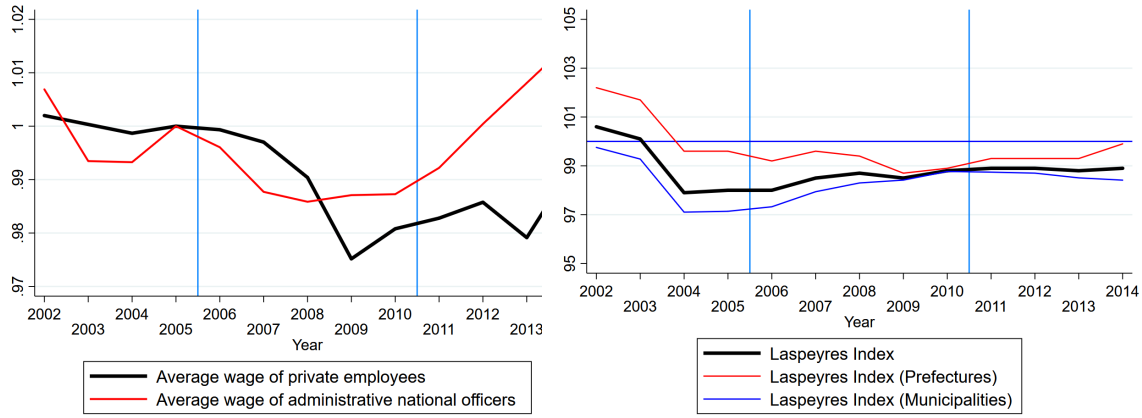
the compensation of public employees constituted 14% of total government expenditures; both are among the lowest in OECD countries (the OECD averages are 18% and 23%, respectively; OECD 2021). While these numbers in Japan are still large as a single employer and the spillover effect can be reasonably observed, finding a significant impact of public-sector wages in the Japanese context might also suggest a significant impact in other countries in which the public sector is more sizable. Among the public officials, 2.85 million, or more than 80%, are local public officials, workers employed by the local governments. The remaining 20% are national public officials, workers employed by the national government.

Salary levels for national public-sector workers are balanced with those of private-sector employees by the National Personnel Authority, the central administrative agency in charge of human resource management in public administration. In Japan, public wages are not determined through negotiations between employers and unions because collective bargaining rights and the right to strike are severely restricted for most public workers (Shimoi 2017). Figure 1a shows the national average private wages and the wages of national public officials. While both wages tend to exhibit similar trends, the wage levels of national public-sector workers are not necessarily equal to those of private-sector workers. This implies that in addition to labor market conditions, the administration's discretionary policies affect the average wages of national public-sector workers.[7] Later in this section, we introduce a policy reform that suddenly changed public-sector wages irrespective of contemporaneous trends in private wages.

According to the Local Public Service Act, the wage level of local public-sector workers must be balanced with the wage level of national public-sector workers, local public-sector workers in other jurisdictions, and local private-sector workers. This rule is called the "equal pay principle", and following this rule implies that the wage level of local public-sector workers depends on the wage level of local private-sector workers. However, as shown by Kawasaki and Nagashima (2007), Aoki (2021), and Marumi (2023), local governments actually focus on the wage gap between local and national governments because of the strict guidance of the national government to minimize this gap. As an example of such guidance, the national government annually publicizes the "Laspeyres index", which shows the previous year's salary level for each local government relative to the central government. Local governments with relatively high wages are frequently reported in newspapers and magazines by referring to the index (Morikawa, 2016), pressuring them to lower local public-sector wages. Figure 1b shows the Laspeyres index of the base salaries for the local governments, overall and separately for the prefectural and municipal governments. Figure 1b shows that throughout our sample period, the Laspeyres index is stable near 100 and ranges from 97 to 102, implying that the gap between the wages of nationally employed and locally employed public officials is, at most, only 3%.

[7]For example, to raise funds for reconstruction following the Great East Japan Earthquake, wages for national public servants were reduced by an average of approximately 7.8% in 2012 and 2013, and some local governments followed this measure. Since this measure is temporal and our results are robust even after excluding data after 2012, we ignore this measure in the figures and analyses of this paper. Our event-study results in Section 4.1 suggest that this temporal measure in 2012 and 2013 did not have a large effect on private-sector wages.

Figure 1: Public-sector wage trends in Japan



(a) National average wages relative to the 2005 basis

(b) The average Laspeyres index of local governments

Source: Basic Survey on Wage Structure and White Paper on Public Employees. Note: Figure 1a shows the national average wages of private employees and national officers relative to the baseline in 2005, which are shown by black and red lines, respectively. Following the definition of wages in the Basic Survey on Wage Structure, the wage here includes the base salary and all allowances except overtime pay and bonus. Figure 1b shows the trends of the Laspeyres index. The Laspeyres index shows the previous year's wage level for each local government relative to the central government. The index represents the base salary level of local government employees when the base salary level of national employees is set at 100. To eliminate the influence of academic background, years of experience, and the composition of staff in local governments, the index is calculated by applying the average salary of local officials by education and years of experience to the national staff composition.

Regardless of their job duties, national government employees receive regional allowances of a certain percentage of their base salary depending on their place of residence. The regional allowance is a place-based wage premium adjusted for the price level in each region, which is independent of individual characteristics, such as age, education, and job. Specifically, the effective wage rate of individual i in municipality j in year t is

$$\text{Effective wage}_{ijt} = (1 + \text{Regional allowances rate}_{jt}) \times \text{Base wage}_{it}. \tag{1}$$

As such, regional allowances act as a multiplicative wage premium of the nationally uniform base wage that depends on individual characteristics. Note that the regional allowance rate depends on municipality j only and is independent of individual characteristics.[8]

The regional allowance rate for national government employees also dictates regional allowance rates for local officials. Although local governments have discretion over the level of their regional allowances, they are effectively required to closely follow the national level as they do for the base salary (Aoki 2021).[9] Therefore, the national regional allowance rate in municipality j represents the overall public-sector wage level in this municipality.

[8]Such a pricing design with a location premium is not unique to public-sector wages in Japanese policy design. For example, Kondo (2019) exploited a similar pricing structure of elderly care services in Japan to estimate the effect of elderly care service prices on the employment, earnings, and working hours of elderly care workers.

[9]The wage gap between national and local governments, accounting for regional allowances, is also stable and is published annually as the "modified Laspeyres index".

Note that the Japanese public-sector wage system is not an outlier in the sense that similar systems can be found in other countries. For example, France has a regional allowances (indemnité de résidence) system, where the local civil service pay is expected to follow the national one.[10] However, the Japanese system is distinctive in that the variation in regional allowances is large (0-20%), whereas the variation in the French system ranges from 0% to 3% of the base salary (Ministry of Public Transformation and Service of France, 2023). The large variation in regional allowances in Japan is helpful for empirically identifying the effects of public-sector wages.

Public-sector wage reform from 2006-2010. From 2006-2010, the Japanese government reformed national public-sector wages by reducing the base wage and introducing a new regional allowance schedule with greater regional variation. The reform is illustrated in Figure 2. The main goal of the reform was to improve the fiscal balance by reducing the wage rate of national public-sector workers in nonurban areas, which was criticized as being too high relative to private wages. This was achieved by combining the following two reforms. First, the base salary, which was nationally uniform, gradually decreased each year over five years. The total wage cut was 4.8% of the original base wage. This reform reduced the public wage of nonurban areas ("municipality A" in Figure 2), but it also reduced the public wage rate in urban areas ("a municipality in Tokyo" in Figure 2), which seems undesirable as the public wage becomes lower than the private wage. The second reform corrected this by introducing new regional allowance rates. Although the old regional allowances were paid in limited locations and in limited amounts, the new regional allowances expanded the coverage and amounts. As a result, urban areas, such as Tokyo, did not experience a public wage decrease, and some even experienced a wage increase due to increased regional allowances despite the reduction in the base wage.

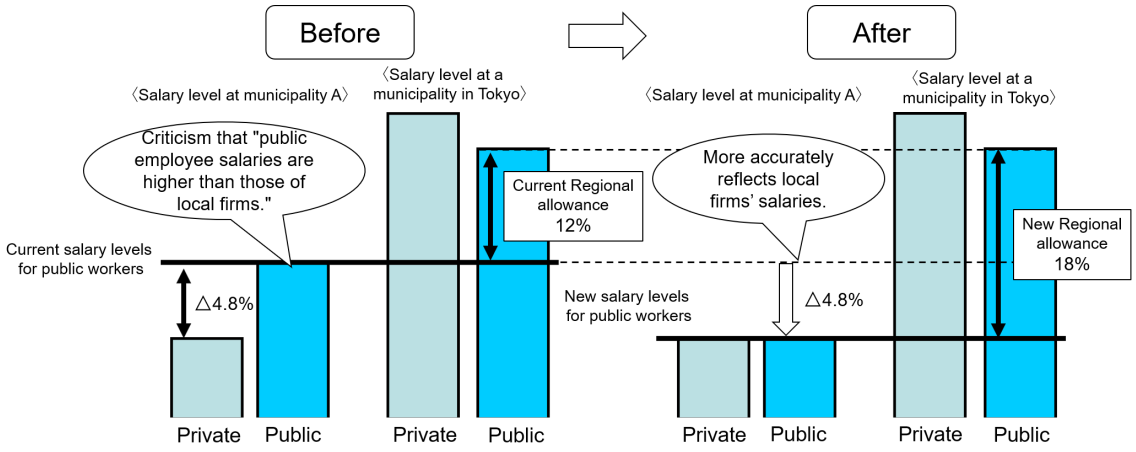
We make three further remarks about the implementation of the policy reform. First, note that the new regional allowance system increased the wage premium in both municipalities that were already covered in the older regional allowance system (e.g., "a municipality in Tokyo" in Figure 2) and newly covered municipalities that did not receive the wage premium in the older system. Second, the new regional allowance system was introduced in 2006, after which the regional allowance rates gradually increased over five years until the completion of the policy reform in 2010.[11] Third, the amount of the new regional allowances was calculated based on each municipality's 10-year average wage index, which means that the regional allowances do not account for contemporaneous economic factors such as current trends in the labor market.

These new regional allowances created greater cross-sectional variation in public-sector

[10]However, in some countries, either trade unions are involved in the salary determination process or the federal system dictates that local public officials are paid differently in different regions, Japan and France are similar in that trade unions have a relatively limited role in salary determination and local governments are expected to follow the central government salary determination process.

[11]For instance, Tokyo experienced a six percentage-point increase in the rate of regional allowances, with an average annual increase of 1.2 percentage points from 2005 to 2010.

Figure 2: Graphical illustration of the national public-sector wage reform



Note: This figure illustrates the national public-sector wage reform, which reduced the base salary and introduced a new regional allowance system. The figure is taken from https://www.mext.go.jp/b_menu/shingi/chukyo/chukyo3/041/siryo/__icsFiles/afieldfile/2019/05/15/1416840_001.pdf (in Japanese, last accessed on June 5, 2023), where comments in the figure are partly modified and translated into English by the authors.

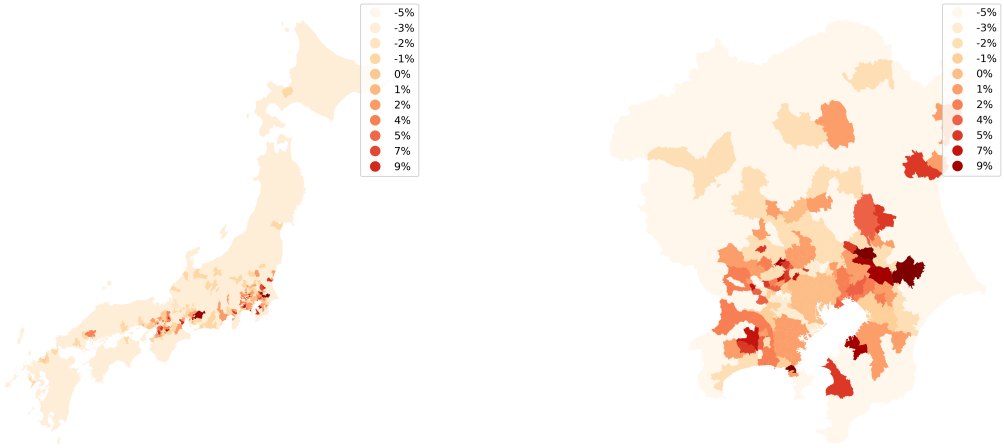
wages at the municipality level, which we exploit to identify their effects on local economic outcomes. Figure 3 shows the impacts of the policy reform on the effective wages of public workers in municipalities in Japan as a whole and in the Kanto region of Japan. Figure 3a clarifies that the increase in effective wages due to increased regional allowance rates was concentrated in urban areas, most notably in the three largest metropolitan areas (Tokyo, Osaka, and Nagoya). However, Figure 3b indicates that there was substantial variation in the change in the effective wage across municipalities within a smaller region or a metropolitan area. In particular, while urban municipalities generally tended to experience an increase in regional allowances, most urban municipalities did not experience the largest increase, and a larger increase was observed in relatively more rural municipalities (e.g., Tokyo's 23 wards experienced an approximately 0% change in the effective wage). This is because our policy variation has both intensive margins and extensive margins, providing a large increase in regional allowance rates for municipalities that were newly eligible for regional allowances.

Taken together, the results show that the base salary of the nationally employed public workers was reduced in most of Japan due to the reform, whereas some areas even experienced an increase in the public-sector wage due to the new regional allowance schedule. Thus, the new regional allowance policy exogenously created greater variation in the public-sector wage across local labor markets.

As shown in Kawasaki and Nagashima (2007), Aoki (2021), and Marumi (2023), the wage rates of local public officials closely track those of national public officials working in the same area through administrative guidance by the national government[12], although local governments

[12]The national government also simultaneously updated the amount of the lump-sum transfer to local governments according to the wage rates of national public officials (Ministry of Internal affairs and Communications 2006). This implies that the local government obtained no fiscal gain from the public-sector wage cut because

Figure 3: Changes in effective public-sector wages



(a) Japan **(b)** Kanto region

Note: These figures show the changes in the effective wage level before and after the introduction of the new regional allowances in Japan (panel 3a) and the Kanto region (panel 3b). The Kanto region is one of the regions of Japan centered on the Tokyo metropolitan area. The darker red areas indicate a greater percentage change in the level of regional allowance payments. In both panels, some small islands (e.g., Okinawa) are omitted for visibility. From Equation (1), the effective wage in 2010 can be expressed as $(1 + RA_{i,2010}) \times \text{Base wage}_{i,2010}$, where RA is the regional allowance rate. The change in the effective wage can be calculated as $(1 + RA_{i,2010}) \times \text{Base wage}_{i,2010} - (1 + RA_{i,2005}) \times \text{Base wage}_{i,2005} = (\text{Base wage}_{i,2010} - \text{Base wage}_{i,2005})(1 + RA_{i,2010}) + (RA_{i,2010} - RA_{i,2005}) \times \text{Base wage}_{i,2005} = -0.048 \times (1 + RA_{i,2010}) + (RA_{i,2010} - RA_{i,2005})$, where we normalize $\text{Base Wage}_{i,2005}$ to 1 in the last equation. The wage changes shown in the figures are based on this calculation, where we round the values to the nearest decimal place.

can, in principle, determine the wage rates of their public officials. Therefore, although the policy reform during 2006-2010 concerned national public officials, it accompanied an almost parallel change in the wages of the local public sector. Consequently, what we identify as the effect of national public-sector wages in a given municipality can be approximately interpreted as the effects of overall public-sector wages in the municipality, including both locally employed and nationally employed public officials.[13]

Workers' age and public-sector jobs in the labor market. In the labor market, public and private sectors may compete with each other to attract workers. From private workers' perspective, a public-sector job is an outside option of a private-sector job. Taking this into account, private firms may adjust their wage rates to the attractiveness of this outside option (Caldwell and Danieli 2024), inducing the wage spillover effect in response to a public-sector wage cut. In Section 4.1 we provide evidence consistent with the interpretation that labor market competition between public and private sectors drives the wage spillover effect in our context.

To examine the wage spillover effect of the public-sector wage cut through such labor market competition, we harness the Japanese institutional setting in which young workers are primarily exposed to the public-sector jobs in the labor market. In the Japanese context, public and private sectors actively compete with each other to attract *young* workers while such competition is limited for *older* workers. There are two key institutional features behind this situation.[14] First, the lifelong employment system is conventional in the Japanese labor market, which substantially limits labor mobility for older workers (e.g., Genda, Kondo and Ohta 2010; Ito and Hoshi 2020). Second, most public-sector jobs mandate a recruitment exam for screening, and an upper age limit is typically imposed for screening.[15] For national public officials, the upper age limit is usually set at 30.[16] There are similar upper age limits for exams for local public officials.[17] Consistent with the limited job mobility between public and private sectors for older workers, while we observe young workers' net inflow into the public sector, such is nearly zero for older

the fiscal benefit was exactly offset by the reduction in the transfer. This leaves little room for the simultaneous policy change that exploits the fiscal gain due to the public-sector wage cut, allowing us to identify the effect of public-sector wage reduction.

[13]As an alternative strategy, we tried a specification in which the explanatory variable is the wage rate of local public officials, instrumented by the national public officials, which yields a larger wage spillover elasticity (see Table B.11). While this suggests the possibility that local public-sector wages are more relevant to private firms in the same municipality than are national public-sector wages, we use national public-sector wages as our main specification while considering that local public-sector wages also change simultaneously. This implies that our main estimate of wage elasticity is relatively conservative.

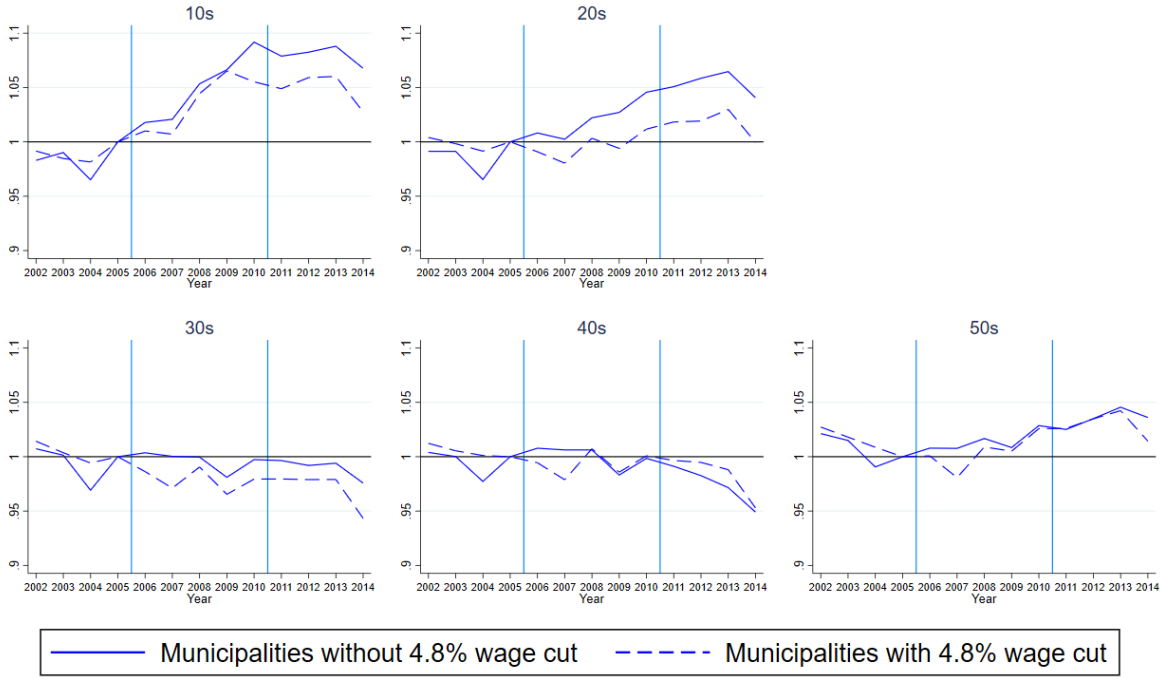
[14]Consistent with the Japanese situation, Telegdy (2018) found that public-sector wage reform in Hungary affected primarily young workers.

[15]There is exceptional mid-career recruitment that is free of the upper age limit, but it constitutes only a negligible fraction of total public-sector employment.

[16]For example, see https://jp.stanby.com/magazine/entry/220961 (in Japanese, last accessed on January 13, 2025).

[17]The upper age limit of 30 is most prevalent in the local public sector, but some local governments are slightly more tolerant than the national government (https://90r.jp/nenrei.html, last accessed on March 15, 2024. In Japanese).

Figure 4: The trend of average wages by region following the 4.8% wage reduction by age group



Note: Each panel shows average private wages by whether the region experienced the 4.8% reduction in the public-sector wage for each age group. The solid and dashed lines show, respectively, the average private wage in areas where the effective wage in the public sector was reduced by 4.8% and in areas where it was not reduced. To control for municipality-specific trends, all wages are shown relative to those of workers in their 60s. For each wage time series, we normalize the 2005 wage rates to one.

workers (Figure A.1). Overall, in our Japanese setting, both entering and leaving public-sector jobs are restricted among workers aged 30 and above. Motivated by the upper age limit of recruitment exams in the public sector, we define young workers as workers younger than 30 and the rest as older workers.

In Figure 4, we present the private wage time series for each 10-year age category, separately for municipalities that did or did not experience the public-sector wage cut. Prior to the reform in 2006, workers in all age groups faced a similar wage trend in all municipalities. However, after the public-sector wage cut in 2006, the wage trend of young workers in municipalities that experienced the public wage cut fell below that in municipalities that did not experience the public-sector wage cut. In contrast, no such divergence is observed for workers older than 30 years. These wage trends in Figure 4 are consistent with our assumption that workers younger than 30 years were affected primarily by the public-sector wage cut.

Taken together, Both the institutional setting and the empirical evidence described above suggest that primarily young workers are affected by public-sector wages, whereas little effect is expected for older workers. Therefore, in this work, we consider that young workers are treated by the public-sector wage cut, whereas older workers serve as the control group.[18] As described

[18]This setting is analogous to Saez, Schoefer and Seim (2019) in that they estimate the payroll tax cut for young workers relative to the wage level of old workers. However, our focus is on wage spillovers, which are outside their

in Section 3.2, this allows us to flexibly control for any confounding factors, such as business cycles and disasters like earthquakes, that vary at the municipality-year level.

A potential concern for identification is that older workers might also be affected by the public-sector wage cut. For instance, if the public-sector wage cut affects older workers' decision to quit the public-sector job and take the private sector job or increases the aggregate goods demand, then older workers are also, albeit less than the young workers, affected by the public-sector wage cut. However, these possible scenarios imply that young and older workers are likely to be affected in the same direction. Indeed, Figure 4 exhibits no indication that older workers are affected in the opposite direction as the young workers. As explained in Section 3.2, our empirical strategy in such a case is conservative in the sense of providing a lower bound estimate. In this sense, our qualitative finding of the positive wage spillover elasticity is robust to the possibility that older workers are also somewhat affected by the public-sector wage cut.

3 Data and empirical strategy

3.1 Data

We combine various datasets to examine the effect of the reform of national officials' regional allowances from 2006 to 2010. As our main outcome variable, we analyze the wage rate of the private sector via individual-level private workers' data. We also investigate net migration by constructing municipality-level data. Our data cover the period from 2002 to 2014, covering four years before and after the policy reform period (2006-2010).

We use the definition of municipalities as of 2015 throughout our sample period.[19] Because of the large-scale mergers of municipalities in Japan in the 2000s, we need to suitably aggregate merged municipalities when the municipal-level variables are constructed. We follow Kondo (2023) to identify merged municipalities. In constructing municipality-level variables, we take the sum of merged municipalities for aggregate values (e.g., population), and we take a weighted average for per capita values (e.g., the tax income per capita).[20]

Public-sector wages. The policy variable we focus on is the regional allowance rate for national public workers.[21] Since the regional allowance payment level is stipulated in rules 9-49 of the National Personnel Authority for the year in question, the payment level for each year was obtained via D1-law.com, a database of Japanese laws and rules. The revised regional allowance levels are also included in the Fact-finding Survey on Compensation of Local Government Employees, which was used in compiling the data.

focus.

[19] We use the 2015 criteria because the last municipal merger was in 2014.

[20] For example, the tax income per capita is calculated by taking the weighted average of the tax income per capita of merged municipalities, where we use the premerger population of each municipality as weights.

[21] In studying the effect of national public-sector wages, we do not need data on the base wage of national public officials because the year fixed effects in our regression models absorb changes in the nationally uniform base wage over time (see also Equation 1 and footnote 26).

We also consider the number of local officials and their salary levels as potential control variables. We obtained these data from the Fact-finding Survey on the Compensation of Local Government Employees. The average salary of local officials is available on the basis of education and years of experience. The average salary in our definition contains a base salary and allowances (except the regional allowances) but not overtime pay and bonuses since overtime pay and bonuses depend heavily on firm-specific idiosyncratic shocks.[22]

Private-sector wages. We use individual-level microdata from the Basic Survey on Wage Structure. The target population for this survey is randomly selected employees from randomly selected establishments from regional and industry strata, and we weight observations by sampling weights included in the data to ensure representativeness. The survey takes the data of different employees every year and records the location, scale, and industry of each employee's workplace, as well as sampling rates and information regarding each employee, such as their wage, gender, age, and education level. While the individual earnings information includes the base salary, allowances, overtime pay, and bonuses, we construct the salary as the base salary and allowances since the overtime pay and bonuses are substantially influenced by idiosyncratic shocks at the firm level.[23] Moreover, we focus on full-time workers aged between 15 and 64 years in our analysis since the Basic Survey on Wage Structure does not contain temporal workers' data before 2005.[24] For the analysis, we use the wage as a dependent variable, which is calculated by dividing the salary by the scheduled working hours. The summary statistics of these data are shown in Table C.1.

Net migration. We take the demographic information for each municipality from the Population, Demographic and Household Surveys of the Basic Resident Registration System and the Demographic Survey. This allows us to observe the population and number of deaths of each municipality annually, separately for five-year age groups.

As we are interested in the population change due to migration, which is not directly available in the data during our sample period, we construct it as follows. The population and the number of deaths for individuals aged X to $X+4$ years in year t for municipality i are denoted as $PopX_{it}$ and $DeathX_{it}$, respectively. If $DeathX_{it} = 0$, the net migration to municipality i for individuals aged X to $X+4$ years between years t and $t-4$ is approximated as $PopX_{it} - Pop(X-5)_{it-5}$. Using this and $DeathX_{it}$, the annual net migration for individuals aged X to $X+4$ years to

[22] We exclude the regional allowance from the local officials' salaries because it is determined with close reference to the regional allowance rate of national public officials (see Section 2). Given that the prescribed working time in local governments is 38 hours and 45 minutes, the salary level divided by this number of hours equals the wage.

[23] The salary here is defined as the amount of cash paid in June, at the time of the Basic Survey on Wage Structure, according to the payment conditions and calculation method predetermined by the labor contract, collective labor agreement, or employment regulations of the business office, including base salary and allowances but excluding overtime pay and bonuses. It is not take-home pay but rather the amount before the deduction of income tax, social insurance premiums, etc.

[24] This is likely a modest limitation for our purpose because part-time jobs in the Japanese public sector were relatively rare in the data period (Goto 2021).

municipality i at year t is approximated as $\frac{PopX_{it}-Pop(X-5)_{it-5}}{5} - DeathX_{it}$. We round this number to the nearest integer after the decimal point.

As we work on the municipal population for the net-migration analysis, we obtain balanced panel data for 1731 municipalities.[25] The summary statistics of this municipality-level dataset are shown in Table C.2.

Municipal fiscal data As potential control variables, we obtain each municipality's fiscal information from the Local Government Finance Survey. We collect local tax revenues per capita, lump-sum transfers (called local allocation taxes, LATs) per capita, and earmarked subsidies (called national treasury disbursements, NTDs) per capita.

3.2 Empirical strategy

We estimate the effect of public workers' wages on private workers' wages via the following triple-difference model:

$$\ln w_{i,j,t,private} = \beta RA_{j,t} \times Young_i + \mu_{j,t} + \sum_{k=\text{young or old}} (\iota_j^k + \tau_t^k) + \gamma X_{i,j,t} + \epsilon_{i,t} \tag{2}$$

$$\ln w_{i,j,t,private} = \sum_{t \neq 2005} \beta_t \{\tau_t \times (RA_{j,2010} - RA_{j,2005}) \times Young_i\} + \mu_{j,t} + \sum_{k=\text{young or old}} (\iota_j^k + \tau_t^k) + \gamma X_{i,j,t} + \epsilon_{i,t}, \tag{3}$$

where i is an individual worker, j is the municipality where worker i lives, and t is the year. $Young_i$ is a dummy variable that takes a value of 1 if i's age is less than 30 and 0 otherwise. $X_{i,j,t}$ is the vector of control variables, and $\epsilon_{i,t}$ is the error term. $\mu_{j,t}$, ι_j^k, and τ_t^k capture the municipal-year, municipal, and year fixed effects, respectively. $w_{i,j,t,private}$ is the salary level of private worker i in municipality j at t. $RA_{j,t}$ is the regional allowance rate in the national public sector, and this can be interpreted as the index of the reative public-sector wage level.[26] Note that $RA_{j,t} = 0$ means that the public-sector wage is set at the national baseline wage and municipality j's wage has no location premium in year t.[27] We use clustered standard errors at the municipality level.

[25] While Japan had 1741 municipalities as of 2015, ten municipalities with missing data due to the Great East Japan Earthquake are omitted.

[26] To determine why, let $Base_{t,k}$ be the index of the base salary level of national public-sector workers in year t for worker type k (= young or old). From Equation (1), the log wage of national public-sector workers of type k is written as $\ln(1 + RA_{j,t})Base_{k,t}$. We write its associated regression coefficient for the young as β, whereas we assume that the regression coefficient is zero for older workers because they are assumed to be unaffected by public-sector wages (see Section 2). Here, $\ln(1 + RA_{j,t})Base_{k,t} = \ln(1 + RA_{j,t}) + \ln Base_{k,t} \simeq RA_{j,t} + \ln Base_{k,t}$, but we do not need to explicitly control for $\ln Base_{k,t}$, as it is absorbed by the year fixed effects τ_t^k. As a result, the coefficient of $RA_{j,t} \times Young_i$ equals β in Equation (2).

[27] Since no municipality has the wages lower than the national baseline, $RA_{j,t}$ is always positive. Note that the nationally-uniform cut in the baseline wage level is absorbed in the year fixed effects and do not affect $RA_{j,t}$.

The coefficient of interest in Equation (2) is β, which shows the elasticity of private-sector wages relative to public-sector wages. In Equation (3), the event study specification, the coefficient of interest is β_t, which is the elasticity of private-sector wages in year t with respect to the total change in the regional allowance rate from this policy change (i.e., $RA_{j,2010} - RA_{j,2005}$). Note that both approaches are complementary. The first specification (2) summarizes all the information in the single elasticity β, whereas the second specification (3) permits the policy reform to have a different effect on private wages in different years.

Our identification assumption behind Equations (2) and (3) is a triple-difference strategy that combines a quasiexperiment in regional allowances and an institutional setting in which only young workers are primarily exposed to the policy change. Note that simply regressing the public workers' salary level on the corresponding private workers' salary level may suffer from endogeneity in that the public workers' base wage is annually determined in reference to the previous year's base wage of the corresponding private workers. In particular, we expect a positive bias in β if public-sector wages tend to increase when private-sector wages are high. To address this endogeneity issue, we first utilize the quasiexperimental variations in national officials' regional allowance levels in each municipality j, $RA_{j,t}$. Given that the change in regional allowances resulting from the 2006 reform was unexpectedly introduced and that the previous 10-year average wage index determined the regional allowance rate, $RA_{j,t}$ is less likely to suffer from endogeneity.

To further address the potential endogeneity that $RA_{j,t}$ is systematically correlated with municipality-specific time trends, we take older workers as the control group and compare the evolution of the wage difference between young and older workers across municipalities. To implement such a triple-difference strategy, we introduce municipality-year fixed effects $\mu_{j,t}$, which can flexibly capture municipality-specific trends. Importantly, these include the municipality-specific wage trend that may be correlated with the regional allowance rate $RA_{j,t}$. We also control for municipality and year fixed effects separately for young and older workers (ι_j^k and τ_t^k). As a result, we compare the differential private wage gap between young and older workers in municipalities with different regional allowance rates to estimate the elasticities β and β_t. Note that although this is a two-way fixed effects specification, we use ordinary least squares estimation since the so-called "negative weight" problem does not arise because the timing of the policy change is the same across all municipalities (Roth, Sant'Anna, Bilinski and Poe 2023).

Our triple-difference strategy relaxes the common trend assumption required in a difference-in-differences strategy by accommodating any municipality-specific time trend common to young workers and others, where the municipality is the level at which the public-sector wage schedule varies (Olden and Møen 2022). This is important to mitigate the concern that our results might be driven by some factors that happened around the same time as the policy change, such as the global financial crisis and the 2011 Great East Japan Earthquake. A potential cost of the triple-difference strategy is that we cannot test the assumption that older workers, the control group, are not affected by public-sector wages. For instance, if the public-sector wage cut affects older

workers' decision of going from the public to the private sector or the aggregate goods demand, then older workers' wage might also be affected by the public-sector wages. That said, it seems plausible to suppose that the wages of young and older workers are affected in the same direction. In such a case, our triple-difference strategy is expected to provide a lower-bound estimate of the wage spillover elasticity β because it focuses on the *difference* between the wage impacts of young and older workers. Our empirical strategy is conservative in this sense.[28]

As covariates, $X_{i,j,t}$, we consider both individual i's characteristics and municipal fiscal characteristics. The individual characteristics consist of dummies for sex and university degree, age categories with 5-year intervals from 15 to 64, and their interaction terms. In addition, we include the logarithm of scheduled working hours.

The inclusion of these control variables is analogous to the earnings functions à la Mincer, but we use dummy variables to relax functional form restrictions (Kawaguchi 2011).[29] Controlling for individual characteristics addresses the possibility that the spillover effect of public-sector wages is driven by changes in the quality and composition of private-sector workers. Since the characteristics of individual i capture private workers' quality , β captures the wage spillover effect holding fixed the observable worker characteristics.[30] For fiscal characteristics, we use the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita.[31] In addition, although the salary level of municipal public workers corresponding to private worker i in municipality j at t, $w_{i,j,t,public}$, could suffer from endogeneity, we include it in some specifications to investigate the sensitivity of our results to the potential discretionary wage changes by the municipal government. We construct $w_{i,j,t,public}$ by matching each private worker's corresponding municipal public workers by the education level and years of service[32]

[28]To illustrate this point, suppose there are two municipalities A and B. Each municipality has young and older workers. Now suppose that the public-sector wage is reduced by 1% only in municipality A, and it reduced the wage rate of young workers by 0.5% and that of older workers by 0.2%. We assume that the wage rate remains constant for both young and older workers in municipality B. Then, the triple-difference strategy estimate, which takes the difference of the young and the older workers and compares it between municipality A and B, implies that (0.5-0.2) - (0 - 0) = 0.3 is the wage spillover elasticity for young workers. Since the true wage spillover elasticity for young workers is 0.5, this is a conservative estimate.

[29]Our control variables are meant to compare workers with similar observable characteristics because our aim is to identify the elasticity with respect to public-sector wages β. The coefficients on our covariates should not necessarily be taken as causal due to endogeneity, such as self-selection of schooling (Heckman, Lochner and Todd 2006).

[30]While we control for the standard observable worker characteristics in the Mincerian regression, there is still a possibility that *unobservable* worker characteristics are affected by the public-sector wage cut, which might contaminate our wage spillover elasticity estimate. However, we expect that accounting for such unobservable worker characteristics would, if any, strengthen the wage spillover effect because the private sector is likely to attract better workers after the attractiveness of public-sector jobs worsens.

[31]These variables are interacted with the young dummy because without the interaction, municipal characteristics are absorbed by the municipality-year fixed effects. In the logarithmic transformation, one is added to the original number to prevent data omission.

[32]For matching, we use the data of the average salary level of local public employees by education and years of service. Private workers lacking a corresponding municipal public worker are omitted from the sample.

4 Spillover effects on private-sector wages

Section 4.1 presents our main estimate of the wage spillover elasticity. In our preferred estimate, 1% decrease in the public-sector wages induces 0.3% decrease in the private-sector wages, meaning the wage spillover elasticity of 0.3. Section 4.2 presents additional evidence, which is suggestive that the wage spillover is driven by the labor market competition between public and private workers. Section 4.3 documents that the wage spillover elasticity becomes smaller when there are labor unions, which would induce stronger downward wage rigidity in response to a public-sector wage cut. This suggests that the wage spillover elasticity might be larger

4.1 Main result: Spillover estimates on private-sector wages

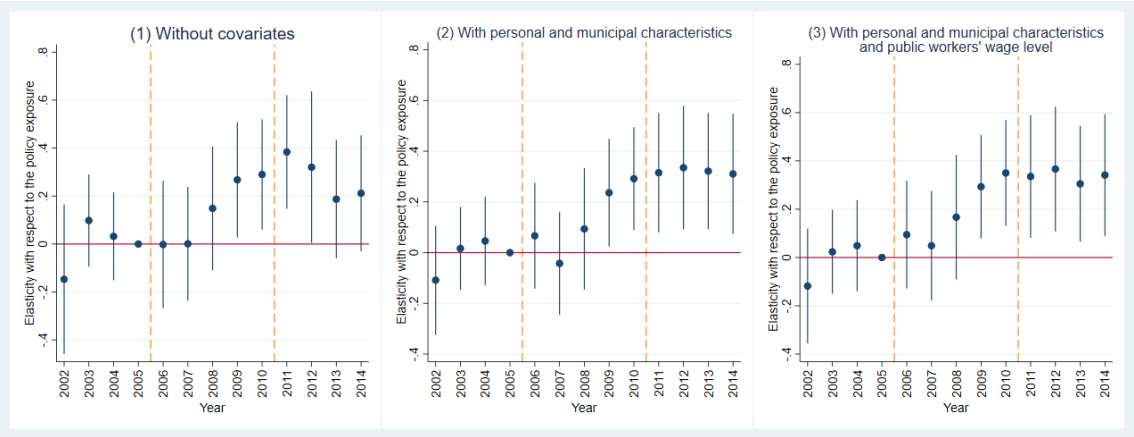
Figure 5 shows the effect of public-sector wages on private wages from the event study specification (3). Given that the public-sector wage reform led to a reduction in wages, note that the positive coefficients indicate a reduction in private sector wages. In each panel, β_t is estimated on the basis of specifications with different sets of control variables. In all panels, there is little indication that the parallel trend assumption is violated in the pretreatment period. Consistent with the gradual update of regional allowance rates due to the reform from 2006 to 2010, the estimated β_ts in each panel gradually increased from 2006 to 2010 and reached approximately 0.35 after 2011. The positive effect on private wages is confirmed by Table 1, which reports an elasticity estimate of approximately 0.3 from the specification (2). In particular, our preferred estimate in Column (2), which controls for individual characteristics, suggests that a 1% public-sector wage cut induces a decrease in private wages of 0.3%.[33] Given that the municipal-year fixed effects are controlled for in our triple-difference strategy, municipality-specific shocks would not explain this result. Therefore, this result suggests that the policy change in regional allowances induced a spillover from the wages of public workers to the wages of private workers. Note that despite our focus on the wage cut, the public sector, and numerous other contextual differences, our preferred elasticity estimate of 0.3 is consistent with several spillover estimates in the literature (e.g., Staiger et al. 2010; Willén 2021).

The identified effect of the public-sector wage on the private wage is not only statistically significant but also economically meaningful. We illustrate this in two ways. First, we compare the effect size to the wage gap between sexes and college premium, two of the most salient wage disparities in the data. The regional allowance rate $RA_{j,t}$ ranges from 0-0.18 in our data, implying that moving from the lowest regional allowance rate to the highest increases wages by approximately 5.4% ($0.3 \times 0.18 \simeq 0.054$). This amounts to approximately one-fifth of the wage gap between sexes and one-fourth of the college premium in our sample.[34] Second, the estimated

[33] The estimated coefficients of the control variables are consistent with the results of Kawaguchi (2011), who applies the Mincer wage equation to Japanese data.

[34] We calculate the wage gap between sexes and college premium in our sample as follows. First, our regression results in Column (2) of Table 1 include sex and college dummies, which interact with five-year age categories. We then construct the weighted average of the sex dummies and college dummies, where the weight is the frequency

Figure 5: The elasticity of private-sector wages in year t with respect to the regional allowance change from 2006-2010



Note: This figure shows the estimated β_t for each year in eq. (3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the college education dummy and gender dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are interacted with the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

elasticity implies a substantial aggregate impact on private wages. In particular, in Section 6, we find that our elasticity estimate implies that private-sector wages decreased by 3.1 trillion yen at the national level.

The spillover effect on private-sector wages suggests the wage-setting power of the public sector in the labor market because the public sector can affect market-based wages. Given that the public sector has a large employment share, it contributes to growing bodies of evidence that a large employer has wage-setting power (e.g., Staiger et al. 2010; Berger et al. 2022). The wage-setting power of the public sector in the labor market is also consistent with Dal Bó et al. (2013), who experimentally find a finite labor supply elasticity to the public sector.[35]

4.2 Mechanism: Labor market competition between public and private sectors

Having estimated the significant wage spillover from the public sector to the private sector, we next explore the underlying mechanism behind such spillover effect. In particular, we hypothesize that the wage spillover effect is likely to be greater when public-sector jobs serve as more important outside options for private-sector jobs in the labor market. In such a case, private firms are expected to respond more to the public-sector wage cut because they compete with the public sector in the labor market to attract workers (Caldwell and Danieli 2024), inducing a

of each age category in the sample.

[35]Note that the labor supply elasticity is also finite in our context because we find no evidence that the public sector could not hire workers after the wage cut.

Table 1: Regression results on private-sector wages based on (2)

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances × Young dummy	0.2978***	0.3066***	0.3408***
	(0.0790)	(0.0752)	(0.0713)
log(base wage of local municipal workers)			0.0735***
			(0.0105)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
N	12194536	12194536	11668764
R^2	0.264	0.514	0.508

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. In Columns (2)-(3), we control for individual (age dummies interacted with college education dummy and gender dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3). Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

larger wage spillover elasticity.

In this section, we investigate whether the wage spillover elasticity depends on the importance of public-sector jobs as an outside option in the labor market. We take four approaches. First, we focus on sectors with high mobility between public and private jobs, where the higher mobility implies that a public-sector job is more relevant outside option for private workers. Second, we exploit the Japanese institutional setting that workers' mobility depends heavily on whether they are new graduates or not. Third, we investigate whether urbanity affects the wage spillover elasticity, motivated by the idea that firms in more urban areas have weaker wage-setting power and a public-sector jobs is less important outside option (Azar et al. 2024). Finally, we analyze whether the wage spillover elasticity is larger in areas with a higher share of public-sector workers, where public-sector jobs are expected to be more important as outside options. In all four analyses, we find evidence consistent with the interpretation that wage spillover elasticity is larger when a public-sector job is a more relevant outside option in the labor market.

Wage spillovers are greater when mobility between public and private jobs is larger We compare the top three broad-classified industries with the largest inflow rates of young workers from the public sector to other industries.[36] We operationalize this idea via subsample analysis on workers belonging to the top three industries with the highest exposure since 2009 (elec-

[36]We define the industry-level inflow rate of young workers as the number of inflows per number of young workers in that industry. The labor flows from the public sector and the number of workers in each industry are obtained from the Survey on Employment Trends and the Labor Force Survey, respectively. Since data from the Labor Force Survey are absent for 2011 because of the Great East Japan Earthquake, the inflows of workers from the public sector compared with the number of workers in the industry cannot be defined for 2011.

tricity, gas, heat supply and water; transport and postal services; real estate and goods rental and leasing).[37] This analysis investigates whether the spillover effect is large for the industries exposed to the larger inflows of young workers from the public sector.

Table B.1 provides the detailed regression results, and Figure A.2 shows the event-study plot used in this analysis. They show that the wage spillover elasticity in industries with the largest rate of young worker inflows. Table B.1 shows a wage elasticity of approximately 0.8, which is substantially greater than 0.3 in our main result in Table 1. Therefore, the wage spillover elasticity is larger when mobility between public and private jobs is higher so that public jobs act as more important outside options for private jobs. This result is also in line with Willén (2021) and Bassier (2022), who found that the wage spillover elasticity is greater in occupations and firms that have more worker flows with the occupations and firms affected by a policy change.

Wage spillover elasticity is larger in a more mobile labor market Here, we examine whether the wage spillover elasticity is larger when workers are more mobile so that labor market competition between public and private sectors are fiercer. For this purpose, We harness the Japanese institutional setting that job mobility of new graduates (*shinsotsu*) is markedly different from other workers. Importantly, the institutional setting of the labor market for new graduates is quite different for college students and high school students. For college students, all major firms are requested to start the recruitment process at the same time by the Japan Business Federation (*keidanren*). After firms start the recruitment process, students can make applications to any firm, regardless of industry and location, as many as they want. We thus expect that employers compete with each other more fiercely in recruiting new graduates than other workers do, leading to the large wage spillover elasticity for workers recruited through the new graduate labor market. In contrast, for high school students, firms trying to hire new high school graduates first send job postings to high schools, and high schools allocate job openings to their students (Genda et al. 2010).[38] Generally, students are required to apply to only one job, and they are not allowed to directly apply to job openings. In such a situation with many restrictions, we expect that firms face less fierce competition in the new graduate market for high school students, as job mobility is likely lower, leading to the lower wage spillover elasticity for workers recruited through the new graduate labor market. In sum, we hypothesize that if labor market competition is important, the wage spillover elasticity is larger for new graduates among college graduates, but smaller for new graduates among high-school graduates.

Figure A.3 and Table B.2 estimate the wage spillover for workers employed through the labor market for new graduates and other workers separately for college and high school graduates.

[37] We use the data after 2009 because the definition of industry classification in the Survey on Employment Trends changed several times before 2009, although we omit the data for 2011 because of missing data (see footnote 36). Notably, electricity, gas, heat supply and water and transport and postal services were the top two industries even under the industry classification definition before 2009. Moreover, we have confirmed that even if we use the top two or top four industries (the fourth industry is "services, N.E.C."), the result does not change.

[38] See also https://jinjib.co.jp/business/rule for an illustration of the job market rules for high school students (in Japanese, last accessed on January 11, 2025).

The results confirm our expectations described above. For college graduates, we find that the wage spillover elasticity is positive for workers employed through the labor market for new graduates, whereas it is near zero for other workers.[39] This finding is consistent with our expectation that for college-educated workers, job mobility is greater in the new graduate labor market. In contrast, for high school graduates, the wage spillover is positive for other workers, whereas it is near zero for workers employed through the new graduate labor market, which is consistent with the lower job mobility of new graduates due to institutional rules. Overall, this result highlights that job mobility at the time of employment, induced by institutional settings of the labor market, matters in determining the magnitude of the wage spillover elasticity.

Fierce labor market competition in urban areas We hypothesize that the wage spillover effect is larger once we exclude the three largest metropolitan areas: Tokyo, Osaka, and Nagoya. Intuitively, cities have many firms and it reduces the wage-setting power of each firm, making them price takers in the labor market, which is in line with empirical evidence by Azar et al. (2024). As a result, a public-sector job are likely to be a less important outside option because there are many other competitors in addition to the public sector, inducing the smaller wage spillover elasticity. Figure A.4 and Table B.3 respectively replicate Figure 5 and Table 1 while excluding workers in the three largest metropolitan areas. In this analysis, the wage spillover elasticity is greater than 0.4 and somewhat greater than those in the baseline analyses. This result is consistent with the above idea that wage-setting power, which is likely to be smaller when a public-sector job is a less important outside option, plays a role in shaping the size of wage spillover elasticity.

Share of public-sector workers We hypothesize that the wage spillover elasticity is larger in the local labor markets with larger share of public-sector jobs since the public-sector job is a more important outside option. To confirm this, we split the sample by whether the share of public workers in the region is higher or lower than the median number of municipal public workers per capita, which is approximately 0.01 in our data (i.e., one municipal public worker for every 100 residents). Figure A.5 and Table B.4 are the result of the sub-sample analysis for the municipalities with higher or lower than the median number of municipal public workers per capita. The result shows that the wage spillover is about 0.35 in the municipalities with many

[39] Although the difference is estimated somewhat noisily, Figure A.3 and Table B.2 suggest that college graduate sample might have smaller wage elasticity than the non-college graduates. We provide two possible reasons. First, in the Japanese labor market, the job mobility of college-graduate workers can be lower because the lifetime employment system is more prevalent for college-graduate workers, who tend to obtain regular employment in large firms (Ito and Hoshi 2020). Second, studies have shown that the geographical scope of job searches is generally narrower for noncollege graduates (Kaplan and Schulhofer-Wohl 2017; Marinescu and Rathelot 2018). In contrast, college graduates are generally more mobile and they search for more distant jobs. As a result, in hiring a worker, firms recruiting noncollege graduates are more likely to recruit within the municipality, and the labor market competition for workers is more likely influenced by the public-sector wage rate in the same municipality at the level of our identifying variation. That said, our results are robust to accommodating a wider geographical scope of job search (see Section 6).

public employees, while it is less than 0.27 in the municipalities with few public employees. Although the difference is not statistically significant, this result is consistent with the hypothesis that the wage spillover is higher when the public sector job is a more important outside option.

4.3 Wage spillovers and union bargaining

Given that we expect that the spillover elasticity is smaller if workers have strong bargaining power so that wages exhibit greater downward wage rigidity. In particular, since we analyze the distinctive case of the public-sector wage *cut*, we expect that labor unions exert strong bargaining power to oppose the wage cut, leading to the downward wage rigidity (Hara and Kawaguchi 2008; Davis and Krolikowski 2025). In this section we analyze whether the wage spillover elasticity is smaller for firms with high firm-level labor union coverage.[40]

In analyzing the case of the wage increase, we might expect somewhat larger wage spillover elasticity as long as downward wage rigidity is stronger than the upward one. It is important to note, however, that we observe the significant wage spillover elasticity in all specifications. That is, we find that the wage rigidity is not strong enough to mute the wage spillovers, even in response to the public-sector wage cut.

Although we cannot directly observe the coverage of firm-level labor unions in our data, we can proxy for it by using each firm's size and industry. First, firm size is a strikingly strong predictor of firm-level labor union coverage in Japan: the coverage rate is approximately half for large companies but near zero for small companies.[41] We combine firm size information with the industry-level union coverage rate to better proxy for the union coverage status at the firm level. Specifically, we split the sample by the first quartile of the industry-level union coverage rate.[42] In industries with high union coverage rates, we expect that most large firms have high union coverage rates, whereas small firms have very low union coverage rates. Thus, we expect that large firms face greater downward wage rigidity due to a high labor union coverage rate and the union's wage bargaining power. In contrast, in other industries, both large and small firms are likely to have low labor union coverage rates. We classify firms with 300 or more workers as large and the rest as small, following the definition of large firms in the Small and Medium Enterprise Basic Act.[43]

Figures A.6 and A.7 show the event-study results and Tables B.5 and B.6 present the regression results. Figure A.6 and Table B.5 concern the industries with high union coverage rates. Here, we expect that the spillover elasticity is smaller for large companies because they tend to

[40] Firm-level labor unions are the most common form of labor union in Japan (Morikawa 2010; Ito and Hoshi 2020). Other forms of labor unions, such as industry-specific ones, are less prevalent.

[41] For example, the 2004 Basic Survey on Labour Unions suggests that the labor union coverage rate is 50.6% for firms with more than 1,000 workers, 15.8% for firms with 100–999 workers, and 1.2% for firms with fewer than 100 workers.

[42] We chose the first quartile because of the skewed nature of the industry-level union coverage rate. Specifically, while the maximum value is 69% (train service), the first quartile is 18%, the median value is 10%, and the third quartile is 6% (Source: the 2004 Basic Survey on Labour Unions). We thus chose the first quartile to focus primarily on firms with a substantial labor union coverage rate.

[43] Using alternative firm size thresholds leads to similar conclusions.

have much larger union coverage rates; thus, their workers could effectively oppose the wage cut. Consistent with this, we find that the elasticity is smaller in large companies (0.20 in Column 2 of Table B.5) than in small companies (0.43 in Column 5 of Table B.5). In contrast, for industries with low union coverage rates, we do not expect a significant difference between large and small companies because the union coverage rate is low regardless of firm size. Consistent with this, Figure A.6 and Table B.5 suggest little difference in wage spillover elasticity between large and small companies.[44]

Overall, we find that the wage spillover elasticity is smaller in the presence of labor unions. In particular, since we analyze the distinctive case of the public-sector wage *cut*, we expect that labor unions exert strong bargaining power to oppose the wage cut, leading to the downward wage rigidity (Hara and Kawaguchi 2008; Davis and Krolikowski 2025). This implies that in analyzing the case of the wage increase, we might expect somewhat larger wage spillover elasticity than our estimate as long as downward wage rigidity is stronger than the upward one. It is important to note, however, that we observe the significant wage spillover elasticity in all specifications. That is, we find that the wage rigidity is not strong enough to mute the wage spillovers, even in response to the public-sector wage cut.

5 The effects on the net migration

We analyze the effect of public-sector wage cuts on the migration decisions of young workers. Our analysis is motivated by a simple spatial equilibrium logic à la Rosen (1979) and Roback (1982).[45] Although the decline in private-sector wages among young workers is already suggestive of their welfare decline, this finding is still inconclusive because the public-sector wage cut may also have other effects. For example, it may affect the quality of public goods (Borjas 1984), job amenities in the private sector, and municipal fiscal surplus. Despite various possible channels through which public-sector wages affect welfare, if the public-sector wage cut induces a decrease in welfare, it should decrease housing demand in that location because people are willing to pay less for living there. Therefore, a decrease in welfare is likely associated with migration outflow. In contrast, if the public-sector wage cut improves young workers' welfare, we should observe migration inflow because people would like to move into a location with higher welfare.

Using municipality panel data, we analyze the effect of the change in regional allowances on

[44]This conclusion also holds when we include firms from all industries. Note also that the wage spillover elasticity is smaller in industries with low union coverage rate, for both large and small firms. This is likely because industries with high union coverage rate tend to have larger inflow rate of young workers.

[45]This analysis relates to studies that use the spatial equilibrium idea to evaluate the welfare effect minimum wages (e.g., Cadena 2014; Monras 2019; Yamagishi 2021).

net migration through regression on the basis of the following specifications:

$$Y_{j,t} = \beta RA_{j,t} + \iota_j + \eta_{t,p} + \gamma X_{j,t} + \epsilon_{j,t} \tag{4}$$

$$Y_{j,t} = \sum_{t \neq 2005} \beta_t \{\tau_t \times (RA_{j,2010} - RA_{j,2005})\} + \iota_j + \eta_{t,p} + \gamma X_{j,t} + \epsilon_{j,t}, \tag{5}$$

where Y is the difference in per capita net migration between young and older populations, j is the municipality in prefecture p and t is the year. $\epsilon_{j,t}$ is the error term. Young (old) per capita net migration is defined as the young (old) net migration divided by the young (old) population. In defining the net migration flow, we code the migration inflow as positive and the outflow as negative. ι_j, $\eta_{t,p}$, and τ_t capture the municipality, prefecture-year, and year fixed effects, respectively. The young and older populations refer to the populations aged 15-29 years and 30-64 years, respectively. We weight the observations by the municipal population as of 2000. We use clustered standard errors at the municipality level.

The coefficients of interest, β and β_t, in Equations (4) and (5), are interpreted as the elasticity of the net migration of young workers with respect to the regional allowances. This is because, as in the triple-difference strategy for analyzing private wages, using the difference in per capita net migration between young and older populations allows us to flexibly control for municipality-specific trends by taking older workers as the control group.[46] To see this point, suppose the following model of young per capita net migration is used: Young per capita net migration$_{j,t}$ = $\beta RA_{j,t} + \iota_j^{'} + \eta_{t,p}^{'} + \Xi_{j,t}^{'} + \gamma^{'} X_{j,t} + \epsilon_{j,t}^{'}$, where $\iota_j^{'}$, $\eta_{t,p}^{'}$, and $\Xi_{j,t}^{'}$ are municipality, prefecture-year, and municipality-year fixed effects, respectively. Since the municipality-year specific trend $\Xi_{j,t}^{'}$ is perfectly collinear with the regional allowances $RA_{j,t}$, this model does not identify β. However, now suppose an analogous model for the net migration of older workers: Older per capita net migration$_{j,t}$ = $\iota_j^{''} + \eta_{t,p}^{''} + \Xi_{j,t}^{'} + \gamma^{''} X_{j,t} + \epsilon_{j,t}^{''}$. Here, the regional allowance ($RA_{j,t}$) does not appear because it is assumed to have no effect on the net migration of older workers. Note also that the municipality-year fixed effects ($\Xi_{j,t}^{'}$) are assumed to be age independent. Then, by subtracting the former from the latter, we obtain the estimation Equation (4).[47] The coefficient β is therefore interpreted as the effect of regional allowances on the net migration of young workers. Similarly, β_t in Equation (5) is also interpreted as the effect on the net migration of young workers.

Figure 6 presents our event-study estimates of the impact of public-sector wages on the net migration. Since it shows the positive elasticity of the net migration of young workers with respect to public-sector wages, the public-sector wage cut is associated with the net migration of young workers.[48] Columns 1–3 of Table 2 show that a 1% decrease in public-sector wages

[46] An analogous identification strategy is also used in the context of childcare and maternal labor (Graves 2013).

[47] To see this, we can define $\iota_j \equiv \iota_j^{'} - \iota_j^{''}$. Other variables are defined analogously.

[48] Although the standard error is relatively large, the point estimate in 2014 is smaller than those in 2011–2013, implying that the impact on migration might be shrinking over time. We view this result is natural because the fraction of workers who have already optimized their location choice to the new public-sector wage rate would increase over time.

is associated with a 0.1% increase in the outflow of young workers. Therefore, on the basis of the spatial equilibrium logic à la Rosen (1979) and Roback (1982), the public-sector wage cut is likely to be associated with a decline in young workers' welfare.[49]

To further ensure that the migration response is associated with public-sector job conditions, we split the sample by the share of public workers in the region: one subsample comprises regions with a higher-than-median number of municipal public workers per capita, and the other comprises regions with a lower-than-median number of municipal public workers per capita. In our data, the median number of municipal public workers per capita is approximately 0.01, i.e., one municipal public worker for every 100 residents. We expect the effects of public-sector wages on private wages and the young population to be stronger in the sample with a greater share of public-sector workers because public-sector jobs are more important outside options. Columns 4–6 of Table 2 add the interaction term of the regional allowances and the dummy variable indicating that the share of public-sector workers is above the median. The positive and significant coefficient of the interaction indicates that the spillover elasticity is greater in municipalities with a greater share of public-sector workers, which is consistent with our expectation.

Implications for the wage spillover elasticity We close this section by analyzing how much migration responses affect the wage spillover elasticity. Since migration changes the total labor supply in a local labor market, the public-sector wage can affect private wages either directly or indirectly through changes in the local labor supply. To formalize the idea, we suppose that the equilibrium private-sector wage is given by the labor demand function in the private sector: $w^{pri}(N; w^{pub})$, where w^{pri} denotes private wages, w^{pub} denotes public wages, and N denotes the size of the workforce supply.[50] By differentiating in logs, we have the following decomposition of the wage spillover elasticity:

$$\underbrace{\frac{d \ln w^{pri}}{d \ln w^{pub}}}_{\text{Overall wage spillover elasticity}} = \underbrace{\frac{\partial \ln w^{pri}}{\partial \ln w^{pub}}}_{\text{Direct wage spillover elasticity}} + \underbrace{\frac{\partial \ln w^{pri}}{\partial \ln N} \frac{d \ln N}{d \ln w^{pub}}}_{\text{Indirect wage spillover elasticity}} . \tag{6}$$

The overall wage spillover elasticity $\frac{d \ln w^{pri}}{d \ln w^{pub}}$ is what we have identified in Section 4.1. The direct wage spillover elasticity is the wage spillover effect of public-sector wages, with the workforce size held constant. The indirect wage spillover elasticity is the wage spillover effect due to the

[49] According to Rosen (1979) and Roback (1982), land prices should decrease if the public-sector wage cut reduces welfare. Indeed, Yamagishi (2021) invokes this idea to test the welfare impact of minimum wage hikes. We take the land price information from the Land Market Value Publication (*kouji chika*), which is based on the changes in repeated appraisal prices for the same land plot and is known to have a strong correlation with transaction prices (LaPoint 2021; Yamagishi and Sato forthcoming). Although we cannot use a triple-difference strategy for land prices, we find suggestive evidence that land prices indeed decrease when a difference-in-differences strategy is used (see Figure A.11 and Table B.12 for the empirical results).

[50] Note that the dependence of w^{pri} on N corresponds to the private wage change *along* the labor demand curve, whereas the dependence of w^{pri} on w^{pub} represents the shift of the labor demand curve. Strictly speaking, N represents the workforce supply in the private sector. However, given that private jobs constitute the majority of all jobs, we simplify our discussion by approximating the private-sector labor supply by the total labor supply

change in the workforce size induced by the public-sector wage change. Our aim in this section is to quantify the indirect wage spillover elasticity.

The indirect wage spillover elasticity is the product of two elasticities: the elasticity of private wages with respect to workforce size $\left(\frac{\partial \ln w^{pri}}{\partial \ln N}\right)$ and the elasticity of the workforce size with respect to public wages $\frac{d \ln N}{d \ln w^{pub}}$. The latter elasticity is what we have estimated in Table 2 because the net migration per capita corresponds to the percentage change in workforce size. Table 2 suggests that it is approximately 0.08 for municipalities with relatively few public officials and 0.18 for municipalities with relatively many public officials. For the first elasticity, we use the elasticity of labor demand of -1.67 estimated by Suárez Serrato and Zidar (2023), which is also in line with Hamermesh (1993). This implies that $\frac{\partial \ln w^{pri}}{\partial \ln N} = -1/1.67 \simeq -0.6$.

Combining these numbers, we estimate that the indirect wage spillover elasticity is approximately -0.05 in municipalities with relatively few public officials and -0.11 in municipalities with relatively many public officials. We also estimate in Table B.4 the overall wage spillover elasticity, which is 0.25 for municipalities with relatively few public officials and 0.35 for municipalities with many public officials. Therefore, we can see that the indirect wage spillover elasticity is approximately one-fifth of the overall wage elasticity in municipalities with relatively few public officials and one-third in municipalities with relatively many public officials.

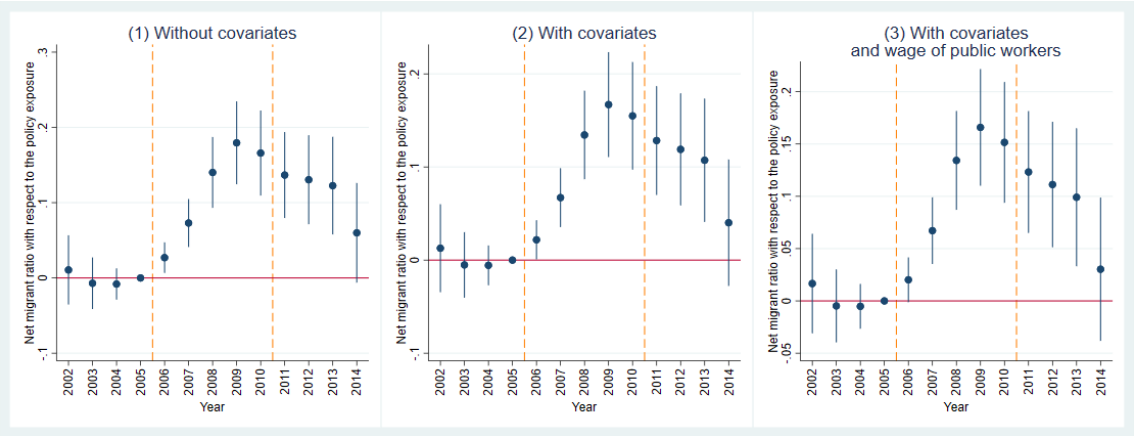
Having calculated the overall and indirect wage spillover elasticities, we can determine that the direct wage spillover elasticity is 0.3 in municipalities with relatively few public officials and 0.46 in municipalities with relatively many public officials. Therefore, the overall wage spillover elasticity we identified in Section 4.1 is conservative: we obtain greater elasticity by holding the workforce size constant. Note also that since the out-migration elasticity is greater in municipalities with relatively more public officials, accounting for labor supply responses magnifies the heterogeneity in wage spillover elasticities among municipalities with different shares of public officials.

In sum, wage spillover elasticity is somewhat greater when we account for the negative effect on labor supply in a local labor market due to out-migration, which we have uncovered in this section. To our knowledge, our paper is the first in the literature to quantify the role of geographical mobility in shaping the wage spillover elasticity.

6 Additional analyses

This section discusses four additional analyses. First, we consider heterogeneity in the wage spillover elasticity by gender, motivated by evidence that public-sector jobs are more attractive to women (Gomes and Kuehn 2019). Second, we consider robustness to the potential impact of public-sector wages of neighboring municipalities. Third, we explore the effect on working hours, which could be considered one form of job amenity. Finally, we illustrate the quantitative importance of wage spillovers by considering the national-level aggregate economic impact of the public-sector wage cut from 2006–2010.

Figure 6: The change in the difference in per capita net migration between young and older populations in year t with respect to the change in regional allowances from 2006-2010



Note: These figures show the estimated β_t for each year in eq. (5), with the difference in per capita net migration between young and older populations as the dependent variable. This corresponds to the change in young per capita net migrations in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. We control for covariates (the logarithms of local tax revenue per capita, LAT per capita, NTD per capita, and the number of local officials per capita) in Panels (2) and (3). We add the average salary level of public workers in municipality j at t, $w_{j,t,public}$ in Panel (3). 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

Table 2: Regression results on the difference in per capita net migration between young and older populations based on (4)

	(1)	(2)	(3)	(4)	(5)	(6)
	Difference in per capita net migration between young and older populations					
Regional allowances	0.1066***	0.0926***	0.0861***	0.0883***	0.0817***	0.0742**
	(0.0262)	(0.0272)	(0.0271)	(0.0278)	(0.0289)	(0.0288)
Regional allowances× Many staff				0.1325**	0.1000*	0.1082*
				(0.0584)	(0.0591)	(0.0610)
log(tax revenue per capita)		0.0078	0.0107		0.0089	0.0120
		(0.0093)	(0.0093)		(0.0092)	(0.0092)
log(LAT per capita)		-0.0007	-0.0008		-0.0003	-0.0002
		(0.0011)	(0.0011)		(0.0011)	(0.0011)
log(NTD per capita)		-0.0040***	-0.0037***		-0.0038***	-0.0035***
		(0.0010)	(0.0009)		(0.0009)	(0.0009)
log(municipal public workers per capita)		-0.0220***	-0.0234***		-0.0207***	-0.0220***
		(0.0055)	(0.0053)		(0.0052)	(0.0050)
log(base wage of local municipal workers)			-0.0641***			-0.0653***
			(0.0147)			(0.0147)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipal fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	22503	22503	22503	22503	22503	22503
R^2	0.980	0.980	0.981	0.980	0.981	0.981

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The regression results of estimating Equation (4) in which the ratio of the young to the older net migration is the dependent variables are presented. Young and older populations correspond to the 15-29 and 30-64 age groups, respectively. The average salary level of public workers in municipality j at t, $w_{j,t,public}$, is controlled in Columns (3), although it is not controlled in the other columns because it is likely to suffer from endogeneity.

Gender. Figure A.8 and Table B.7 present the estimated elasticity of private wages for men and women, respectively. We do not find a significant difference in the elasticity estimates for men and women. Although women are more likely to work in the public sector for reasons such as a smaller gender wage gap and other job amenities (Gomes and Kuehn 2019), such heterogeneity does not seem to translate into gender differences in the wage spillover elasticity.

Public-sector wages of neighboring municipalities. We analyze the possibility that not only the public-sector wage rate of a municipality but also the wage rates of neighboring municipalities may affect outcomes. Theoretically, incorporating commuting and general equilibrium effects on the welfare level of the marginal worker leads to such an effect by creating intermunicipal dependence.[51] We address this possibility via two complementary methods and find that our main result in Section 4.1 is robust.

First, we use the so-called "SLX" model in spatial econometrics (Halleck Vega and Elhorst 2015), which adds to our main regression the spatial lag that summarizes the regional allowance rates of neighboring municipalities. Adding such a spatial lag term, Figure A.9 and Table B.8 repeat the analysis of Figure 5 and Table 1 for private wages. The results of this analysis show that the regional allowance might have a positive spillover effect on neighboring municipalities, but such an effect is smaller than the own effect and statistically insignificant. However, the inclusion of the spatial lag does not change the main spillover elasticity.

Second, we aggregate the units of the analysis to the commuting zones. This allows for the possibility that the public-sector wage rates of different municipalities in the same commuting zone may affect the private wage rate. We use the commuting zone definition of Japan by Adachi et al. (2021), which assigns every municipality to one of 265 commuting zones. The public-sector wage rate of a commuting zone is defined by the weighted average of the public-sector wage rates of municipalities in the same zone, where we use the number of municipal public-sector staff as weights. Figure A.10 and Table B.9 report the results. Overall, we find similar elasticity estimates as our main result in Section 4.1.

Effects on job amenities. We discovered in Section 4.1 that the public-sector wage cut had a spillover effect on private-sector wages. In addition to such wage adjustments, private firms may also adjust their job amenity levels. While job amenities are hard to observe, we do observe hours of work in our data. Considering it as a proxy for the toughness of work conditions, we use it as the dependent variable in the specification in Section 3.2.[52] In Table B.10, we find no

[51] For example, Monte, Redding and Rossi-Hansberg (2018) and Borusyak, Dix-Carneiro and Kovak (2022) highlighted the importance of incorporating such geographical interdependence in a reduced-form analysis. In addition to commuting and the general equilibrium effect highlighted in these papers, another reason for the interdependence is that in setting their wage rates, private firms might use not only the public wage rates in their own municipality but also those in neighboring municipalities as yardsticks for an optimal wage-setting rule (Afonso and Gomes 2014; Besley and Case 1995; Kishishita and Yamagishi 2021).

[52] In this analysis, we exclude hours of work from control variables to avoid the obvious tautology.

significant impact, suggesting that the effect on job amenities might be limited.[53]

Aggregate impacts of the public-sector wage cut on private wages and tax revenues. As discussed in Section 2, the Japanese public wage cut from 2006–2010 was introduced to achieve fiscal consolidation. However, since the public-sector wage cut decreased private-sector wages, it may also reduce the income tax revenue. In terms of the net effect, how effective was the public wage cut as a fiscal austerity measure? Here, by using our wage spillover elasticity estimate, we conduct a back-of-the-envelope calculation of the tax revenues lost due to the lower private wages to illustrate their economic magnitude.

Given that the total number of government employees in Japan was 3.1 million and the average salary was 368 thousand yen, a 1% reduction in public-sector salaries would save 136 billion yen for one year.[54] However, on the basis of the total number and average earnings of young workers in the data and our preferred wage spillover elasticity estimate of 0.3[55], the loss in wages of young workers in the private sector due to the 4.8% public wage cut would be 3.1 trillion yen. Using the effective marginal income tax rate of 20% in the corresponding tax bracket of the average earnings, the loss of total tax revenue due to a 1% reduction in public-sector wages would be 665 billion yen for one year.[56] Therefore, on net, there was a tax revenue *loss* of 65 billion yen due to the public-sector wage cut, reversing the fiscal benefit of the public-sector wage cut.

We note that the back-of-the-envelope nature of the above calculation should be considered and additional considerations may change the results. For instance, the reduced private wages may increase corporate profits, which would increase the tax revenue in the presence of corporate taxes.[57] That said, the above simple calculation illustrates the general policy implication: the unintended effects of a public-sector wage cut should be carefully considered, as they may substantially affect their efficacy as a fiscal austerity measure.

7 Conclusion

How do institutional wage reforms in one sector spill over to other sectors? This paper studies the spillover effects of a public-sector wage cut on private-sector wages as a prominent example of institutional reforms that could induce wage spillovers across sectors. We leverage

[53]Note also that, consistent with the null impact on job amenities, we find in Section 5 that the welfare effect of the public-sector wage cutoff remains negative even if we allow for its potential impact on private-sector job amenities.

[54]This figure is consistent with the government's estimate in 2005 that a 4.8% salary reduction was expected to reduce personnel costs by approximately 600 billion yen.

[55]According to the Basic Wage Structure Survey, the average monthly wage of full-time workers was 167.8 thousand yen for those aged 15-19, 194.9 thousand yen for those aged 20-24, and 228.2 thousand yen for those aged 25-29. In addition, according to the Labor Force Survey, the number of full-time workers was 0.43 million among those aged 15-19, 3.14 million among those aged 20-24, and 5.04 million among those aged 25-29.

[56]The local income tax rate (*juminzei*) and the marginal national income tax rate for income over 1.95 million yen are 10%, summing to 20%.

[57]In fact, in our data, we observe an increase in local tax revenue from the corporate inhabitant tax, which is levied on profits, in the region with the public wage cut. More details on this result are available from the authors upon request.

the Japanese policy reform that cut public-sector wages only in certain municipalities and the institutional setting in which public-sector jobs are relevant outside option to private jobs primarily for young workers. This leads us to a triple-difference strategy, allowing us to control for any municipality-specific confounding trends. Moreover, even if older workers are also somewhat affected by the public-sector wage cut, the triple-difference strategy yields a conservative wage spillover elasticity estimate as long as young and older workers are affected in the same direction.

We find that a 1% decrease in public-sector wages reduces the wages of young workers by 0.3%. In terms of underlying mechanism behind the wage spillover, we find pieces of evidence suggesting that competition between public and private sectors in the labor market to attract workers would be a key mechanism. Moreover, we find that the spillover elasticity is smaller in sectors with high union coverage rates, highlighting the potential role of downward wage rigidity in mitigating wage spillover. We also find that a 1% decrease in public-sector wages also increased the migration outflow by 0.1%, suggesting an overall negative welfare effect on young workers in spatial equilibrium.

Overall, we have uncovered an unintended side effect of the public-sector wage cut: the decline in private-sector wages and welfare. Such spillover effects should be accounted for when evaluating public-sector wage reforms. More broadly, this highlights the importance of considering spillover effects in evaluating reforms in institutional wage rules, including minimum wages, anti-union laws, and equal-pay requirements across different geographical areas.

We close this paper with the reminder that since our identification is based on the local variation in public-sector wages within a country, the effect size may be different when the policy reform is at the national level. This is an inherent problem in many quasiexperimental studies that exploit cross-sectional variation to shed light on macroeconomic issues. A carefully designed structural model may be useful in linking the effects of local policy changes to the effects of national changes (Nakamura and Steinsson 2018). Using quasiexperimental variation to infer national-level public wage reform in the context of public-sector wages is an important next step.

References

Abdallah, Chadi, David Coady, and La-Bhus Fah Jirasavetakul, "Public-private wage differentials and interactions across countries and time," *IMF Working Papers*, 2023, *23/63*.

Adachi, Daisuke, Taiyo Fukai, Daiji Kawaguchi, and Yukiko Umeno Saito, "Commuting Zones in Japan," *RIETI Discussion Paper Series*, 2021, *20-E-021*.

Afonso, António and Pedro Gomes, "Interactions between private and public sector wages," *Journal of Macroeconomics*, 2014, *39*, 97–112.

Albrecht, James, Monica Robayo-Abril, and Susan Vroman, "Public-sector employment in an equilibrium search and matching model," *The Economic Journal*, 2019, *129* (617), 35–61.

Aoki, Takashi, *Chihou koumuin no kyuyo shisutemu ni kansuru kenkyu (On the salary system of local public workers)*, Nihon hyouron sha, 2021. (In Japanese).

Auld, D.A.L., L.N. Christofides, R. Swidinsky, and D.A. Wilton, "A microeconomic analysis of wage determination in the Canadian public sector," *Journal of Public Economics*, 1980, *13* (3), 369–387.

Auricchio, Marta, Emanuele Ciani, Alberto Dalmazzo, and Guido de Blasio, "Life after public employment retrenchment: evidence from Italian municipalities," *Journal of Economic Geography*, 2020, *20* (3), 733–782.

Azar, José, Emiliano Huet-Vaughn, Ioana Marinescu, Bledi Taska, and Till von Wachter, "Minimum Wage Employment Effects and Labour Market Concentration," *The Review of Economic Studies*, 09 2024, *91* (4), 1843–1883.

Bassier, Ihsaan, "Collective bargaining and spillovers in local labor markets," *Mimeograph*, 2022.

Becker, Sascha O, Stephan Heblich, and Daniel M Sturm, "The impact of public employment: evidence from Bonn," *Journal of Urban Economics*, 2021, *122*, 103291.

Berger, David, Kyle Herkenhoff, and Simon Mongey, "Labor market power," *American Economic Review*, 2022, *112* (4), 1147–93.

Bermperoglou, Dimitrios, Evi Pappa, and Eugenia Vella, "The government wage bill and private activity," *Journal of Economic Dynamics and Control*, 2017, *79*, 21–47.

Bernanke, Ben S., "The Mayekawa Lecture: Some Reflections on Japanese Monetary Policy," *Monetary and Economic Studies*, 2017, *35*, 23–38.

Besley, Timothy and Anne Case, "Incumbent behavior: Vote-seeking, tax-setting, and yardstick competition," *American Economic Review*, 1995, pp. 25–45.

Boeri, Tito and Jan Van Ours, *The economics of imperfect labor markets*, third ed., Princeton University Press, 2021.

Borjas, George J, "Electoral cycles and the earnings of federal bureaucrats," *Economic Inquiry*, 1984, *22* (4), 447–459.

Borusyak, Kirill, Rafael Dix-Carneiro, and Brian Kovak, "Understanding migration responses to local shocks," *Available at SSRN 4086847*, 2022.

Bradley, Jake, Fabien Postel-Vinay, and Hélene Turon, "Public sector wage policy and labor market equilibrium: a structural model," *Journal of the European Economic Association*, 2017, *15* (6), 1214–1257.

Burdett, Ken, "Towards a theory of the labor market with a public sector," *Labour Economics*, 2012, *19* (1), 68–75.

Cadena, Brian C, "Recent immigrants as labor market arbitrageurs: Evidence from the minimum wage," *Journal of Urban Economics*, 2014, *80*, 1–12.

Caldwell, Sydnee and Oren Danieli, "Outside options in the labor market," *Review of Economic Studies*, 2024, p. rdae006.

Chang, Juin-Jen, Hsieh-Yu Lin, Nora Traum, and Shu-Chun S. Yang, "Fiscal Consolidation and Public Wages," *Journal of Money, Credit and Banking*, 2021, *53* (2-3), 503–533.

Chirakijja, Janjala, "The Local Economic Impacts of Prisons," *The Review of Economics and Statistics*, 2024, *106* (6), 1442–1459.

Dal Bó, Ernesto, Frederico Finan, and Martín A Rossi, "Strengthening state capabilities: The role of financial incentives in the call to public service," *The Quarterly Journal of Economics*, 2013, *128* (3), 1169–1218.

Davis, Steven J and Pawel M Krolikowski, "Sticky Wages on the Layoff Margin," *American Economic Review*, 2025, *115*, 491–524.

Demir, Gökay, "Labor market frictions and spillover effects from publicly announced sectoral minimum wages," *Available at SSRN 4306501*, 2023.

Derenoncourt, Ellora and David Weil, "Voluntary minimum wages: The Local Labor Market Effects of National Retailer Policies," *Quarterly Journal of Ecnonomics*, 2025. forthcomong.

Ehrenberg, Ronald G and Gerald S Goldstein, "A model of public sector wage determination," *Journal of Urban Economics*, 1975, *2* (3), 223–245.

Faggio, Giulia, "Relocation of public sector workers: Evaluating a place-based policy," *Journal of Urban Economics*, 2019, *111*, 53–75.

_ **and Henry Overman**, "The effect of public sector employment on local labour markets," *Journal of Urban Economics*, 2014, *79*, 91–107.

Forni, Lorenzo and Natalija Novta, "Public employment and compensation reform during times of fiscal consolidation," *IMF Working Papers*, 2014, *14/192*.

Franklin, Simon, Clément Imbert, Girum Abebe, and Carolina Mejia-Mantilla, "Urban Public Works in Spatial Equilibrium: Experimental Evidence from Ethiopia," *American Economic Review*, 2024, *114* (5), 1382–1414.

Genda, Yuji, Ayako Kondo, and Souichi Ohta, "Long-term effects of a recession at labor market entry in Japan and the United States," *Journal of Human Resources*, 2010, *45* (1), 157–196.

Gomes, Pedro, "Optimal public sector wages," *The Economic Journal*, 2015, *125* (587), 1425–1451.

_ , "Heterogeneity and the public sector wage policy," *International Economic Review*, 2018, *59* (3), 1469–1489.

_ **and Zoë Kuehn**, "You're the One that I Want! Public Employment and Women's Labor Market Outcomes," *IZA Discussion Paper*, 2019.

Goto, Tsuyoshi, "Hi-seiki no Chihou-koumuin no zouka-youin ni kansuru bunseki (Analysis on the factors inducing the increase of irregular public-sector workers)," *Zaisei-kenkyu*, 2021, *17*, 155–183. (In Japanese. A previous version written in English is available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3574457).

Graves, Jennifer, "The Effects of School Calendar Type on Maternal Employment across Racial Groups: A Story of Child Care Availability," *American Economic Review*, May 2013, *103* (3), 279–83.

Gregory, Robert G and Jeff Borland, "Recent developments in public sector labor markets," *Handbook of Labor Economics*, 1999, *3*, 3573–3630.

Guillouzouic, Arthur, Emeric Henry, and Joan Monras, "Public Sector Pay in Spatial Equilibrium," *Mimeo*, 2024.

Halleck Vega, Solmaria and J Paul Elhorst, "The SLX model," *Journal of Regional Science*, 2015, *55* (3), 339–363.

Hamermesh, Daniel S., *Labor Demand*, Princeton University Press, 1993.

Hara, Hiromi and Daiji Kawaguchi, "The union wage effect in Japan," *Industrial Relations*, 2008, *47* (4), 569–590.

Heckman, James J, Lance J Lochner, and Petra E Todd, "Earnings functions, rates of return and treatment effects: The Mincer equation and beyond," *Handbook of the Economics of Education*, 2006, *1*, 307–458.

Ito, Takatoshi and Takeo Hoshi, *The Japanese Economy*, MIT press, 2020.

Jofre-Monseny, Jordi, José I Silva, and Javier Vázquez-Grenno, "Local labor market effects of public employment," *Regional Science and Urban Economics*, 2020, *82*, 103406.

Kaplan, Greg and Sam Schulhofer-Wohl, "Understanding the long-run decline in interstate migration," *International Economic Review*, 2017, *58* (1), 57–94.

Katz, Lawrence F and Alan B Krueger, "Changes in the Structure of Wages in the Public and Private Sectors," Working Paper 3667, National Bureau of Economic Research March 1991.

Kawaguchi, Daiji, "Applying the Mincer Wage Equation to Japanese Data (*Mincer gata chingin kansu no nihon no roudou shijyo heno ouyou* in Japanese)," *RIETI Discussion Paper Series*, 2011, *11-J-026*, 1–26.

Kawasaki, Kazuyasu and Saori Nagashima, "Chiiki ni okeru kyuuyo no kanmin-kakusa ni kansuru toukei bunseki - Naze chihou dewa koumuin ninki ga takai noka (A statistical analysis on the local public-private earnings gap: Why the public sector is so popular in rural areas)," *Kaikei Kansa Kenkyu*, 2007, *36*, 107–123. (In Japanese).

Kishishita, Daiki and Atsushi Yamagishi, "Contagion of populist extremism," *Journal of Public Economics*, 2021, *193*, 104324.

Kondo, Ayako, "Impact of increased long-term care insurance payments on employment and wages in formal long-term care," *Journal of the Japanese and International Economies*, 2019, *53*, 101034.

Kondo, Keisuke, "Municipality-level Panel Data and Municipal Mergers in Japan," *RIETI Technical Paper Series*, 2023, *23901*.

Lacroix, Robert and Francois Dussault, "The spillover effect of public-sector wage contracts in Canada," *The Review of Economics and Statistics*, 1984, pp. 509–512.

Lamo, Ana, Javier J Pérez, and Ludger Schuknecht, "Public or private sector wage leadership? An international perspective," *The Scandinavian Journal of Economics*, 2012, *114* (1), 228–244.

LaPoint, Cameron, "You Only Lend Twice: Corporate Borrowing and Land Values in Real Estate Cycles," *Available at SSRN 3633606*, 2021.

Lee, Hwanoong, Changsu Ko, and Wookun Kim, "Heterogeneous Local Employment Multiplier: Evidence from Relocations of Public Entities in South Korea," *Labour Economics*, 2024, *88*, Article 102515.

Lu, Zhenkun and Keigo Kameda, "Impact of fiscal policies on the labor market with search friction: An estimated DSGE model for Japan," *Journal of the Japanese and International Economies*, 2024, p. 101315.

Marinescu, Ioana and Roland Rathelot, "Mismatch unemployment and the geography of job search," *American Economic Journal: Macroeconomics*, 2018, *10* (3), 42–70.

Marumi, Kazuyuki, *Chihou koumuin kyuyo niju isseiki no kensyou (Local public sector wages: An assessment in the 21st century)*, Kouyou shobo, 2023. (In Japanese).

Ministry of Internal affairs and Communications, "Overview of local financial planning for FY2006 *Heisei 18 nendo Chihou Zaiseikeikaku no gaiyou in Japanese*," 2006.

Ministry of Public Transformation and Service of France, "Residence allowance (*L' indemnité de résidence* in French)," 2023. https://www.fonction-publique.gouv.fr/etre-agent-public/ma-remuneration/le-traitement-indiciaire-brut/lindemnite-de-residence-0.

Monras, Joan, "Minimum Wages and Spatial Equilibrium: Theory and Evidence," *Journal of Labor Economics*, 2019, *37* (3), 853–904.

Monte, Ferdinando, Stephen J Redding, and Esteban Rossi-Hansberg, "Commuting, migration, and local employment elasticities," *American Economic Review*, 2018, *108* (12), 3855–3890.

Morikawa, Masayuki, "Labor unions and productivity: An empirical analysis using Japanese firm-level data," *Labour Economics*, 2010, *17* (6), 1030–1037.

_ , "A comparison of the wage structure between the public and private sectors in Japan," *Journal of the Japanese and International Economies*, 2016, *39*, 73–90.

Nakamura, Emi and Jón Steinsson, "Identification in macroeconomics," *Journal of Economic Perspectives*, 2018, *32* (3), 59–86.

OECD, *Government at a Glance 2021*, Organization for Economic Co-operation and Development (OECD), 2021.

Olden, Andreas and Jarle Møen, "The triple difference estimator," *The Econometrics Journal*, 2022, *25* (3), 531–553.

Roback, Jennifer, "Wages, rents, and the quality of life," *Journal of Political Economy*, 1982, *90* (6), 1257–1278.

Rosen, Sherwin, "Wages-based Indexes of Urban Quality of Life," in Peter M Mieszkowski and Mahlon R Straszheim, eds., *Current Issues in Urban Economics*, Baltimore: John Hopkins University Press, 1979.

Roth, Jonathan, Pedro H. C. Sant'Anna, Alyssa Bilinski, and John Poe, "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature," *Journal of Econometrics*, 2023, *235*, 2218–2244.

Saez, Emmanuel, Benjamin Schoefer, and David Seim, "Payroll Taxes, Firm Behavior, and Rent Sharing: Evidence from a Young Workers' Tax Cut in Sweden," *American Economic Review*, May 2019, *109* (5), 1717–63.

Serrato, Juan Carlos Suárez and Owen Zidar, "Who Benefits from State Corporate Tax Cuts? A Local Labor Market Approach with Heterogeneous Firms: Reply," *American Economic Review*, December 2023, *113* (12), 3401–10.

Shimoi, Yasushi, *Koumuin Seido no Houriron (Legal Theory of the Japanese Civil Service System)*, Kobun dou, 2017. (In Japanese).

Shinkai, Yoichi, "Spillovers in wage determination: Japanese evidence," *The Review of Economics and Statistics*, 1980, pp. 288–292.

Staiger, Douglas O, Joanne Spetz, and Ciaran S Phibbs, "Is there monopsony in the labor market? Evidence from a natural experiment," *Journal of Labor Economics*, 2010, *28* (2), 211–236.

Telegdy, Álmos, "Public wage spillovers: The role of individual characteristics and employer wage policies," *Labour Economics*, 2018, *55*, 116–129.

Willén, Alexander, "Decentralization of wage determination: Evidence from a national teacher reform," *Journal of Public Economics*, 2021, *198*, 104388.

Yamagishi, Atsushi, "Minimum wages and housing rents: Theory and evidence," *Regional Science and Urban Economics*, 2021, *87*, 103649.

_ **and Yasuhiro Sato**, "Persistent Stigma in Space: 100 Years of *Japan's Invisible Race* and Their Neighborhoods," *Review of Economics and Statistics*, forthcoming.

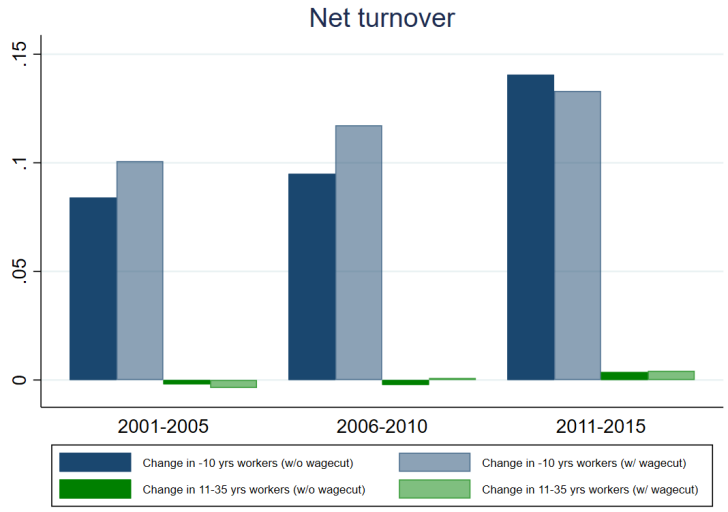
Zou, Ben, "The local economic impacts of military personnel," *Journal of Labor Economics*, 2018, *36* (3), 589–621.

Appendix to "Wage Spillovers across Sectors: Evidence from a Localized Public-sector Wage Cut" (Not for Publication)

A Omitted Figures

Note: This figure shows the turnover rate of local public-sector workers by age group. The turnover rate is calculated as the number of employees leaving the local government divided by the number of local government employees in each age group. For an aesthetic purpose, the turnover rate for workers in their 60s is omitted from the figure because it exceeds 2 due to retirement.

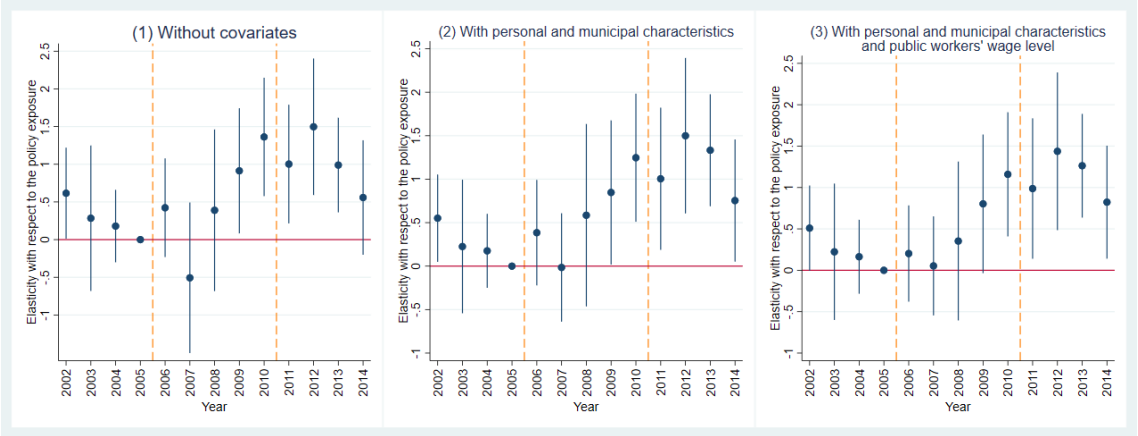
Figure A.1: Net turnover rate of local government employees by region following the 4.8% wage reduction by the years of experience



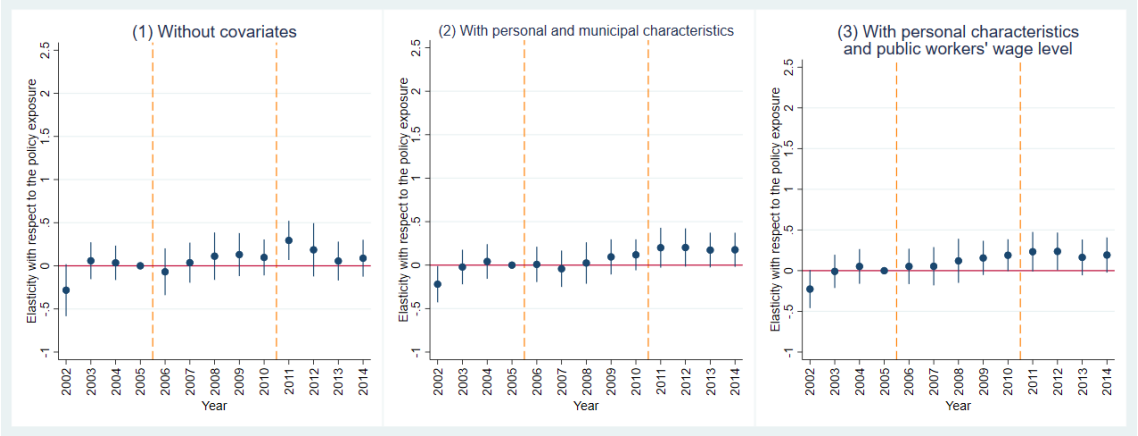
Note: This figure shows the average five-year net turnover rate of local public employees by region after the 4.8% wage cut and by years of experience. The net turnover rate is calculated as follows. Denote the number of employees in municipality i at the specific years s of experience at year t as $N_{i,s,t}$. In the data of the Fact-finding Survey on Compensation of Local Government Employees, s takes $0, 5, 10, 15, 20, 25, 30$, and 35, and t takes $2000 - 2015$. Since the number of employees at their age groups cannot be taken from the data, we use the years of experience here. "Change in -10 yrs worker" corresponds to $-\sum_{s=0,5}(N_{i,s+5,t+5} - N_{s,t})/\sum_{s=0,5}(N_{i,s,t})$ and "Change in 11-35 yrs worker" corresponds to $-\sum_{s=10,15,20,25,30}(N_{i,s+5,t+5} - N_{s,t})/\sum_{s=10,15,20,25,30}(N_{i,s,t})$ for each $t = 2000, 2005$, and 2010, respectively.

Figure A.2: Elasticity of private sector wages in year t with respect to the change in regional allowances from 2006-2010 for the industries with high and low young worker inflow from the public sector

(a) Analysis for the industries with high young worker inflow from the public sector



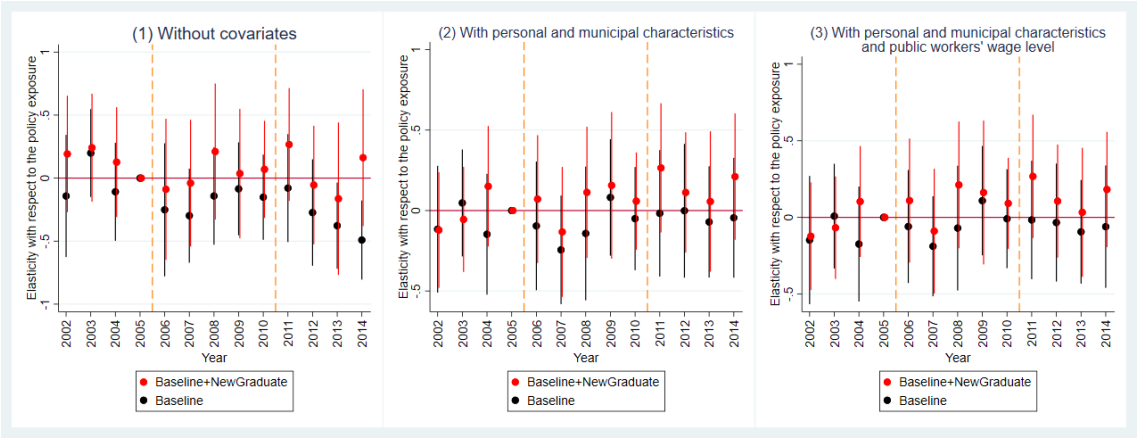
(b) Analysis for the industries with low young worker inflow from the public sector



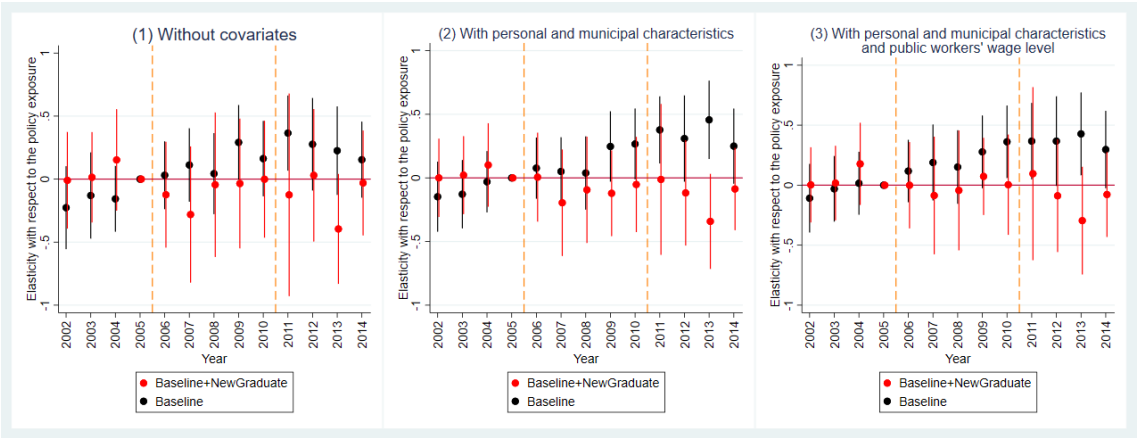
Note: These figures show the estimated β_t for each year in eq.(3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. For Panel (a) ((b)), we restrict the sample of (other industries than) the three industries with the highest young worker inflow from the public sector. The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies and sex dummies interacted with the college education dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.3: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 by timing of job entry

(a) Analysis for university graduates



(b) Analysis for nonuniversity graduates

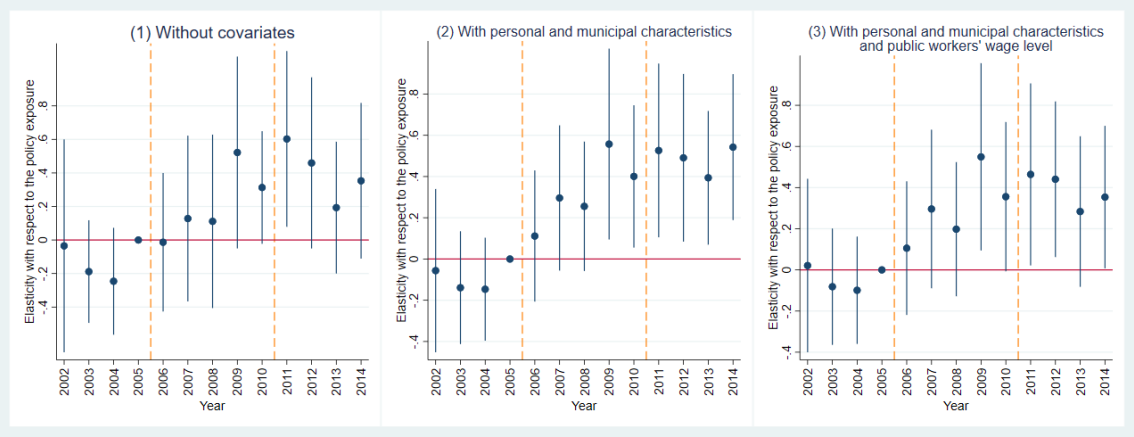


Note: These figures show the estimated β_t for each year in eq. (3). The estimated β_t (black) and $\beta_t + \beta_t^{New}$ (red) for each year in the equation:

$$\ln w_{i,j,t,private} = \sum_{t \neq 2005} [(\beta_t + \beta_t^{New} NewGraduate_i)\{\tau_t \times (RA_{j,2010} - RA_{j,2005})\}] \times Young_i + (\alpha_t + \alpha_t^Y Young_i) \times \tau_t \times NewGraduate_i + \mu_{j,t} + \sum_{k=\text{young or old}} (\iota_j^k + \tau_t^k) + \gamma X_{i,j,t} + \epsilon_{i,t}, \quad \text{(A.1)}$$

where $NewGraduate_i$ shows that i has been hired by new-graduate recruitment and τ_t shows year dummies. We restrict the sample to (non)university graduates in Figure (a) ((b)). β_t and $\beta_t + \beta_t^{New}$, respectively, correspond to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for all young workers and young workers hired by new-graduate recruitment, when the reform of regional allowances was conducted. The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. The number of young workers who (a) have a college degree and have experienced a job change, (b) have a college degree and have not experienced a job change (i.e., hired through new graduate recruitment), (c) have no college degree and have experienced a job change, and (d) have no college degree and have not experienced a job change (i.e., hired through new graduate recruitment) is 552,405, 374,078, 1,112,006, and 650,601, respectively. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the gender dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

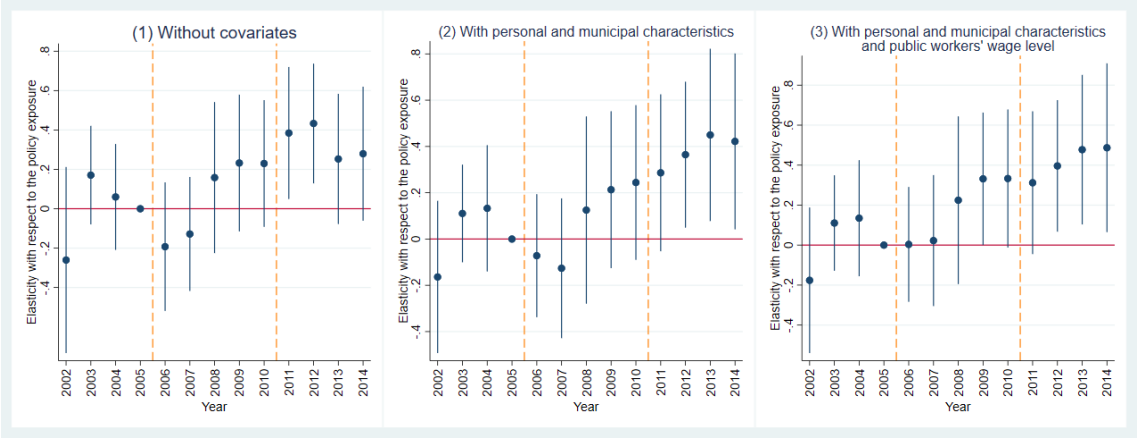
Figure A.4: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for regions other than the three largest metropolitan areas



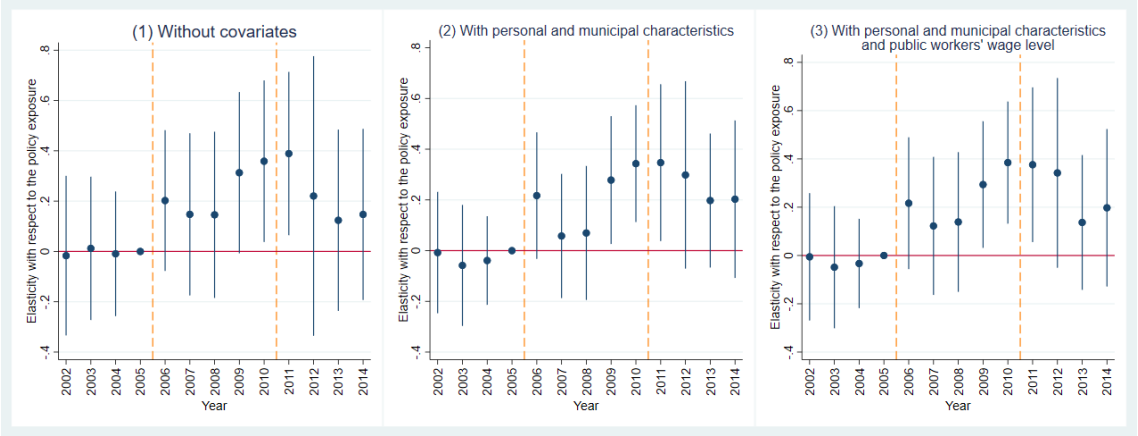
Note: These figures show the estimated β_t for each year in eq.(3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. We restrict the sample to regions other than three metropolitan areas (Tokyo, Kanagawa, Chiba, Ibaraki, Saitama, Aichi, Mie, Osaka, Kyoto, Nara, and Hyogo prefectures), for which the laws for the respective regions are designated as the three metropolitan areas in the figure. The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the college education dummy and sex dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.5: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for the regions with a higher- and lower-than-median share of public employees

(a) Analysis for the regions with a higher-than-median share of public employees



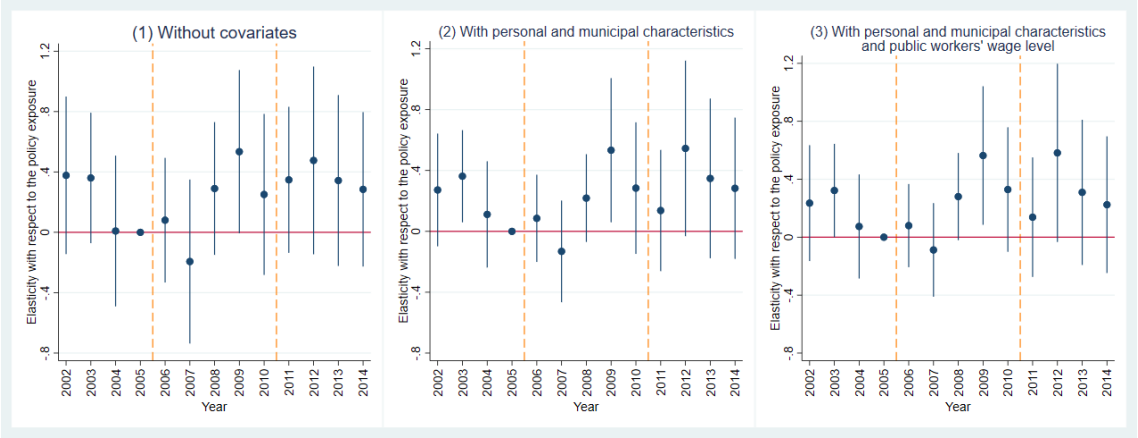
(b) Analysis for the regions with a lower-than-median share of public employees



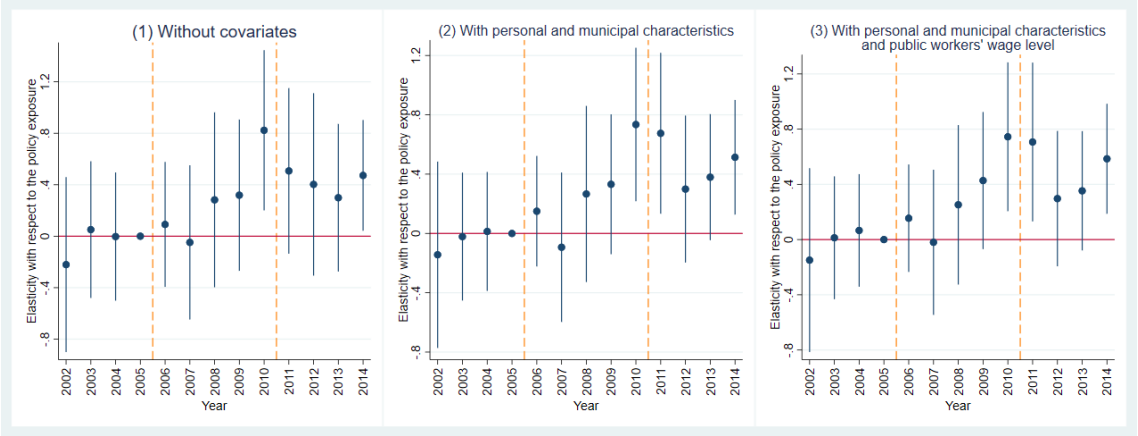
Note: These figures show the estimated β_t for each year in eq.(3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. We restrict the sample to the regions with a higher-than-median (lower-than-median) share of public employees in Figure (a) ((b)). The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies and sex dummies interacted with the college education dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita.), which are multiplied by the age dummy . The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in panel (3).

Figure A.6: The elasticity of the private-sector wage in year t with respect to the change in regional allowances during 2006-2010 for the industries with the first quartile of the labor union organization rate.

(a) Analysis for the companies with more than 300 employees



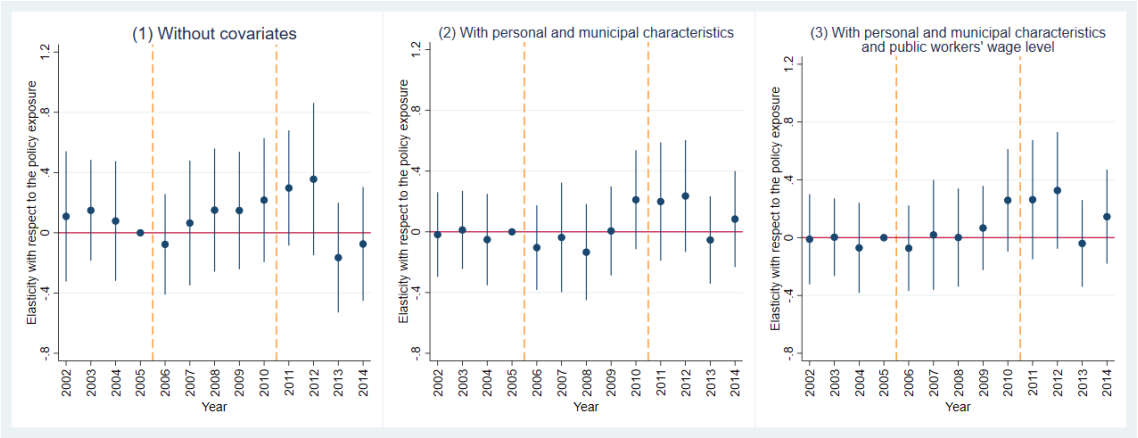
(b) Analysis for the companies with less than 300 employees



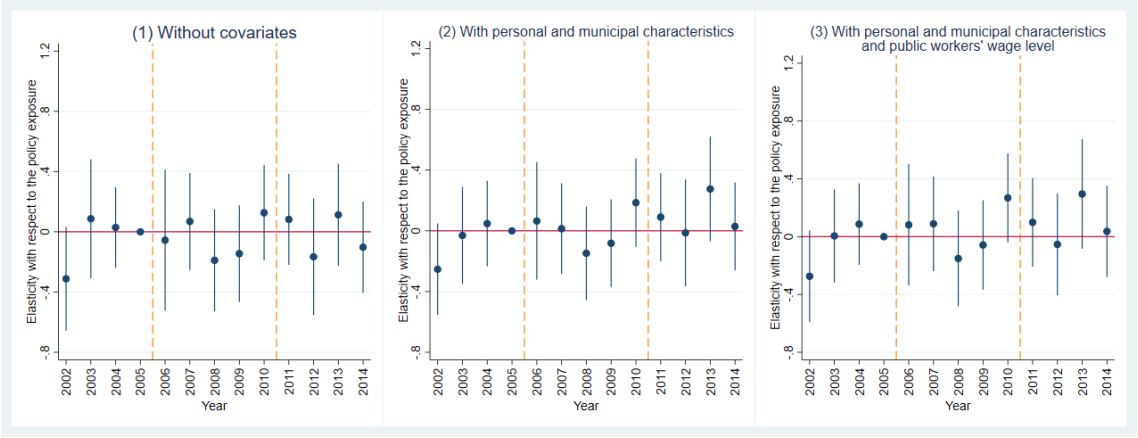
Note: These figures show the estimated β_t for each year inthe eq.(3). This corresponds to the elasticity of the private-sector wage in year t with respect to the change in regional allowances during 2006-2010, when the reform of regional allowances was conducted. We restrict the sample to the industries with the first quantile of the labor union organization rate. For panel (a) ((b)), we restrict the sample of the companies with more than 300 employees (less than 300 employees). In addition ,95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control municipal, year, and municipal-year fixed effects. In panel (1), we do not control any other variables. In panels (2)-(3), we control for individual (age dummies and sex dummy interacted with college education dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.7: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for industries outside the first quartile of the labor union organization rate

(a) Analysis for the companies with more than 300 employees



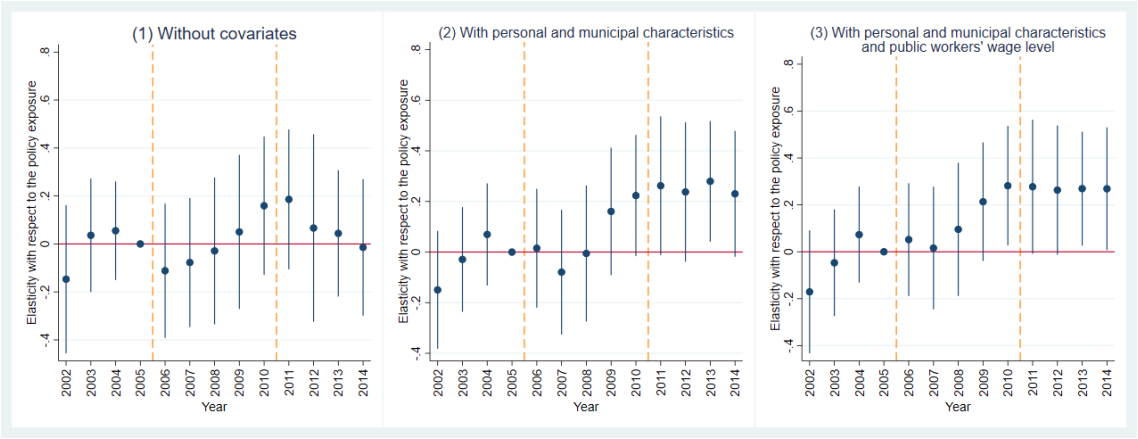
(b) Analysis for the companies with fewer than 300 employees



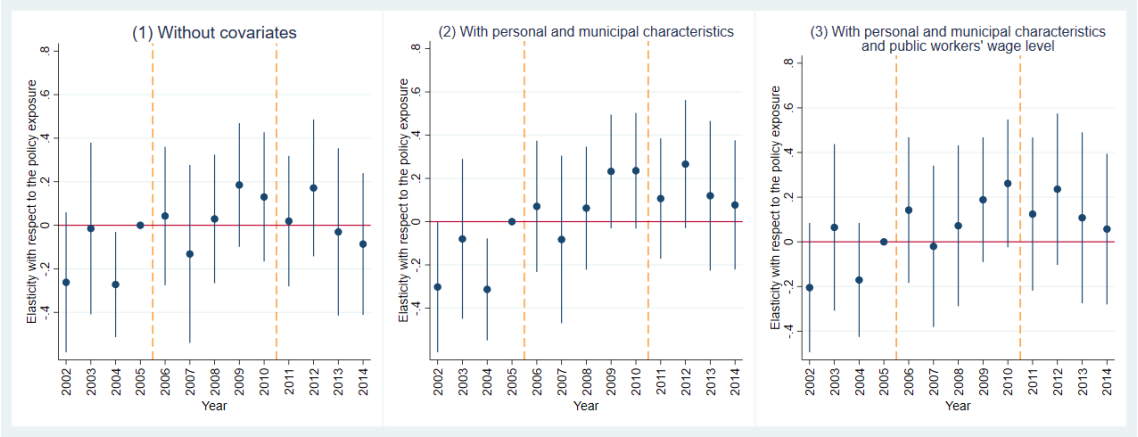
Note: These figures show the estimated β_t for each year in the eq. (3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. We restrict the sample to the industries other than the first quantile of the labor union organization rate. For Panel (a) ((b)), we restrict the sample of the companies with more than 300 employees (fewer than 300 employees). The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies and sex dummies interacted with the college education dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.8: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for men and women

(a) Analysis for men

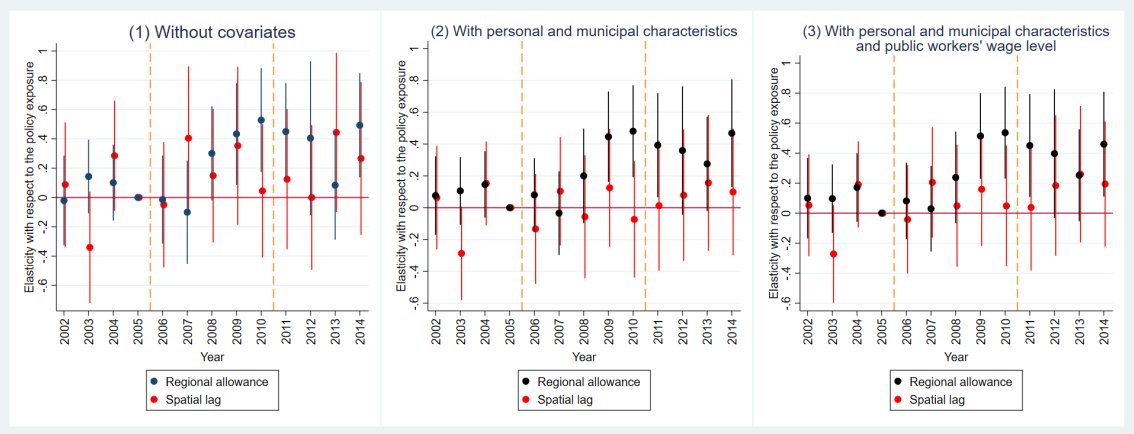


(b) Analysis for women



Note: These figures show the estimated β_t for each year in eq. (3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. We restrict the sample to men (women) in Figure (a) ((b)). The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the college education dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.9: The elasticity of private-sector wages in year t with respect to the change in regional allowances during 2006-2010 estimated based on the SLX model



Note: These figures show the estimated β_t (black) and β_t^{SLX} (red) for each year in the equation

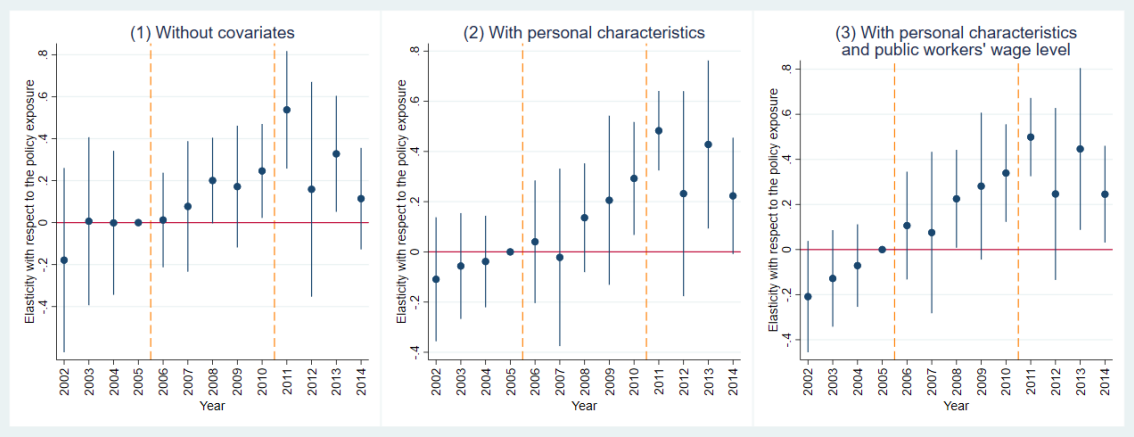
$$\ln w_{i,j,t,private} = \sum_{t \neq 2005} [\beta_t \{\tau_t \times (RA_{j,2010} - RA_{j,2005})\} + \beta_t^{SLX} \{\tau_t \times (\boldsymbol{WRA}_{j,2010} - \boldsymbol{WRA}_{j,2005})\}] \times Young_i + \mu_{j,t} + \sum_{k=\text{young or old}} (\iota_j^k + \tau_t^k) + \gamma X_{i,j,t} + \epsilon_{i,t}. \quad \text{(A.2)}$$

β_t and β_t^{SLX}, respectively, correspond to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 and with respect to the spatial lag of the change in regional allowances when the reform of regional allowances was conducted. The spatial lag is performed on the basis of the exponential type of spatial weight matrix whose element (i, j) is

$$\omega_{i,j} = \begin{cases} \frac{\exp(-\delta d_{i,j})}{\sum_{j=1}^{n} \exp(-\delta d_{i,j})}, & \text{if } d_{i,j} < d, i \neq j, \delta > 0 \\ 0 \text{ otherwise,} \end{cases} \quad \text{(A.3)}$$

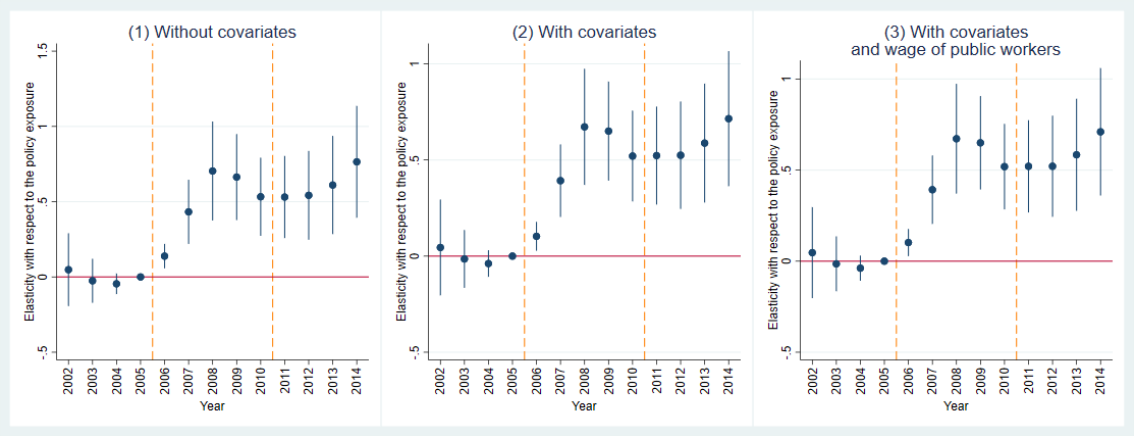
where we set the decay parameter δ as 1.2 kilometers by using the `spgen` command in Stata (see Kondo 2016 for details). The 95% confidence intervals based on standard errors clustered at the municipality level are also shown. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the college education dummy and gender dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.10: The elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010 for the analysis based on the commuting zone



Note: These figures show the estimated β_t for each year in eq.(3). This corresponds to the elasticity of private-sector wages in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. We use a weighted average of the regional allowance defined at the municipality level, which is redefined at the commuting area level, instead of the original regional allowance defined at the municipal level. We use the number of municipal staff as the weight and the data of the commuting zone defined by Adachi et al. (2021). The 95% confidence intervals based on standard errors clustered at the commuting zone level are also shown. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. In Panels (2)-(3), we control for individual (age dummies interacted with the college education dummy and gender dummy and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience with private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Panel (3).

Figure A.11: The elasticity of land prices in year t with respect to the change in regional allowances from 2006-2010



Note: This figure shows the estimated β_t for each year in eq.(5), with the land price as the dependent variable. This corresponds to the elasticity of land prices in year t with respect to the change in regional allowances from 2006-2010, when the reform of regional allowances was conducted. In all panels, we control for municipal, year, and municipal-year fixed effects. In Panel (1), we do not control for any other variables. We control for covariates (the logarithms of local tax revenue per capita, LAT per capita, NTD per capita, and the number of local officials per capita) in Panels (2) and (3). We add the average salary level of public workers in municipality j at t, $w_{j,t,public}$ in Panel (3). The 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

We take the land price information from the Land Market Value Publication (*kouji chika*). Our municipal land price data are based on the changes in repeated appraisal prices for the same land plot. In the Japanese context, land appraisal prices are based on transaction prices and well reflect market conditions. Indeed, studies have found a strong correlation between appraisal and transaction prices (LaPoint 2021; Yamagishi and Sato forthcoming).

We construct our municipal land price index as follows. We first calculate the ratio of the official land price of the current year to that of the previous year for all land plots that are appraised in two consecutive years. For each year, we then calculate the average ratio within each municipality. Finally, we use this ratio to construct a municipality-level land price index, normalizing the 2002 price to 1. Importantly, our land price data account for any fixed characteristics of each land plot, even if they are unobservable. The number of municipalities included in the land price analysis is 1355, which is somewhat less than the number included in our population and unemployment analysis because only municipalities with a land price survey point are included. To construct a balanced panel, the dataset for the land price analysis covers not all municipalities but 1355 municipalities according to the municipality definition of 2015.

B Omitted Tables

Table B.1: Regression results on private-sector wages for industries with high and low young worker inflow from public sector

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Industries with high inflow			(b) Industries with low inflow		
	log(wage rate of private workers)					
Regional allowances × Young dummy	0.7182***	0.8358***	0.8048***	0.2114***	0.2026***	0.2388***
	(0.2645)	(0.3114)	(0.3000)	(0.0659)	(0.0508)	(0.0499)
log(base wage of local municipal workers)			0.1085***			0.0756***
			(0.0108)			(0.0111)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	1685390	1685390	1628306	10509058	10509058	10040314
R^2	0.283	0.457	0.455	0.279	0.538	0.532

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. In Columns (2), (3), (5), and (6), we control for individual (age dummies interacted with college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6) although it is not controlled in the other columns. Note that the sample sizes of Columns (3) and (6) are limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.2: Regression results on private-sector wages for new-graduate workers

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) University graduates			(b) Nonuniversity graduates		
	log(wage rate of private workers)					
Regional allowances × Young dummy	-0.2078**	0.0165	0.0401	0.3842***	0.3898***	0.3875***
	(0.1021)	(0.1015)	(0.0958)	(0.0885)	(0.0884)	(0.0919)
Regional allowances × Young dummy× New graduates	0.2120*	0.1592	0.1642	-0.4645***	-0.5265***	-0.4611***
	(0.1237)	(0.1058)	(0.1006)	(0.1525)	(0.0958)	(0.1097)
log(base wage of local municipal workers)			0.3475***			-0.0157**
			(0.0060)			(0.0073)
Regional allowances × Young dummy×(1+New graduates)	0.0041	0.1756	0.2043	-0.0802	-0.1366	-0.0735
	(0.1423)	(0.1286)	(0.1230)	(0.1792)	(0.1173)	(0.1205)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year×New-Graduate×(1+Young dummy)	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yest	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	3633491	3633491	3626628	8557415	8557415	8038298
R^2	0.329	0.541	0.544	0.281	0.454	0.447

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The table shows the estimated result of the equation

$$\begin{aligned}\ln w_{i,j,t,private} =&(\beta+\beta^{New}NewGraduate_i)\times RA_{j,t}\times Young_i+(\alpha_t+\alpha_t^{young}Young_i)\times\tau_t\times NewGraduate_i\\&+\mu_{j,t}+\sum_{k=\text{young or old}}(\iota_j^k+\tau_t^k)+\gamma X_{i,j,t}+\epsilon_{i,t},\end{aligned}\tag{B.1}$$

where $NewGraduate_i$ shows that i was hired via new graduate recruitment and τ_t shows year dummies. The results of β and β^{new} are shown in the table. The number of young workers who (a) have a college degree and have experienced a job change, (b) have a college degree and have not experienced a job change (i.e., hired through new graduate recruitment), (c) have no college degree and have experienced a job change, and (d) have no college degree and have not experienced a job change (i.e., hired through new graduate recruitment) is 552,405, 374,078, 1,112,006, and 650,601, respectively. In Columns (2), (3), (5) and (6), we control for individual (age dummies interacted with the college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6), although it is not controlled in the other columns. Note that the sample size of Columns (3) and (6) are limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted. The results shown as "Regional allowances × Young dummy×(1+New graduates)" indicate the result of linear combinations of estimators "Regional allowances × Young dummy" and "Regional allowances × Young dummy× New graduates", which is estimated by `lincom` code of Stata.

Table B.3: Regression results on private-sector wages for regions excluding three metropolitan areas

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances × Young dummy	0.5131***	0.4237***	0.4364***
	(0.1253)	(0.1139)	(0.1197)
log(base wage of local municipal workers)			0.0204**
			(0.0084)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
N	8903248	8903248	8503467
R^2	0.176	0.440	0.433

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We restrict the sample to regions other than three metropolitan areas (Tokyo, Kanagawa, Chiba, Ibaraki, Saitama, Aichi, Mie, Osaka, Kyoto, Nara, and Hyogo prefectures), for which the laws for the respective regions are designated as the three metropolitan areas. In Columns (2) and (3), we control for individual (age dummies interacted with the college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3), although it is not controlled in the other columns. Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.4: Regression results on private-sector wages based on (2) for regions with higher- and lower-than-median shares of public employees

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Regions with many public workers			(b) Regions with few public workers		
	log(wage rate of private workers)					
Regional allowances × Young dummy	0.3401***	0.3515***	0.4116***	0.1858**	0.2534***	0.2671***
	(0.0983)	(0.1206)	(0.1113)	(0.0925)	(0.0679)	(0.0664)
log(base wage of local municipal workers)			0.1069***			0.0505***
			(0.0175)			(0.0088)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	6851803	6851803	6540347	7248851	7248851	6947525
R^2	0.307	0.546	0.540	0.213	0.472	0.466

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We restrict the sample to regions with a higher-than-median (lower-than-median) share of public employees in 2005 in Panel (a) ((b)). In Columns (2), (3), (5), and (6), we control for individual (age dummies interacted with college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6) although it is not controlled in the other columns. Note that the sample sizes of Columns (3) and (6) are limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.5: Regression results on private-sector wages based on (2) for the industries with the first quartile of the labor union organization rate

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Large companies			(b) Small companies		
	log(wage rate of private workers)					
Regional allowances × Young dummy	0.2094	0.2001	0.2325	0.3967***	0.4347***	0.4329***
	(0.1704)	(0.1875)	(0.1819)	(0.1176)	(0.1065)	(0.1075)
log(base wage of local municipal workers)			0.1842***			0.0414***
			(0.0100)			(0.0091)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	2962631	2962631	2882844	2040613	2040613	1936343
R^2	0.320	0.597	0.590	0.325	0.555	0.548

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We restrict the sample to the industries with the first quartile of the labor union organization rate in 2004. For Panel (a) ((b)), we restrict the sample of the companies with more than 300 employees (less than 300 employees). In Columns (2), (3), (5), and (6), we control for individual (age dummies interacted with college education dummy and gender dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6) although it is not controlled in the other columns. Note that the sample sizes of Columns (3) and (6) are limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.6: Regression results on private-sector wages based on (2) for the industries other than the first quartile of the labor union organization rate

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Large companies			(b) Small companies		
	log(wage rate of private workers)					
Regional allowances × Young dummy	0.1303	0.1928*	0.2622**	0.0560	0.1153	0.1186
	(0.1312)	(0.1037)	(0.1025)	(0.0907)	(0.0846)	(0.0848)
log(base wage of local municipal workers)			0.1146***			0.0412***
			(0.0143)			(0.0090)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	2838475	2838475	2731954	4352468	4352468	4117156
R^2	0.307	0.556	0.550	0.259	0.448	0.441

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We restrict the sample to the industries other than the first quartile of the labor union organization rate in 2004. For Panel (a) ((b)), we restrict the sample of the companies with more than 300 employees (less than 300 employees). In Columns (2), (3), (5), and (6), we control for individual (age dummies interacted with college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6) although it is not controlled in the other columns. Note that the sample sizes of Columns (3) and (6) are limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.7: Regression results on private-sector wages based on (2) for men and women

	(1)	(2)	(3)	(4)	(5)	(6)
		(a) Men			(b) Women	
	log(wage rate of private workers)					
Regional allowances × Young dummy	0.0806	0.2498***	0.2863***	0.1706*	0.2419**	0.2400**
	(0.0870)	(0.0682)	(0.0655)	(0.0928)	(0.0987)	(0.0994)
log(base wage of local municipal workers)			0.1603***			-0.1191***
			(0.0077)			(0.0186)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
N	9788905	9788905	9408084	4311241	4311241	4079192
R^2	0.284	0.498	0.491	0.249	0.354	0.34

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We restrict the sample with men and women in Panel (a) and (b), respectively. In Columns (2), (3), (5), and (6), we control for individual (age dummies interacted with the gender dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Columns (3) and (6), although it is not controlled in the other columns. Note that the sample size of Columns (3) and (6) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.8: Regression results on private-sector wages based on the SLX model

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances × Young dummy	0.3544***	0.3110***	0.3396***
	(0.1209)	(0.1069)	(0.1029)
Spatial lag of regional allowances × Young dummy	0.1796	0.0918	0.1406
	(0.1321)	(0.1160)	(0.1182)
log(base wage of local municipal workers)			0.0736***
			(0.0105)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
N	12194536	12194536	11668764
R^2	0.264	0.514	0.508

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: These tables show the estimated β and β^{SLX} in the equation

$$\ln w_{i,j,t,private} = [\beta RA_{j,t} + \beta^{SLX} \boldsymbol{W} RA_{j,t}] \times Young_i + \mu_{j,t} + \sum_{k=\text{young or old}} (\iota_j^k + \tau_t^k) + \gamma X_{i,j,t} + \epsilon_{i,t}. \tag{B.2}$$

The results of β and β^{SLX} are shown

The spatial lag is made based on the exponential type of spatial weight matrix whose (i, j) element is

$$\omega_{i,j} = \begin{cases} \frac{\exp(-\delta d_{i,j})}{\sum_{j=1}^{n} \exp(-\delta d_{i,j})}, & \text{if } d_{i,j} < d, i \neq j, \delta > 0 \\ 0 \text{ otherwise,} \end{cases} \tag{B.3}$$

where we set decay parameter δ as 1.2 kilometers by using the `spgen` command in Stata (See Kondo 2016 for details). In Columns (2) and (3), we control for individual (age dummies interacted with the college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3), although it is not controlled in the other columns. Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.9: Regression results on private-sector wages for the analysis based on the commuting zone

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances × Young dummy	0.3145*	0.3681***	0.4535***
	(0.1686)	(0.1264)	(0.1205)
log(base wage of local municipal workers)			0.2711***
			(0.0289)
	(0.0019)	(0.0050)	(0.2371)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
N	12160325	12160325	12084501
R^2	0.220	0.427	0.430

Standard errors clustered at the commuting zone level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented. We use a weighted average of the regional allowance defined at the municipality level, redefined at the commuting area level instead of the original regional allowance defined at the municipal level. We use the number of municipal staff as the weight and the data of commuting zone defined by Adachi et al. (2021). In Columns (2) and (3), we control for individual (age dummies interacted with the college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3), although it is not controlled in the other columns. Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.10: Regression results on working hours

	(1)	(2)	(3)
	log(working hours)		
Regional allowances × Young dummy	-0.0113	-0.0506	-0.0370
	(0.0273)	(0.0320)	(0.0325)
log(base wage of local municipal workers)			0.0019
			(0.0019)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
N	12194685	12194685	11668901
R^2	0.057	0.100	0.100

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented, where the dependent variable is the logarithm of working hours, which is the sum of prescribed and overtime working hours. In Columns (2) and (3), we control for individual (age dummies interacted with the college education dummy and sex dummy) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3), although it is not controlled in the other columns. Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.11: Regression results about the effect of the regional allowance rate in local public officials on private wages, instrumented by the regional allowance rate in national public officials

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances of the local government × Young dummy	0.5811***	0.7007***	0.7859***
	(0.1865)	(0.2038)	(0.2047)
log(base wage of local municipal workers)			0.0734***
			(0.0105)
Year fixed effects	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes
Municipality-year fixed effects	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes
Cragg-Donald F stat	4.0e+06	2.6e+06	2.5e+06
Kleibergen-Paap F stat	68.162	94.503	89.518
N	12194536	12194536	11668764
R^2	0.000	0.340	0.341

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The regression results of estimating Equation (2) are presented, where we use the regional allowance rate in the local public sector as an endogenous policy variable and the regional allowance rate in the national public sector as an instrumental variable, since the regional allowance rate in local public sector is determined by each municipality in reference to the national rate. In Columns (2) and (3), we control for individual (age dummies interacted with the college education dummy and sex dummy, and the logarithm of prescribed working hours) and municipal fiscal characteristics (the logarithms of local tax revenue per capita, lump-sum transfer per capita, earmarked subsidies per capita, and the number of local officials per capita), which are multiplied by the young dummy. The average salary level of public workers corresponding in terms of education level and experience to private worker i in municipality j at t, $w_{i,j,t,public}$, is controlled in Column (3), although it is not controlled in the other columns. Note that the sample size of Column (3) is limited because samples lacking public workers corresponding to the municipal public workers in terms of education and experience are omitted.

Table B.12: Regression results on land prices based on (4)

	(1)	(2)	(3)
	log(land prices)		
Regional allowances	0.5677***	0.5423***	0.5395***
	(0.1573)	(0.1421)	(0.1413)
log(tax revenue per capita)		0.0909**	0.0924**
		(0.0370)	(0.0367)
log(LAT per capita)		-0.0177***	-0.0177***
		(0.0052)	(0.0052)
log(NTD per capita)		-0.0048	-0.0047
		(0.0046)	(0.0046)
log(municipal public workers per capita)		-0.0321	-0.0329
		(0.0225)	(0.0227)
log(base wage of local municipal workers)			-0.0322
			(0.0679)
Year fixed effects	Yes	Yes	Yes
Municipal fixed effects	Yes	Yes	Yes
Prefecture-year fixed effects	Yes	Yes	Yes
N	17615	17615	17615
R^2	0.922	0.924	0.924

Standard errors clustered at the municipal level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The table presents the regression results of estimating Equation (4), in which the land price is the dependent variable. The average salary level of public workers in municipality j at t, $w_{j,t,public}$, is controlled for in Column (3), although it is not controlled for in the other columns because it is likely to suffer from endogeneity.

We take the land price information from the Land Market Value Publication (*kouji chika*). Our municipal land price data are based on the changes in repeated appraisal prices for the same land plot. In the Japanese context, land appraisal prices are based on transaction prices and well reflect market conditions. Indeed, studies have found a strong correlation between appraisal and transaction prices (LaPoint 2021; Yamagishi and Sato forthcoming).

We construct our municipal land price index as follows. We first calculate the ratio of the official land price of the current year to that of the previous year for all land plots that are appraised in two consecutive years. For each year, we then calculate the average ratio within each municipality. Finally, we use this ratio to construct a municipality-level land price index, normalizing the 2002 price to 1. Importantly, our land price data account for any fixed characteristics of each land plot, even if they are unobservable. The number of municipalities included in the land price analysis is 1355, which is somewhat less than the number included in our population and unemployment analysis because only municipalities with a land price survey point are included. To construct a balanced panel, the dataset for the land price analysis covers not all municipalities but 1355 municipalities according to the municipality definition of 2015.

C Summary Statistics

Table C.1: Summary statistics for the wage analysis dataset

	Areas without the regional allowances		Areas receiving the regional allowances	
	(1) -2005	(2) 2006-	(3) -2005	(4) 2006-
Panel A. Regional allowances				
Regional allowances	0.00	0.00	0.04	0.08
	(0.00)	(0.00)	(0.05)	(0.05)
Panel B. Individual private workers' characteristics				
Wage of private workers	16.58	16.09	21.08	20.14
	(9.67)	(9.19)	(12.58)	(12.38)
Sex	0.70	0.68	0.74	0.69
	(0.46)	(0.47)	(0.44)	(0.46)
University	0.18	0.22	0.35	0.40
	(0.38)	(0.41)	(0.48)	(0.49)
Age	40.47	41.22	39.74	40.42
	(11.77)	(12.03)	(11.65)	(11.83)
Prescribed working hours	165.71	165.05	161.97	161.74
	(20.23)	(20.25)	(19.61)	(20.69)
Percentage of workers aged less than 30	0.23	0.21	0.24	0.22
	(0.42)	(0.40)	(0.43)	(0.42)
Percentage of workers in companies with over 100 employees	0.44	0.41	0.29	0.29
	(0.50)	(0.49)	(0.45)	(0.45)
Panel C. Municipal characteristics				
Population	1.6e+05	1.7e+05	7.6e+05	7.7e+05
	(1.8e+05)	(1.8e+05)	(8.5e+05)	(8.6e+05)
Local tax revenue per capita	119.97	130.02	170.58	175.80
	(43.83)	(46.30)	(52.69)	(47.59)
LAT per capita	104.27	113.79	27.73	26.45
	(75.24)	(90.11)	(26.61)	(26.47)
NTD per capita	38.29	60.79	45.98	59.77
	(21.48)	(95.29)	(24.37)	(26.88)
Number of municipal public workers	1,631.05	1,542.87	9,212.98	7,737.79
	(1,677.01)	(1,588.27)	(12613.63)	(10022.95)
Average income of the corresponding municipal public workers	3,292.17	3,085.41	3,373.80	3,237.96
	(1,105.72)	(1,083.46)	(1,059.09)	(992.97)
N	1806222	4044021	2223787	4120531

The summary statistics of the areas where regional allowances have been provided (at least once) and the areas where regional allowances have not been provided. The means are shown as coefficients, and the standard deviations are given in parentheses. Note that the characteristics of urban municipalities are more representative, reflecting the larger sample size in urban areas.

Table C.2: Summary statistics for the population and unemployment rate analysis dataset

	Areas without the regional allowances		Areas receiving the regional allowances	
	(1) -2005	(2) 2006-	(3) -2005	(4) 2006-
	Panel A. Regional allowances			
Regional allowances	0.00	0.00	0.02	0.06
	(0.00)	(0.00)	(0.04)	(0.05)
	Panel B. Demographic characteristics			
Population	36932.27	35813.29	2.1e+05	2.1e+05
	(60949.07)	(60672.33)	(3.3e+05)	(3.4e+05)
Population aged 15-29	6,439.55	5,410.02	40638.13	35151.25
	(11423.97)	(9,779.60)	(64970.65)	(56893.69)
Population aged 30-64	16958.74	16490.95	1.0e+05	1.1e+05
	(28776.33)	(28785.59)	(1.7e+05)	(1.7e+05)
	Panel C. Administrative characteristics			
Local tax revenue per capita	107.38	120.25	144.26	151.14
	(66.63)	(85.19)	(47.31)	(43.18)
LAT per capita	230.33	264.15	34.68	34.08
	(221.37)	(263.55)	(35.07)	(37.02)
NTD per capita	47.97	75.31	29.17	44.15
	(106.16)	(167.75)	(16.13)	(23.17)
Number of municipal public workers	442.39	398.78	2,019.13	1,804.60
	(613.37)	(568.93)	(4,047.27)	(3,453.39)
Average income of municipal public workers	3,247.07	3,173.34	3,431.02	3,287.83
	(212.19)	(191.96)	(218.37)	(183.57)
N	5464	12294	1460	3285

The summary statistics of the areas where regional allowances have been provided (at least once) and the areas where regional allowances have not been provided. The means are shown as coefficients, and the standard deviations are given in parentheses.

Table C.3: Summary statistics for the land price analysis dataset

	Areas without the regional allowances		Areas receiving the regional allowances	
	(1) -2005	(2) 2006-	(3) -2005	(4) 2006-
	Panel A. Regional allowances			
Regional allowances	0.00	0.00	0.02	0.06
	(0.00)	(0.00)	(0.04)	(0.05)
	Panel B. Demographic characteristics			
Land price	0.93	0.74	0.90	0.78
	(0.07)	(0.12)	(0.08)	(0.14)
	Panel C. Administrative characteristics			
Local tax revenue per capita	110.11	120.49	144.36	151.26
	(57.34)	(57.18)	(47.33)	(43.18)
LAT per capita	151.26	171.21	34.67	34.07
	(103.63)	(125.95)	(35.10)	(37.06)
NTD per capita	35.51	61.62	29.20	44.20
	(27.13)	(139.92)	(16.13)	(23.18)
Number of municipal public workers	560.92	507.58	2,023.93	1,808.81
	(681.25)	(632.58)	(4,051.79)	(3,457.19)
Average income of municipal public workers	3,284.95	3,202.02	3,432.45	3,288.63
	(190.12)	(173.82)	(216.93)	(183.17)
N	3964	8919	1456	3276

The summary statistics of the areas where regional allowances have been provided (at least once) and the areas where regional allowances have not been provided. The means are shown as coefficients, and the standard deviations are given in parentheses.

D Details on Calculating the Aggregate Economic Impact

In this appendix, we explain how we calculate the economic impact of the public wage reform in Section 6.

Our estimation results show the extent to which the outcomes change with the change in the regional public wage level. Therefore, by multiplying the coefficients of the outcomes, the changes in the effective public wage, and the actual amount of the outcome variables in each municipality, we can estimate how much the outcomes in each municipality changed due to the public wage reform.

For the changes in the effective public wage in each region, since the effective wage in region i in 2010 can be expressed as $(1 + RA_{i,2010}) \times \text{Base wage}_{i,2010}$, where RA is the regional allowance rate, the change in the effective wage in region i can be calculated as follows:

$$
\begin{aligned}
&(1 + RA_{i,2010}) \times \text{Base wage}_{i,2010} - (1 + RA_{i,2005}) \times \text{Base wage}_{i,2005} \\
&= (\text{Base wage}_{i,2010} - \text{Base wage}_{i,2005})(1 + RA_{i,2010}) + (RA_{i,2010} - RA_{i,2005}) \times \text{Base wage}_{i,2005} \\
&= -0.048 \times (1 + RA_{i,2010}) + (RA_{i,2010} - RA_{i,2005}),
\end{aligned}
$$

where we normalize $\text{Base Wage}_{i,2005}$ to 1 in the last equation.

Impact on private earnings Since our study shows that a 1% decrease in public wages leads to an approximately 0.3% decrease in private wages for young full-time workers aged 15 to 29, we can infer the impact of the public wage reform on private earnings if the total amount of earnings for young full-time workers in each municipality is observed.

We approximate this via the following procedure. In the absence of data regarding the number of young full-time workers by municipality, the number of young full-time workers is reproduced using the number of full-time workers in private sectors[D.1] and the percentage of the working-age population aged 15-29 years from the census in each municipality. In addition, since data on the average wage of young full-time workers are not available for some municipalities, we use the average wage of the prefecture from the Basic Survey on Wage Structure to infer the average wage of each municipality. We then construct the approximate total amount of earnings for young full-time workers in each municipality by multiplying the approximate number of young full-time workers by the average wage of young full-time workers.

By multiplying the estimated elasticity of the private wages of young full-time workers, the changes in the effective public wage, and the approximate total amount of earnings for young full-time workers in each municipality, the reduction in earnings for young full-time workers due to the reduction in public wages is estimated to be 3.1 trillion yen for 2010.

[D.1] The sample is limited to workers in the secondary and tertiary industries, which are the subject of our analysis.

The total amount of public wage reduction in local governments In addition to estimating the economic impact on the various outcomes, we infer the total amount of public wage reduction in local governments, considering that the changes in the effective public wage were different for each region. Since the Fact-Finding Survey on the Compensation of Local Government Employees includes the number and average wage of local government employees by age and education level for each locality, we estimate that the total amount of public wage reduction for all municipalities due to the reform was 104.6 billion yen in 2010. However, the public wage reduction for prefectures cannot be exactly estimated because different regional allowance rates are applied in different municipalities within the same prefecture, and it is not known how many prefectural workers are located in each municipality. Since the number of prefectural workers is approximately 1.1 times greater than the number of municipal workers and prefectural workers tend to be located in the prefectural capital, which tends to have higher regional allowance rates than other regions do, we suppose that the total amount of public wage reduction for all prefectures due to the reform is similar to that for all municipalities, i.e., approximately 100 billion yen in 2010.

Taken together, the estimated total amount of local public wage reduction was approximately 200 billion yen in 2010.

References for the Appendix

Kondo, Keisuke, "Introduction to Spatial Econometric Analysis: Creating spatially lagged variables in Stata," *RIETI Technical Paper Series*, 2016, *16-T-001*.