

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

Tsuyoshi Goto
Chiba University

Atsushi Yamagishi
Hitotsubashi University
(&UTokyo&Princeton)

February, 2025

■ Institutional wage reform in one sector may cause wage spillovers in other sectors

- Institutional wage rules: Minimum wages, equal-pay requirement across different area (in healthcare and education)...
- Spillovers should be taken into account in evaluating a reform in these institutional wage rules

■ We study **the spillover effects of public-sector wage to the private sector wage**

- The public-sector wage is heavily influenced by institutional rules.
- Spillovers onto other sectors may be substantial as the public sector is a sizable employer (18% of total employment at the OECD average)
- Public-sector wages themselves are important as policy tools

Quote: Policy debate about public-sector wages



細野豪志
@hosono_54

...

キャリア官僚の初任給18万円代は日本の貧しさの象徴。公務員給与は民間を基準にして給与を抑える人事院勧告で決まる。特に地方で「構造的賃上げ」を実現するためには公務員の賃上げで民間の賃上げを促す方向に転換すべきでは。みんなで貧しくなっても仕方がない。公務員叩きをしている場合ではない。

Translated from Japanese by Google

The starting salary of a career bureaucrat in the 180,000 yen range is a symbol of Japan's poverty. The salaries of civil servants are determined by the National Personnel Authority's recommendations to keep salaries down based on private sector standards. In particular, in order to achieve a "structural wage increase" in rural areas, we should shift toward promoting wage increases in the private sector through wage increases for public employees. It can't be helped if we all become poor. This is not the time to harass public officials.

7:29 PM · Oct 27, 2022

2,798 Retweets 947 Quotes 15.4K Likes 115 Bookmarks

- Hosono is a member of the House of Representatives and a former Minister of the Environment.

- **This paper evaluates the spillover effects of public-sector wages**
- For identification, we combine **Japanese policy reform and the institutional setting**:
 - Policy reform: Public-sector wage cut that led to a larger geographical variation in the public-sector wages from a more uniform pay scheme
 - Institutional setting: Young workers are primarily affected by the public-sector wages because the public-private job mobility is limited for older workers.
- This leads to a **triple difference strategy**
 - Compares the evolutions of young-old private wage differences in municipalities with or without the public-sector wage cut

- We find that **1% decrease in public-sector wages induces 0.3% decrease in private-sector wages of young workers**
- In terms of mechanism behind wage spillovers, **the worse outside option for private-sector workers in the labor market is likely to drive the wage spillovers**
 - The spillover elasticity is larger when workers are more mobile between public and private jobs
- We also **analyze the migration response** based on a spatial economic model
 - 1% public-sector wage cut increases out-migration of the young by 0.1%
 - Welfare decline due to the public-sector wage cut

■ **Wage spillovers of institutional rules:**

Staiger, Spetz, Phibbs (2010); Cengiz et al. (2019); Willèn (2021); Berger, Herkenhoff, Mongey (2022); Bassier (2024); Demir (2024); Derenoncourt and Weil (2024)

■ **Reduced-form relationship between public and private wages:**

Ehrenberg and Goldstein (1975), Lacroix and Dussault (1984), Gregory and Borland (1999), Lamos, Pérez, Schuknecht (2012), Afonso and Gomes (2014), Telegdy (2018), Abdallah, Coady, Fah Jirasavetakul (2023)

■ **Structural approaches for identifying the effects of public-sector wages:**

Burdett (2012), Gomes (2015, 2018), Bradley, Postel-Vinay, Turon (2017), Bermperoglou, Pappa, Vella (2017), Albrecht, Robayo-Abril, Vroman (2019), Chang, Lin, Traum, Yang (2021), Lu and Kameda (2023)

■ **Local labor market approach for public-sector employment:**

Faggio and Overman (2014), Zou (2018), Faggio (2019), Auricchio, Ciani, Dalmazzo, de Blasio (2020), Jofre-Monseny, Silva, Vázquez-Grenno (2020), Becker, Heblich, Sturm (2021), Franklin, Imbert, Abebe, Mojia-Mantilla (2021), Guillouzouic, Henry, Monras (2021), Chirakijja (2023)

1. **Background**
2. Private-sector wage spillovers
3. Some spatial perspective
4. Conclusion

Theoretical background behind wage spillovers

- We hypothesize that the public-sector wage cut has a spillover effect on private-sector wages through *labor market competition between public and private sectors*
 - In particular, public-sector jobs serving as an outside option for private-sector jobs (Caldwell and Danieli 2024)
- To illustrate the idea, we consider a standard Nash bargaining model
- A worker is negotiating with a private-sector firm over their wage w_{private}
 - If employed by this firm, this firm-worker match produces y (0 output otherwise).
 - As an outside option, the worker gets a public-sector job with probability λ , whose wage rate is denoted by w_{public} (earns 0 otherwise)
 - For the firm side, it obtains the output y while paying the wage rate w_{private} , implying that the profit is written as $y - w_{\text{private}}$.
- Assuming the Nash bargaining, the private-sector wage solves
$$\max_{w_{\text{private}}} (y - w_{\text{private}})^{\gamma} (w_{\text{private}} - \lambda w_{\text{public}})^{1-\gamma}$$

Theoretical background behind wage spillovers

- Nash bargaining solution: $w_{\text{private}} = \gamma\lambda w_{\text{public}} + (1 - \gamma)y$
- The “spillover effect” of the public-sector wages on the private-sector wages is written as

$$\partial w_{\text{private}} / \partial w_{\text{public}} = \gamma\lambda > 0.$$

- The spillover effect is predicted to be larger when
 - The public job is more available for a private worker as an outside option (larger λ)
 - Workers have weaker wage bargaining power (larger γ)

Public sector in Japan

- About 3.5 million public officials (6% of the total employment)
 - One of the countries with the lowest share of the public sector → Japan may provide a lower-bound for the effects of public-sector wages
- The wages of nationally-employed public-sector workers depend on the municipality of workplace
 - There are two types of public-sector workers: the nationally-employed and locally-employed.
 - Local governments' wages are required to closely follow those of the nation public-sector workers (Kawasaki and Nagashima 2007; Aoki 2021). Public-private relative wages over time
- The base wages of national public-sector workers are uniform across locations, but **regional allowances (RA)** adjust for wage differentials across municipalities Average wages over time

Regional allowance rate

- Regional allowance rate for individual i is multiplicative with the nationally-uniform base wage and depends only on municipality j :

$$\text{Effective wage}_{ij} = (1 + \text{Regional allowances rate}_j) \times \text{Base wage}_i$$

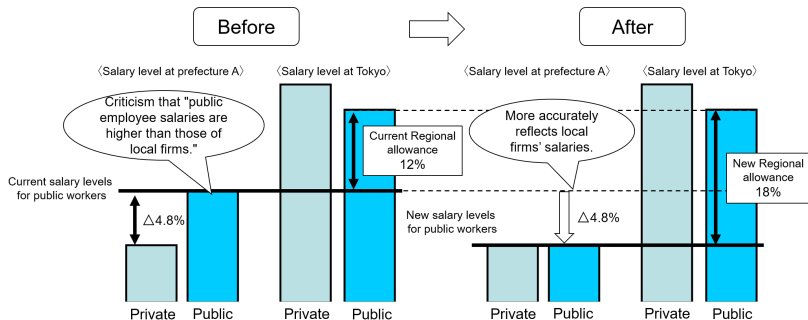
- Taking the log, we can consider that regional allowance rate captures the municipality wage premium for all workers:

$$\ln(\text{Effective wage}_{ij}) \simeq \text{Regional allowances rate}_j + \ln(\text{Base wage}_i) \quad (1)$$

- In our main analysis, we use the regional allowance rate of nationally-employed public workers who work in municipality j
 - Instrumenting for the wage rate of locally-employed public workers by the wage rates of nationally-employed public workers yields similar (larger but somewhat noisier) wage spillover elasticities

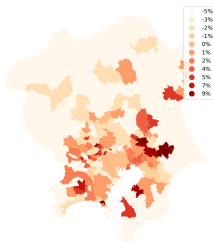
Public-sector wage reform

- During 2006 and 2010, the Japanese government implemented a policy reform Business cycle
- The reform addressed the long-standing public-private wage gap in the relatively rural areas
- While the base wage was uniformly reduced, regional allowance rate was increased in areas with relatively high private-sector wage rates.
 - The policy was gradually introduced over 2006 and 2010



Variation in regional allowance rates across municipalities

- As a result, the public-sector wage was reduced in many municipalities, while some urban municipalities did not experience the decline or experienced even an increase
- Policy impact in Kanto area: [Map for the entire Japan](#)



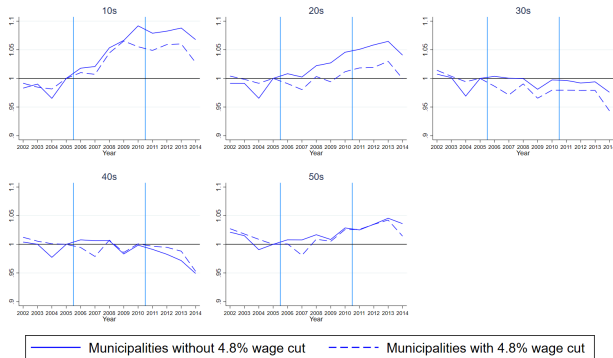
- *Conditional on municipality fixed effects that control for the sources of pre-existing public-sector wage gap*, we use the introduction of this wage cut as an exogenous source of variation in the public-sector wages.

Workers' age and public-sector jobs

- We also leverage the institutional setting: **young workers are primarily affected by the public sector in the labor market**
- Most jobs in the national public sector impose **the upper age limit of 30**.
 - Moreover, older workers rarely leave the public sector under the lifetime employment system (Ito and Hoshi 2020) Turnover by age
- Therefore, the public and private sectors compete in a labor market essentially only for young workers
- This motivates a **triple-difference strategy, which assumes that young workers are primarily exposed to the policy shock**.
 - We classify workers below 30 as young, and the rest as older.
 - This allows us to control for municipality-year fixed effects, not just municipality fixed effects
 - Since we use the difference between the young and the older workers, our approach is conservative if the older workers are somewhat affected but in the same direction as the young workers

Wage trends by age deciles

Our triple-difference strategy compares the young's and old's wage trends in municipalities with or without public-sector wage cut



Solid line=Municipalities that did not experience the wage cut.

Dash line=Municipalities that got public-sector wage cut.

♣ The dash line goes below the solid line only for workers below 30.

Data

- For the period of 2002–2014, we collect data on public wages, private wages, population, and municipal fiscal characteristics.
 - The sample period ensures a four-years window before and after the policy change 2006–2010.
- Public wages: Regional allowance (*chiiki teate*) and its precedent (*chousei teate*) taken from D1-law.com, Fact-finding Survey on Compensation of Local Government Employees
 - We do not need to measure the base wage of national public officials as it is nationally uniform.
- Private wages: The Basic Survey on Wage Structure
 - Large-scale survey (>1m observations). Includes only private-sector workers.
 - We look only at regular workers aged from 15 to 64.
- Population: The System of Social and Demographic Statistics
- Municipal fiscal characteristics: The Survey on the Conditions of Local Public Finance (*chihou zaisei jyoukyou chosa shiryou*)
- Throughout the analysis, we use the municipality definition as of 2015 to address municipal mergers.

1. Background
2. **Private-sector wage spillovers**
3. Some spatial perspective
4. Conclusion

Empirical strategy: Private wages

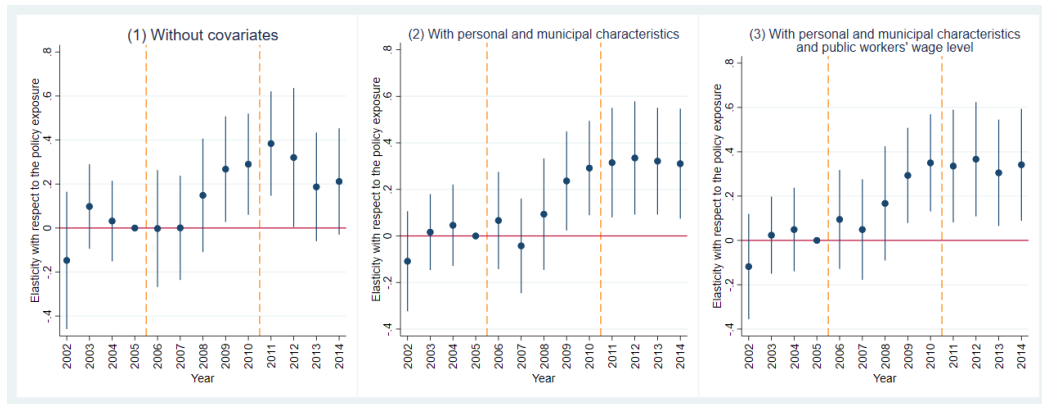
- Using microdata of private-sector workers (Basic Survey on Wage Structure), we estimate the following model to estimate the effect of public-sector wages on private-wages:

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

where a worker is young if and only if they are below 30. $RA_{j,t}$ is the regional allowance (in percentage points) in the public-sector wage.

- To estimate β , we compare the wage difference between the young and the older workers in a municipality with and without public-sector wage cut (**triple-difference strategy**)
- As the control, we include workers' characteristics (age, education etc), fiscal characteristics interacted with young dummy
 - In a robustness check, we also control for the corresponding base wage rate of local public officials, reflecting discretionary wage policies of local municipalities.

Result: Private wages



- Note: Positive elasticity means the wage increase in response to a public-sector wage *increase*
 - Hence the positive elasticity means the private-sector wage decrease in response to the public-sector wage *cut*
- Elasticity of around 0.3
- Little indication of the positive pre-trend.

Result: Private wages

	(1)	(2)	(3)
	log(wage rate of private workers)		
Regional allowances $\times$ Young dummy	0.2978*** (0.0790)	0.3066*** (0.0752)	0.3408*** (0.0713)
log(base wage of local municipal workers)			0.0735*** (0.0105)
Year fixed effect	Yes	Yes	Yes
Municipality fixed effect	Yes	Yes	Yes
Municipality-year fixed effect	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 a municipal level in parentheses

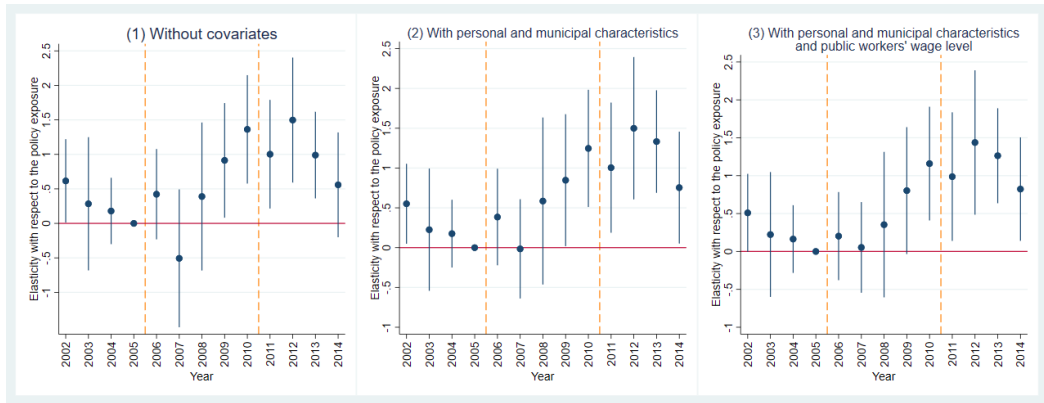
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Elasticity of around 0.3 in all specifications with different control variables.
- Statistically and economically meaningful: RA ranges 1–1.18, so the effect size is roughly six percent ($0.3 \times 0.18 \simeq 0.06$)
 - About one-fifth of gender wage gap, one-third of college premium in our data.

Mechanism: Public-sector wage as an outside option

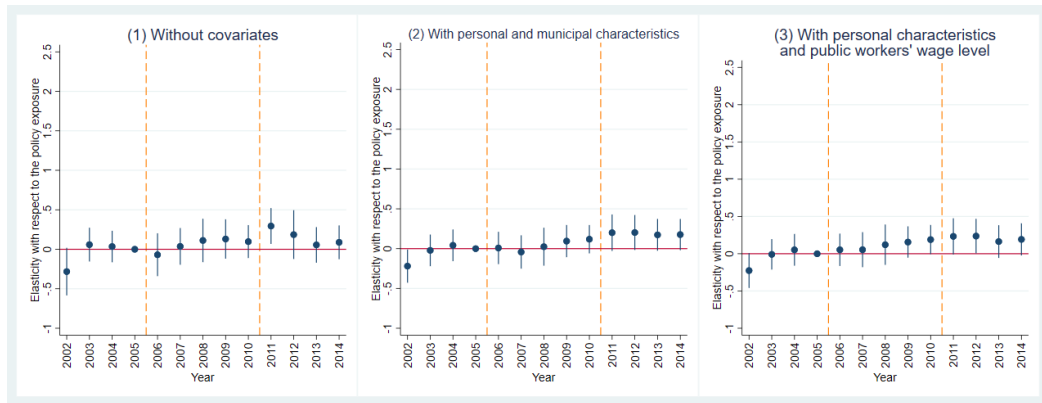
- What is the mechanism behind the wage spillover?
- Hypothesis: When public-sector job is a more important outside option for private workers, we observe larger wage spillover elasticity
 - This is the case in sectors in which workers are highly mobile between public and private jobs
- We therefore analyze whether the wage spillover elasticity is larger in sectors that receive a lot of workers from the public sector
 - Top 3 in 2009: Electricity, Gas, Heat Supply and Water; Transport and Postal Services; Real Estate and Goods Rental and Leasing

Wage spillover elasticity with high public-private job mobility



- Wage spillover elasticity around 0.8 in sectors with high public-private job mobility

Wage spillover elasticity with low public-private job mobility



- Wage spillover elasticity around 0.2 in sectors with low public-private job mobility
- Consistent with the outside option mechanism

The role of downward wage rigidity

- We investigate whether downward wage rigidity prevents the downward adjustment of wages in response to a public-sector wage cut
 - Other things being equal, unions induce stronger downward wage rigidity (Hara and Kawaguchi 2008; Davis and Krolkowski 2024)
- In Japan, firm size and sectors predict the coverage rate of firm-level labor union
 - Almost all small firms have near zero labor union coverage rate, regardless of sectors
 - In contrast, large firms may have labor union but there is large heterogeneity across sectors
- We find evidence that downward wage rigidity somewhat dampens the wage spillover Results
 - The wage spillover elasticity is smaller for large firms, but only in sectors with high labor union coverage rate
 - New to the literature, as prior studies have focused on the exogenous wage *increase*

1. Background
2. Private-sector wage spillovers
3. **Some spatial perspective**
4. Conclusion

A spatial perspective: net migration

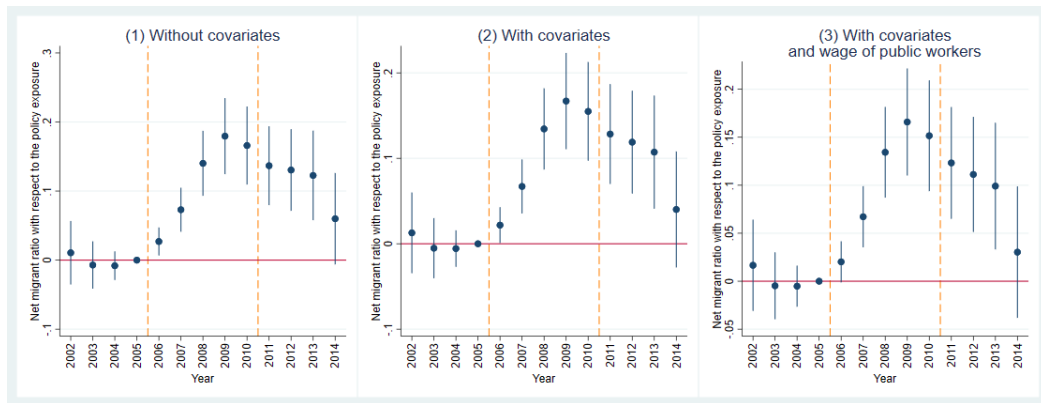
- A simple spatial equilibrium model implies that population response is informative of the welfare impact of the public-sector wage cut
- Spatial equilibrium condition as in Rosen (1979) and Roback (1982):

$$\text{Amenities} + \text{Labor market attractiveness} + \text{Housing cost} = \text{Outside utility}$$

- Public-sector wage cut may affect not only labor market attractiveness, but also amenities (that summarize public goods quality, job amenities, fiscal burden etc.)
 - Therefore, the private-sector wage decrease does not immediately imply the welfare decline of young workers
- But inclusive of all these effects, people are less willing to live in a municipality that is made unattractive by the policy change
- This induces net migration outflow of the young

Net migration

By using the difference of the young net migrant share and the older net migrant share as an outcome variable, we find that 1% public wage cut induces 0.1% increase in migration outflow



■ Further results [Details](#)

- Net migration elasticity is larger in areas with relatively more public officials
- Adjusting for changes in local labor supply increases the wage elasticity by around 20-30%

List of additional analysis

- Wage elasticity heterogeneity
 - Gender
 - Education attainment
 - New graduate labor market (*shinsotsu saiiyou*)
- Impact of public-sector wages in neighboring municipalities
- Excluding the three largest metropolitan areas (Tokyo, Osaka, Nagoya)
- Back-of-the-envelope calculation on the economic magnitude of wage spillover elasticity

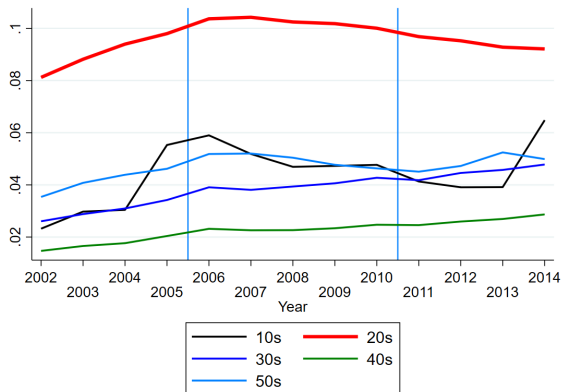
1. Background
2. Private-sector wage spillovers
3. Some spatial perspective
4. **Conclusion**

Conclusion

- How do institutional wage reforms in one sector spill over to other sectors?
- We investigate the spillover effects of public-sector wages, using
 - Japanese policy reform that created geographical variation in public-sector wages
 - Institutional setting in which only young workers are primarily affected by the public-sector jobs
- We find that 1% cut in the public-sector wages induced 0.3% decrease in private-sector wages of young workers
- The worse outside option for private-sector workers is consistent with the wage spillover effect
- Based on spatial equilibrium model, public-sector wage cut lowered workers' welfare
 - 1% increase in public wage is associated with 0.1% increase in out-migration of the young

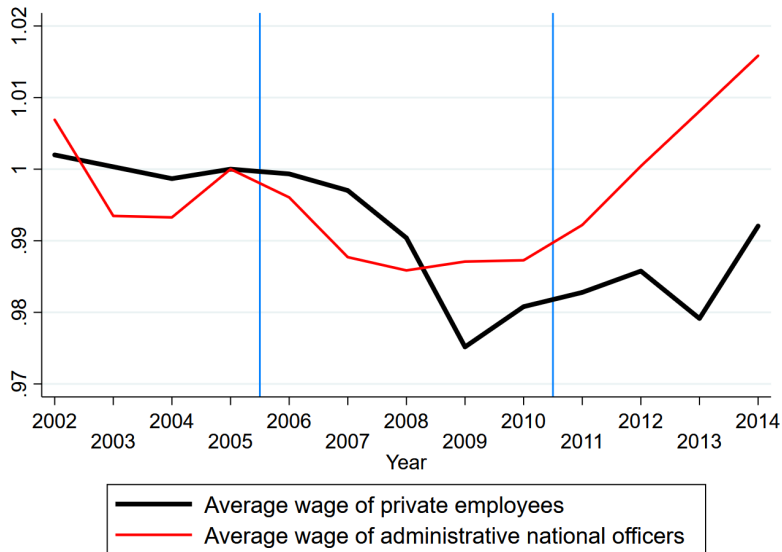
Appendix slides

Turnover rate of local government employees by age

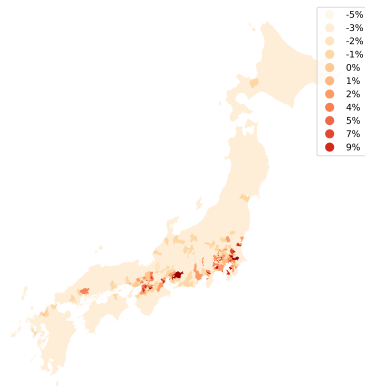


Note: This figure shows the turnover rate of local public-sector workers by age group. The turnover rate is calculated as the number of employees leaving the local government divided by the number of local government employees in each age group. The turnover rate for workers in their 60s is omitted from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

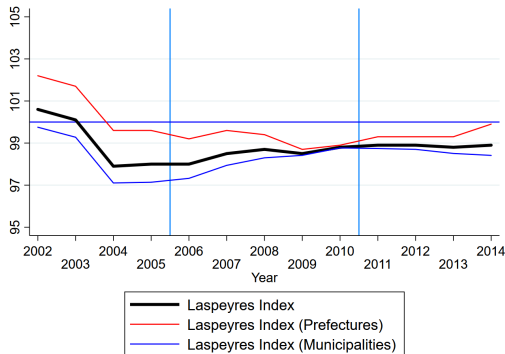
Average wages of the private and the public sectors



Public-sector wage change for (almost) entire Japan



Relative wages of national and local public officials



- Laspeyres index shows the wage level of local public officials in percentages, where it takes 100 when it equals the wage level of the national public officials.
- It conditions on education and tenure.

Result: Sectors with high union coverage rate

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Large company			(b) Small company		
	log(wage rate of private workers)					
Regional allowances $\times$ 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 effect	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
<i>N</i>	2962631	2962631	2882844	2040613	2040613	1936343
<i>R</i> ²	0.320	0.597	0.590	0.325	0.555	0.548

Standard errors clustered at a municipal level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Large firms' wage spillover elasticity $>$ small firms' wage spillover elasticity
- Consistent with downward wage rigidity, measured by labor union coverage, dampens the elasticity
 - Union coverage rate is near zero for small firms, while substantial for large firms

Result: Sectors with low union coverage rate

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) Large company			(b) Small company		
	log(wage rate of private workers)					
Regional allowances $\times$ 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 effect	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual and municipal fiscal characteristics	No	Yes	Yes	No	Yes	Yes
<i>N</i>	2838475	2838475	2731954	4352468	4352468	4117156
<i>R</i> ²	0.307	0.556	0.550	0.259	0.448	0.441

Standard errors clustered at a municipal level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Large firms' wage spillover elasticity $\simeq$ small firms' wage spillover elasticity
- Consistent with the fact that in these sectors, both large and small firms have low union coverage rate.

Wage spillover elasticity without migration

- We analyze the wage spillover elasticity in the absence of changes in the workforce amount in a local labor market (i.e., no migration)
- Differentiating the private-sector labor demand curve, we have

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

- The wage spillover elasticity in our main analysis = "Overall wage spillover elasticity"
- "Indirect wage spillover elasticity" is the product of net migration elasticity and the inverse elasticity of labor demand
 - Calibrated to -0.6, based on Suárez Serrato and Zidar (2023) and Hamermesh (1993)
- Analyzing separately for regions with relatively high and low share of public officials,
 - Regions with relatively many public officials: "Overall elasticity" = 0.35, "Direct elasticity" = 0.45
 - Regions with relatively few public officials: "Overall elasticity" = 0.25, "Direct elasticity" = 0.3

Summary statistics (wage data)

	Areas without the regional allowances (1) -2005	(2) 2006-	Areas receiving the regional allowances (3) -2005	(4) 2006-
Panel A. Regional allowances				
Regional allowances	0.00 (0.00)	0.00 (0.00)	0.04 (0.05)	0.08 (0.05)
Panel B. Individual private workers' characteristics				
Wage of private workers	16.63 (9.66)	16.13 (9.18)	21.11 (12.58)	20.16 (12.38)
gender	0.70 (0.46)	0.68 (0.47)	0.74 (0.44)	0.69 (0.46)
Univ	0.18 (0.38)	0.22 (0.41)	0.35 (0.48)	0.40 (0.49)
Age	40.46 (11.76)	41.22 (12.02)	39.73 (11.65)	40.42 (11.82)
Prescribed working hours	165.66 (20.12)	165.01 (20.16)	161.95 (19.55)	161.72 (20.63)
Percentage of workers aged less than 30	0.23 (0.42)	0.21 (0.40)	0.24 (0.43)	0.22 (0.42)
Percentage of workers in companies with over 100 employees	0.44 (0.50)	0.41 (0.49)	0.28 (0.45)	0.29 (0.45)
Panel C. Municipal characteristics				
Population	1.6e+05 (1.8e+05)	1.7e+05 (1.8e+05)	7.6e+05 (8.5e+05)	7.7e+05 (8.6e+05)
Local tax revenue per capita	120.02 (43.87)	130.04 (46.31)	170.60 (52.70)	175.82 (47.60)
LAT per capita	104.24 (75.25)	113.77 (90.13)	27.71 (26.61)	26.44 (26.46)
NTD per capita	38.27 (21.48)	60.82 (95.46)	45.97 (24.37)	59.78 (26.89)
Number of municipal public workers	1,630.95 (1,676.98)	1,543.32 (1,588.70)	9,214.11 (12615.09)	7,738.99 (10024.84)
Average income of corresponding municipal public workers	3,292.20 (1,104.79)	3,085.97 (1,082.50)	3,373.74 (1,058.83)	3,238.10 (992.56)
N	1798242	4030178	2219901	4113361

Summary statistics (population data)

	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)	0.00 (0.00)	0.02 (0.04)	0.06 (0.05)
Panel B. Demographic characteristics				
Population	36932.27 (60949.07)	35813.29 (60672.33)	2.1e+05 (3.3e+05)	2.1e+05 (3.4e+05)
Population aged 15-29	6,439.55 (11423.97)	5,410.02 (9,779.60)	40638.13 (64970.65)	35151.25 (56893.69)
Population aged 30-64	16958.74 (28776.33)	16490.95 (28785.59)	1.0e+05 (1.7e+05)	1.1e+05 (1.7e+05)
Unemployment rate for 15-29	0.09 (0.04)	0.10 (0.04)	0.09 (0.02)	0.09 (0.02)
Unemployment rate for 30-64	0.04 (0.02)	0.05 (0.02)	0.05 (0.01)	0.05 (0.01)
Panel C. Administrative characteristics				
Local tax revenue per capita	107.38 (66.63)	120.25 (85.19)	144.26 (47.31)	151.14 (43.18)
LAT per capita	230.33 (221.37)	264.15 (263.55)	34.68 (35.07)	34.08 (37.02)
NTD per capita	47.97 (106.16)	75.31 (167.75)	29.17 (16.13)	44.15 (23.17)
Number of municipal public workers	442.39 (613.37)	398.78 (568.93)	2,019.13 (4,047.27)	1,804.60 (3,453.39)
Average income of municipal public workers	3,247.07 (212.19)	3,173.34 (191.96)	3,431.02 (218.37)	3,287.83 (183.57)
N	5464	12294	1460	3285