# Does an expansionary fiscal policy prevent suicide? Evidence from the Great Depression

2023.8.30
Econometric Society European Meeting
Barcelona, Spain

Michihito Ando
Rikkyo University

Masato Furuichi
Teikyo University

This study is supported by JSPS KAKENHI (JP17K03795, JP19K01723, JP20H01508, JP20K01733)

# Research Question

- **Did fiscal expansion mitigate suicide increase during the Great Depression？**

- Expansionary fiscal policy in the early 1930s in Japan
  - Introduced by Korekiyo Takahashi, “Japan’s Keynes”
  - Large-scale economic measures through public works projects
- The goal was to create jobs and overcome the recession
- Did it also achieve suicide reduction?

# Why important?

## 1. Broader impact of a fiscal stimulus?

- Most studies focus on macro-economic outcomes such as GDP
- Long debate on fiscal expansion vs. balanced budget
- Scarce evidence on social outcomes

## 2. An effective tool for suicide prevention?

- Suicide is a serious problem caused by socio-econ suffering（WHO,2014)
- Is a macro-economic fiscal policy an effective tool for suicide prevention?

# Summary of results

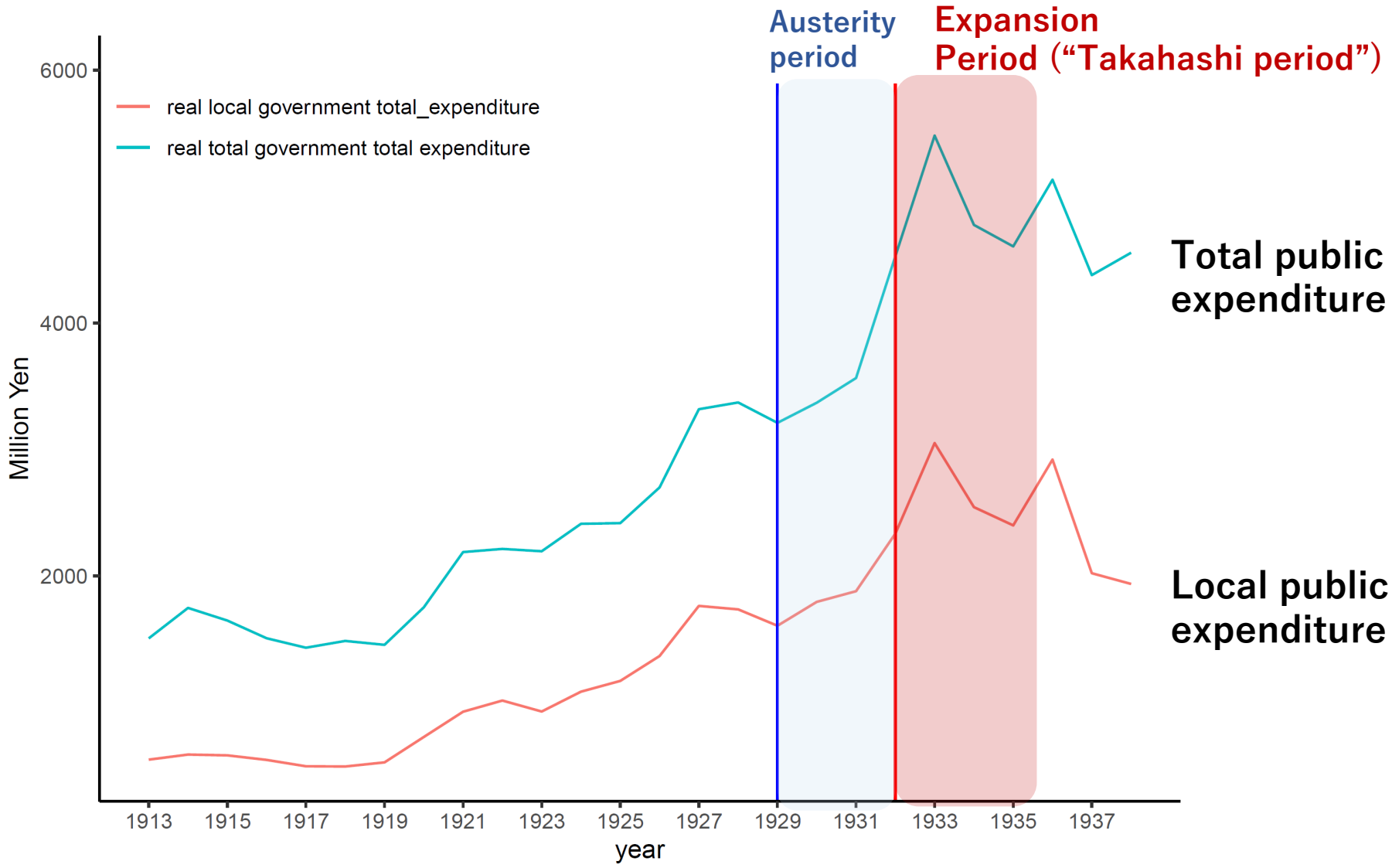
- **Local fiscal expansion in 1930s mitigated suicide increase.**

- **Total suicides** decreased by about **704 persons** on yearly average
  - **4.9% reduction** from 1931 on yearly average

- **Mechanism**: Public investment and job creation in secondary and service industries in relatively urbanized areas may have improved economic conditions of households.

# Background

# Fiscal stimulus in 1932-1935

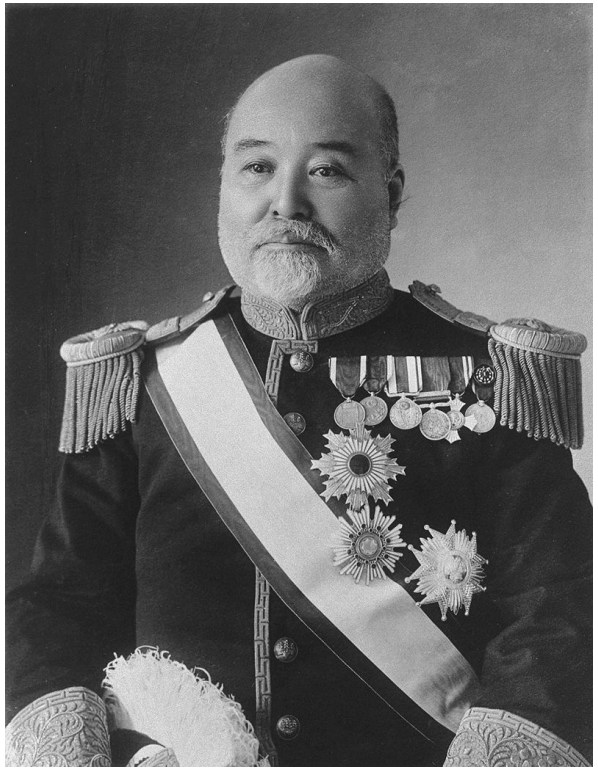



Sources: Expenditure data are taken from Emi et al. (1966)
We use GDP deflator taken from Fukao et al. (2017). Deflator is based on 1934-1936 and 1935 =1

# Fiscal stimulus in 1932-1935, cont.

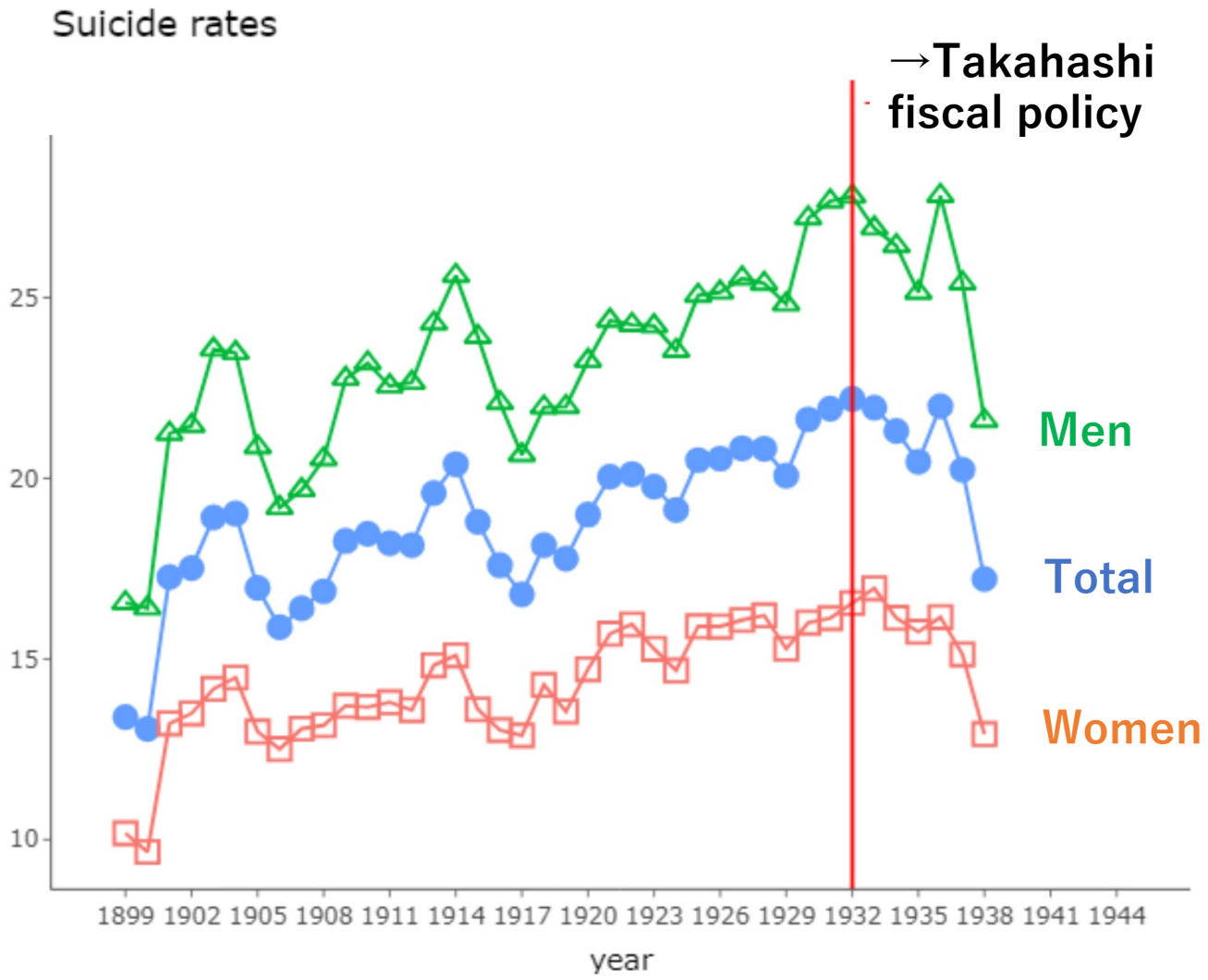
- **So called "*Takahashi Fiscal Policy*"**
- **Mainly public works as employment measures**

- Compared with spendings in 1931,
  - Central spending increase：**45% of spending in 1931**
    - nominal, average of spendings in 1932-1935
  - Local spending increase：**40% of spending in 1931**
    - nominal, average of spendings in 1932-1935



**Takahashi Korekiyo**
https://commons.wikimedia.org/wiki/File:Korekiyo_Takahashi_2.jpg

# Suicide rates in 1899-1938 (per 100,000 people)



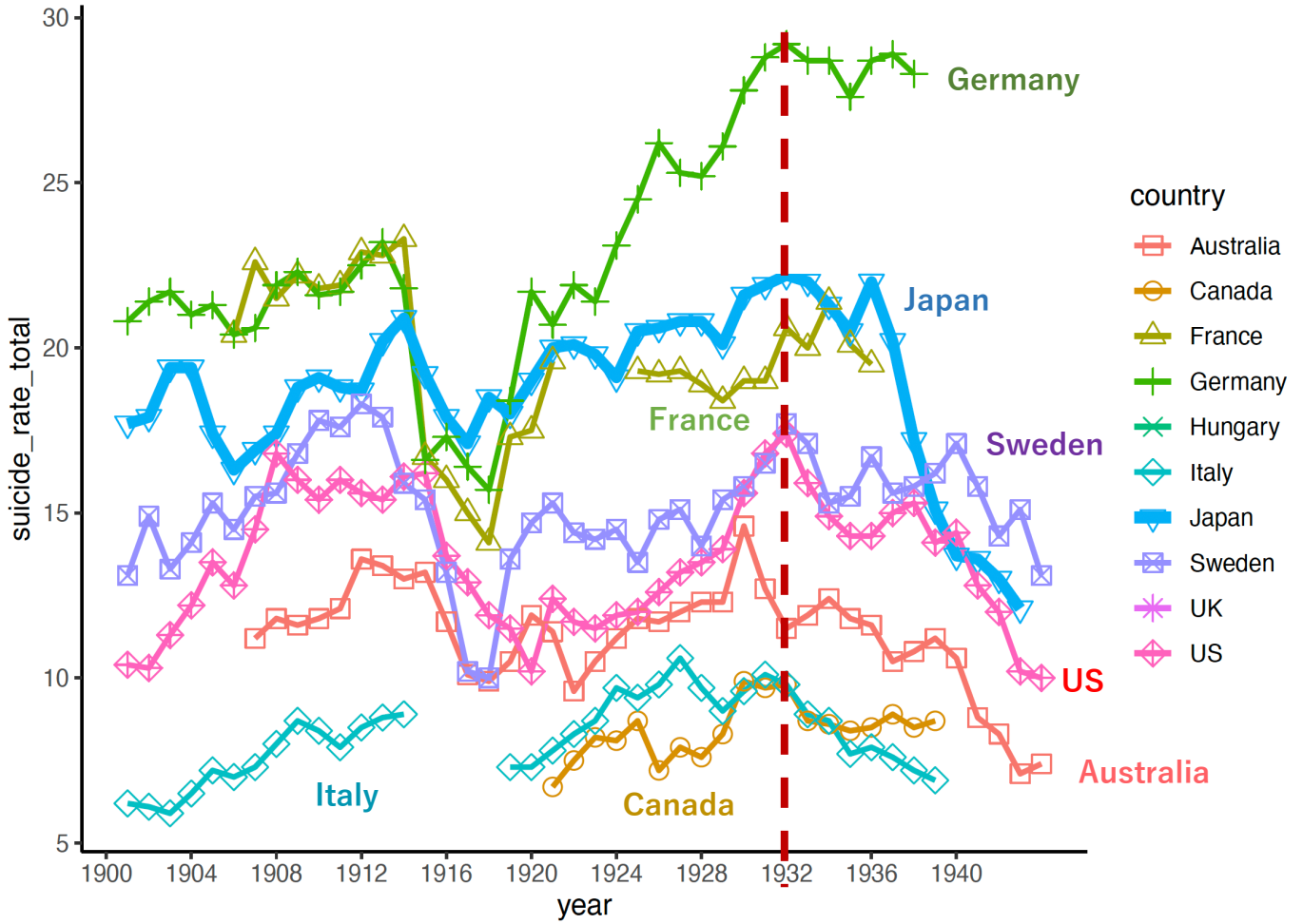

- **1930: rapid increase**
- **1931-32: modest increase**
- **1933-: decrease**

Suicide rates in 2019

- Total：15.7
- Men：22.7
- Women：9.1

（Vital Statistics）

# Suicide rates in 1900-1944 (per 100,000 people), International comparison




Source: Ministry of Welfare, Suicide mortality statistics- Specified Report of Vital Statistics,1999

# Related literature

- **Fiscal expansion in the Great Depression and mortality**
  - Galofre-Vila (2020 *Explor. Econ. Hist.* )：Payment for the elderly in 1935 (US)
  - Galofre-Vila et al.,(2021 *Eur. Rev. Econ. Hist.*) ：Payment for children in 1935 (US)
  - Fishback et al. (2007 *REStat*)：Municipal expenditure in the New Deal (US)
  - **Only Fishback et al.(2017) examine suicide and find suicide reduction by fiscal relief**
- **Economic shocks and suicide**
  - Great Depression： Stuckler et al., 2012 *J. Epidemiol. Community Health*：US
  - Recession： Ruhm, 2000 *Q. J. Econ*
  - Unemployment：Ando and Furuichi 2022 *PLOS ONE*
- **Fiscal expenditures and suicide**
  - Stuckler et al.(2009 *Lancet*) ：Active labor market policy (EU)
  - Matsubayashi et al.(2020 *BMC Public Health*) ：Local public expenditure (Japan)

# Data and research design

# Data

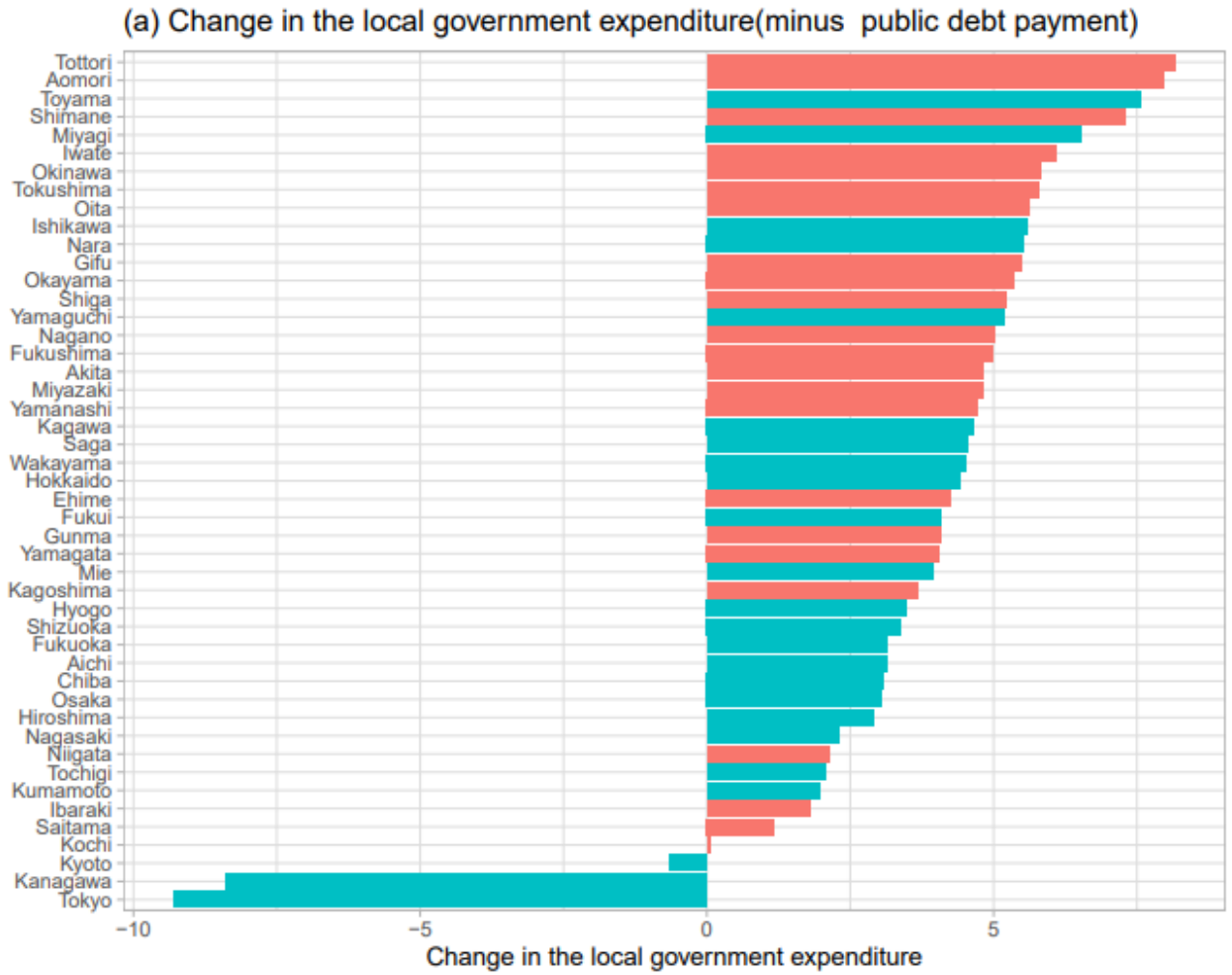
- **Prefecture-level panel data**
  - 47 prefectures (comparable to states in the US and provinces in Canada)
  - Fiscal year 1899-1938. Sample size is 1,880
- **Suicide statistics (1899-1938）**
  - Total, Women, Men
  - Suicide rate＝ (suicides/population） × 100,000
  - Source: Statistics on Causes of Death, Vital statistics
- **Local spending （1928-1935）**
  - Sum of spending in prefectures and municipalities (cities, towns, villages)
  - Source：Statistical report of the Home Ministry
- **Population data**
  - Annual population is estimated by linear interpolation based on Census.

# Treatment variable: Fiscal stimulus in 1932-1935

$$FiscalStimulus_i = \frac{1}{4}\sum_{t=1932}^{1935} X_{it} - \frac{1}{4}\sum_{t=1928}^{1931} X_{it}$$

- $X_{it}$ = **per capita local spending**
  - $i$=prefecture、$t$=year
  - “Debt expenditure” is excluded
- **Expansion-period average – pre-expansion-period average**
- Unit: yen, realized by the GDP deflator

# Treatment variable：
# Fiscal stimulus in 1932-1935



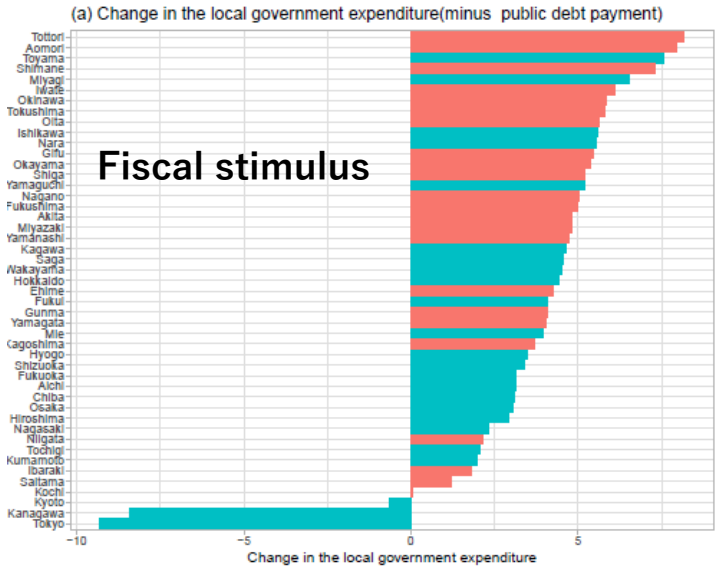

- Average: **3.73** yen
- Highest: **8.17** yen

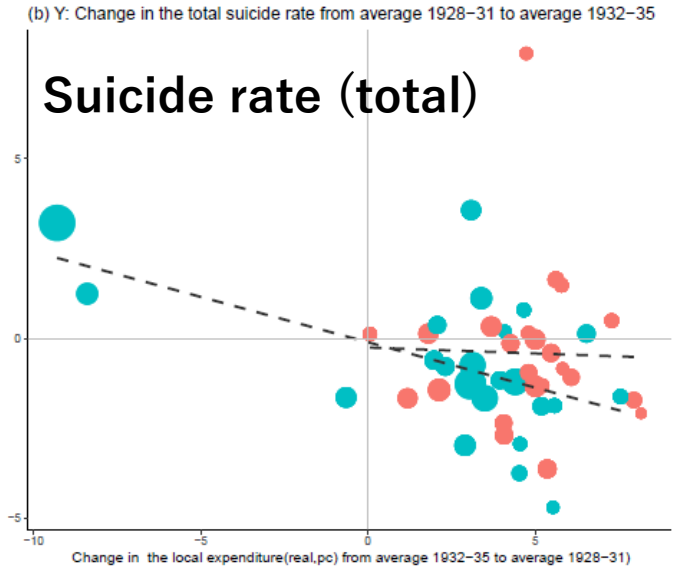
- Per capita GDP is **276** yen in in 1935.

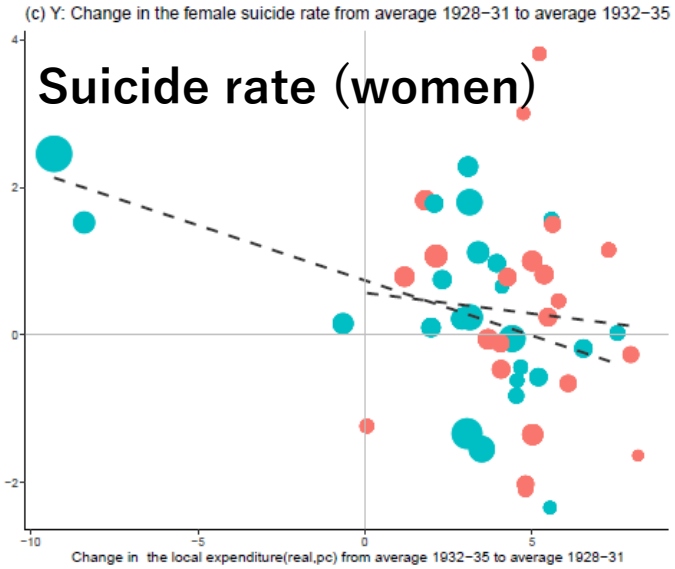
**Red: “More rural”**
(Service-sector ratio is below median in 1930)

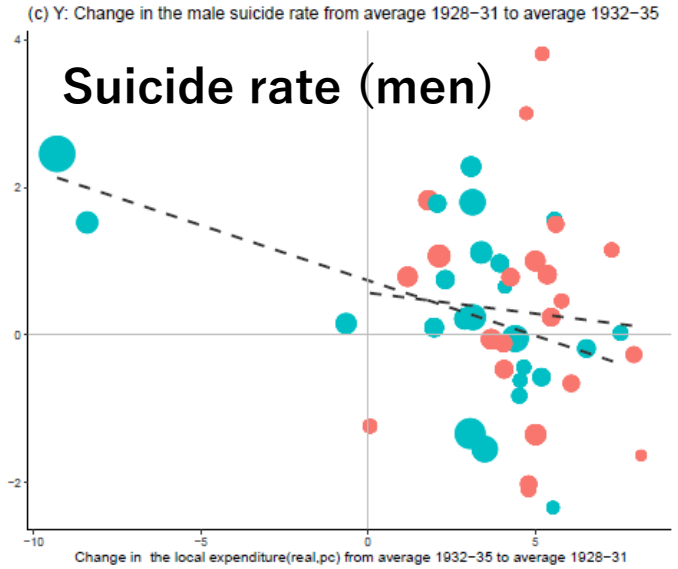
**Green: “More urban”**
(service-sector ratio is above median in 1930)

# Fiscal stimulus(X) and change in suicide rate(Y)




●: population size

**Red: "More rural"**
(Service-sector ratio is below median in 1930)

**Green: "More urban"**
(service-sector ratio is above median in 1930)

# Research design

- **Exploit a regional variation in local fiscal expansion in 1932-1935**
  - Prefecture-level spending variation
    - 47 prefectures are upper-level local governments in Japan
    - Comparable to states in the U.S. and provinces in Canada.
- Eliminate country-level macro effects as fixed effects
  - Monetary policy / exchange rate policy/ military expansion, etc.
- A local fiscal expansion is expected to be uncorrelated with a local suicide trend.
- Event study diff-in-diff with a simultaneous intervention.
- Main outcomes: suicide rates at the prefecture level.

# Model 1: Event-study DID with year-based coeff.

$$Y_{it} = \pi_i + \theta_t + \sum_{\tau \neq 1928} \beta_\tau FiscalStimulus_i \times 1[t = \tau] + \varepsilon_{it},$$

- Event-study DID parameter：$\beta$
- Outcome var. $Y_{i,t}$：suicide rate
- Treatment var. $FiscalStimulus_i$
- $\pi_i$: prefecture fixed effects, $\theta_t$: year fixed effects
- WLS（weighted by prefecture population)
- Pre-determined covariates interacted with year dummies
  - Gross agricultural value added / Direct national tax revenue / Factory production volume / Ratio of textile factory production volume to total factory production volume / Number of military personnel / Ratio of machinery factory production volume to total factory production volume
- Great-depression covariates interacted with year dummies
  - Gross agricultural value added, Direct national tax revenue, and factory production volume. (diff. 1931-1928)

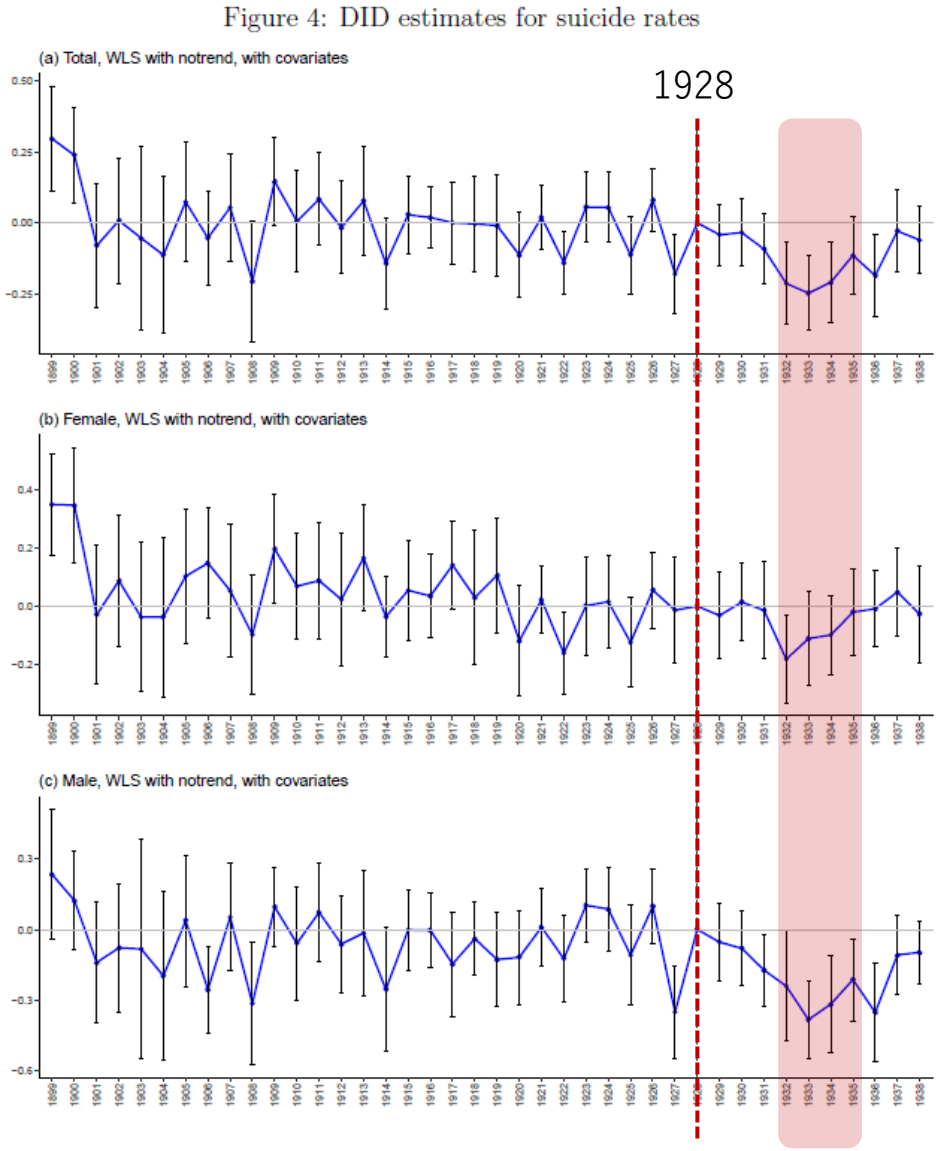
# Model 2: Event-study DID with period-based coeff.

$$
\begin{aligned}
Y_{it} = & \beta_1 FiscalStimulus_i \times Period1900s_t \\
& + \beta_2 FiscalStimulus_i \times Period1910s_t \\
& + \beta_3 FiscalStimulus_i \times Austerity_t \\
& + \beta_4 FiscalStimulus_i \times Expansion_t \\
& + \beta_5 FiscalStimulus_i \times PostExpansion_t \\
& + \pi_i + \theta_t + \varepsilon_{it},
\end{aligned}
$$

- Event-study DID parameter：$\beta$
- Outcome var. $Y_{i,t}$：suicide rate
- Treatment var. $FiscalStimulus_i$
- $\pi_i$: prefecture fixed effects,
- $\theta_t$: year fixed effects
- WLS（weighted by prefecture population)
- Pre-determined covariates interacted with year dummies:
- Great-depression covariates interacted with year dummies:

# Results

# Results with year-based coefficients




- The reference year is **1928**, before the austerity period.
- Expansion period is **1932-1935**

- A negative correlation between X and Y is observed during the fiscal expansion period (1932~).

# Results with period-based coefficients

If the fiscal stimulus increased by ¥1, suicides per 100,000 people decreased by:

- Total: **0.28** persons.
- Female: **0.06** persons
- Male: **0.46** persons

(Actual fiscal stimulus size:

mean ¥3.7, max ¥8.2)

Table 3: DID estimates for suicde rates, with covariates

| | Total | Female | Male |
|---|---|---|---|
| Period 1900s | −0.029 | 0.065 | −0.115 |
| | (0.101) | (0.116) | (0.108) |
| Period 1910s | −0.020 | 0.057 | −0.107 |
| | (0.067) | (0.078) | (0.080) |
| Austerity period(1929-31) | −0.021 | 0.120 | −0.107 |
| | (0.056) | (0.090) | (0.094) |
| Expansion period(1932-35) | −0.278*** | −0.061 | −0.455*** |
| | (0.092) | (0.065) | (0.156) |
| Post expansion period(1936-) | −0.142** | 0.053 | −0.280*** |
| | (0.065) | (0.066) | (0.102) |
| Num.Obs. | 1869 | 1869 | 1869 |
| R2 | 0.911 | 0.870 | 0.873 |
| R2 Adj. | 0.880 | 0.825 | 0.829 |

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

# Effect size:
# back of envelop calculation

By an increase in fiscal expenditures of ¥3.73 per capita during 1932-1935,

- **Total suicide**: decreased by **704** persons per year
  - Average annual decrease of **4.9%** since 1931
- **Female suicides**: decreased by **77** persons per year
  - Average annual decrease of **1.5%** since 1931
- **Male suicides**: decreased by **578** persons per year
  - Average annual decrease of **6.4%** since 1931

- Simplified estimates that do not consider the effect heterogeneity

# Robustness checks

- With linear trend in prefectures
- OLS, not WLS
- Event study DID (reference year =1931)
- Different treatment variables
  - Expenditures of “public investment” and “industry promotion”
  - Total expenditure including “debt expenditure”

→**The baseline findinds are generally maintained.**

- Drop Tokyo and Kanagawa, two austerity-oriented prefectures.

→**Some results become less precise.**

→**Need to examine “Tokyo Metropolitan effects”.**

# Mechanism

# Mechanism: summary

**Subsample analysis**

“More urban” areas experienced larger effects on total and male suicides.

**Relevant outcomes**

- For female suicides, effects are observed only for the non-employed group.
- Effects are not observed in the primary industry (e.g. agriculture).
- Fiscal stimulus increased employment and taxable income
- No clear effect on tenancy disputes
- No clear effect on epidemiological and familial outcomes

**Fiscal expansion in relatively urbanized areas may have improved economic and mental conditions of households.**

# Subgroup analysis

- Split the sample into "**more urban**" and "**more rural**" prefectures.
- Threshold = the median of the service-sector ratio in 1930.

**"More urban" sample**

- **Significant effects in total and male.**
- "Fiscal contraction" in Tokyo and Kanagawa may drive the results.

**"More rural" sample**

- **Significant effect only in male.**
- Effect size is smaller

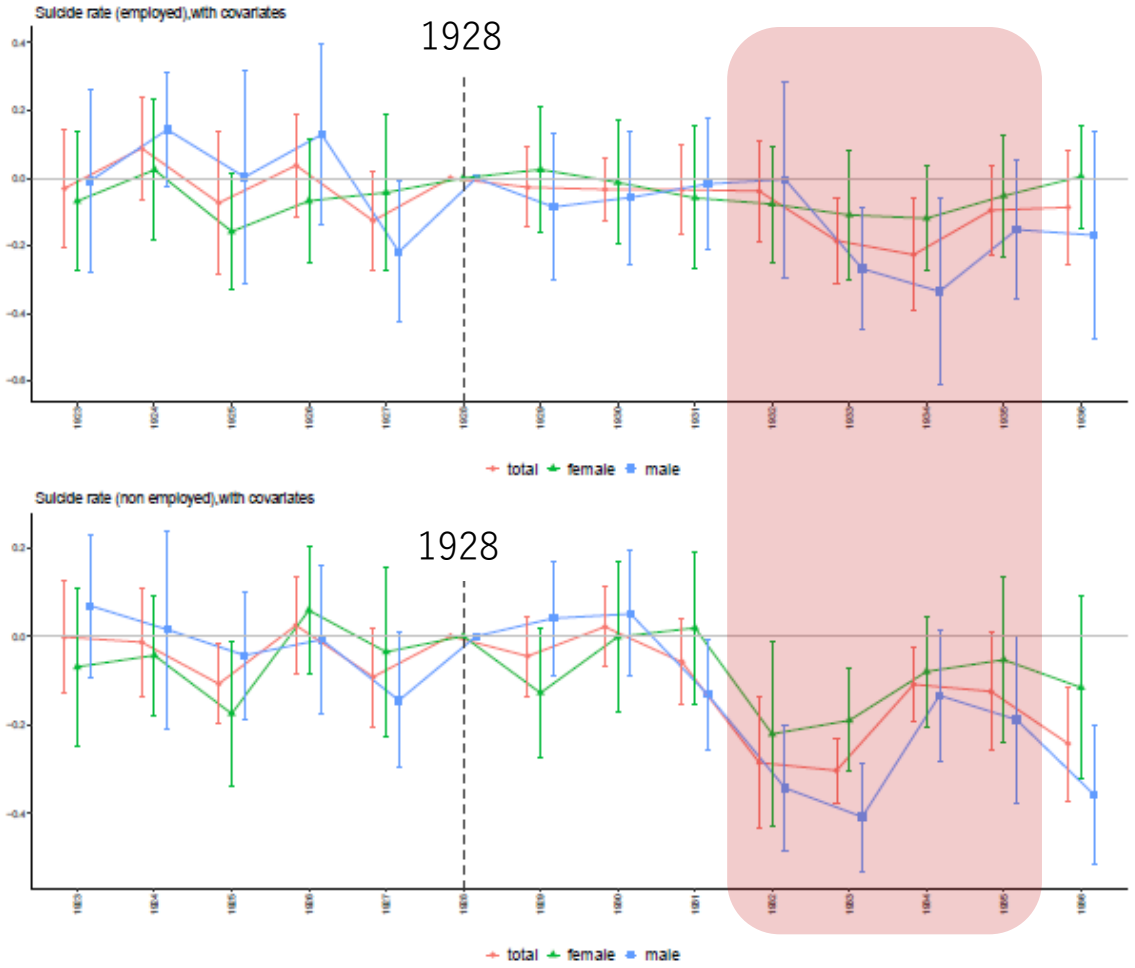
Table 4: DID estimates for suicide rates with covariates, by tertiary industry ratio

| | tertiary industry ratio above median | | | tertiary industry ratio below median | | |
|---|---|---|---|---|---|---|
| | (1)Total | (2)Female | (3)Male | (4)Total | (5)Female | (6)Male |
| Period 1900s | 0.034 | 0.193 | −0.104 | −0.074 | −0.001 | −0.086 |
| | (0.152) | (0.177) | (0.154) | (0.209) | (0.154) | (0.333) |
| Period 1910s | 0.013 | 0.112 | −0.091 | −0.188 | −0.006 | −0.377** |
| | (0.057) | (0.070) | (0.087) | (0.143) | (0.164) | (0.190) |
| Austerity period(1929-31) | −0.045 | 0.150 | −0.200** | −0.086 | −0.032 | −0.029 |
| | (0.064) | (0.101) | (0.088) | (0.167) | (0.222) | (0.254) |
| Expansion period (1932-35) | −0.412*** | −0.120 | −0.666*** | −0.276 | −0.106 | −0.416** |
| | (0.097) | (0.090) | (0.171) | (0.218) | (0.237) | (0.211) |
| Post expansion period(1936-) | −0.228*** | 0.020 | −0.415*** | −0.097 | −0.020 | −0.094 |
| | (0.076) | (0.103) | (0.096) | (0.222) | (0.199) | (0.300) |
| Num.Obs. | 949 | 949 | 949 | 920 | 920 | 920 |
| R2 | 0.931 | 0.896 | 0.902 | 0.945 | 0.920 | 0.916 |
| R2 Adj. | 0.868 | 0.799 | 0.811 | 0.892 | 0.841 | 0.834 |

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

# Suicide rates for the employed (top) and the non-employed (bottom)

Figure 5: DID estimates for employed and non employed suicide rates



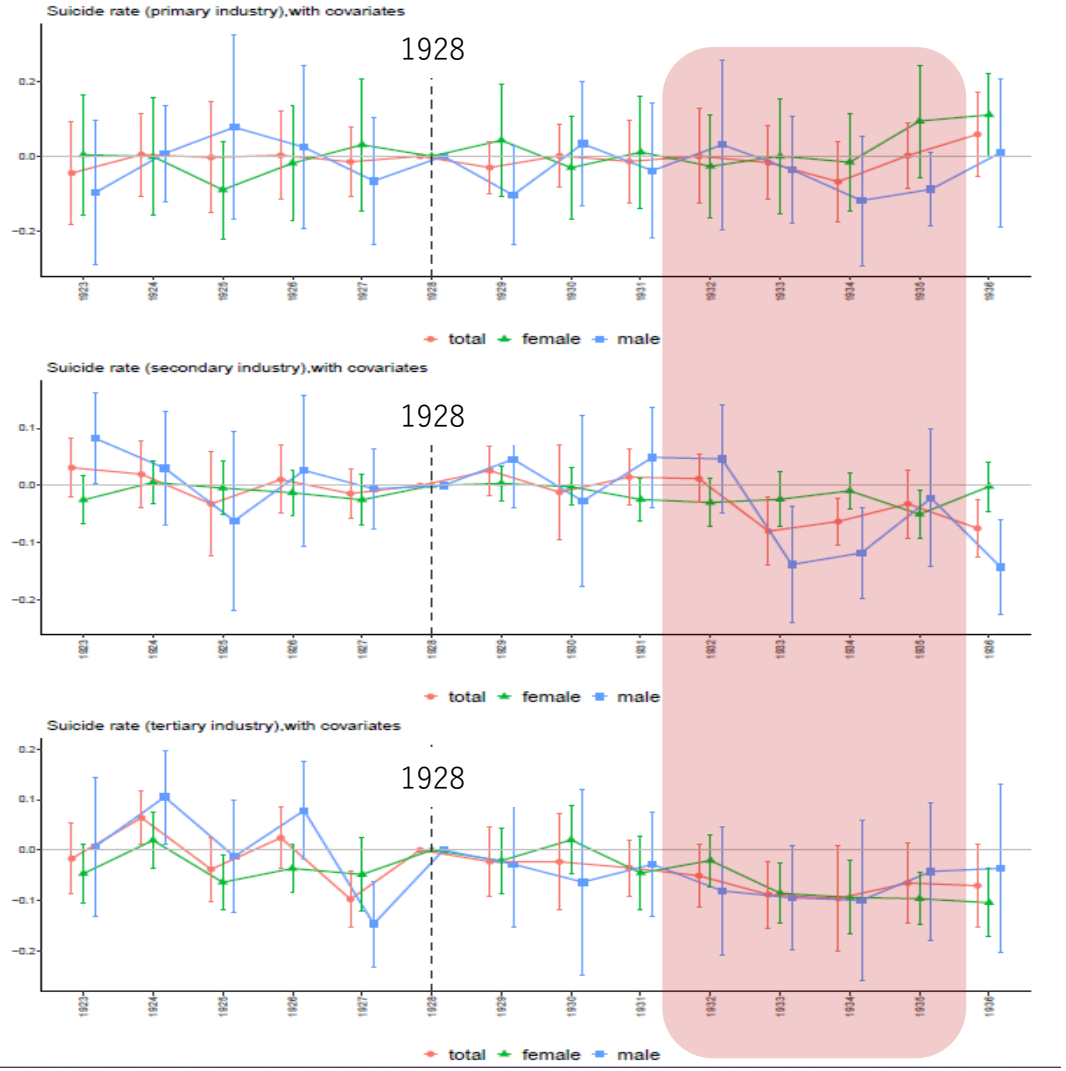

- Total suicides were mitigated regardless of employment status
- **For female suicides, effects are observed only for the non-employed group.**
  - Spill-over effects from improved economic condition of husbands?

Red: total

Green: female

Blue: male

# Suicide rates of employed, by industry (primary, secondary, service)




- Effects are observed in **the secondary and the service industries.**

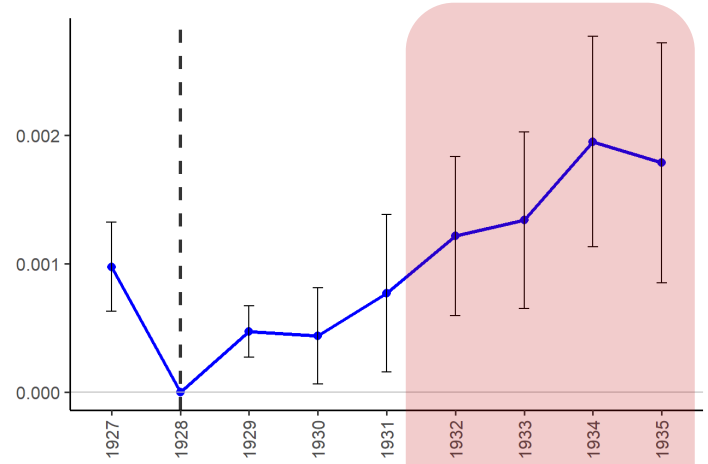
Red: total

Green: female

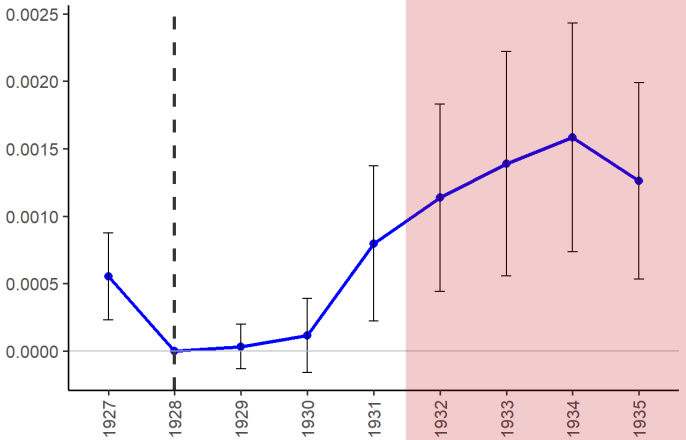
Blue: male

# Employment statistics at employment agencies

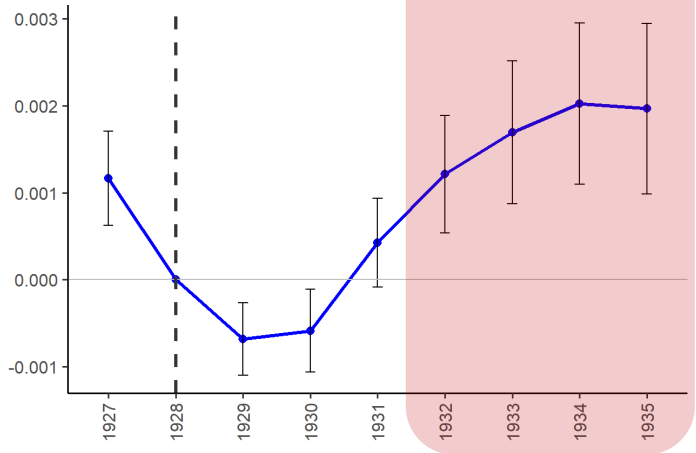
**(Men, divided by 100,000 male population)**




Job opening rate




Job application rate

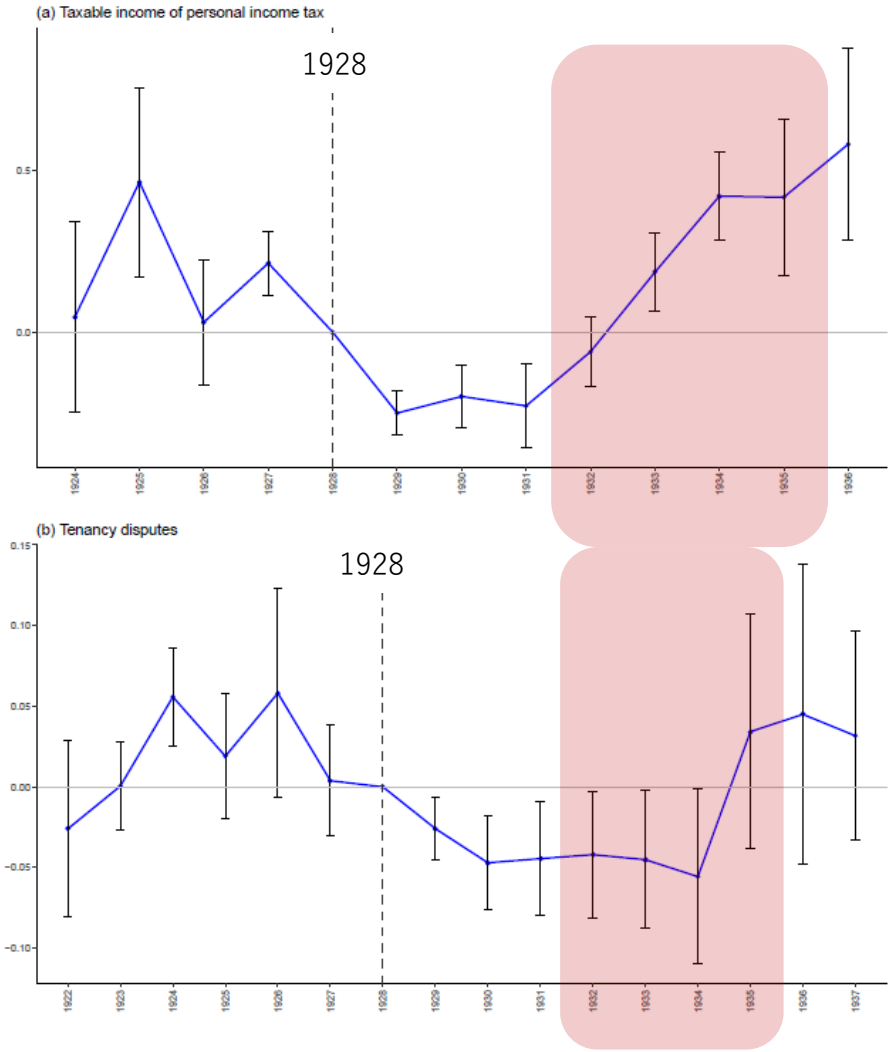



Employment rate

- Positively correlated with the fiscal expansion intensity during the expansionary period.

# Taxable income (top) and number of tenancy disputes (bottom)

Figure 9: DID estimates for taxable income and tenancy disputes




- Fiscal stimulus increased taxable income
- **No clear effect on tenancy disputes**

# Epidemiological outcomes: mortality and infant mortality
# Familial outcomes: marriage, divorce, and fertility

- Overall, ineffective or difficult to interpret results
- Epidemiological and familial outcomes are likely not the primary pathway

Table 11: DID estimates for mortality and family variables, with covariates

| | Total death rate | Infant death rate | Marriage rate | Divorce rate | Birth rate |
|---|---|---|---|---|---|
| Period 1900s | −0.035 | −1.804** | −0.030 | −0.021** | −0.026 |
| | (0.102) | (0.781) | (0.042) | (0.011) | (0.122) |
| Period 1910s | −0.010 | −0.795** | −0.010 | −0.009* | −0.136* |
| | (0.057) | (0.385) | (0.023) | (0.006) | (0.070) |
| Austerity period (1929-31) | 0.096** | 0.336 | 0.008 | −0.003 | −0.011 |
| | (0.042) | (0.325) | (0.013) | (0.003) | (0.035) |
| Expansion period(1932-35) | 0.108** | 0.087 | 0.020 | −0.008** | 0.094** |
| | (0.044) | (0.495) | (0.014) | (0.003) | (0.037) |
| Post Expansion period(1936-) | 0.104* | 0.351 | 0.008 | −0.014*** | −0.001 |
| | (0.062) | (0.532) | (0.029) | (0.004) | (0.059) |
| Num.Obs. | 1869 | 1869 | 1869 | 1869 | 1869 |
| R2 | 0.906 | 0.932 | 0.858 | 0.929 | 0.926 |
| R2 Adj. | 0.874 | 0.908 | 0.809 | 0.904 | 0.901 |

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

# Conclusion

# Conclusion

- **Question**: Did expansionary fiscal policies during the Great Depression reduce the suicide rate?

- **Answer**: **YES**

- **Effect size**:  Suicide reduction by an average of about **4.9%** per year, or about **2,800** fewer suicides nationwide over 4 years.

- **Mechanism**: Public investment and job creation in the secondary and service industries in relatively urbanized areas may have improved economic and mental conditions of households.