A Lost Decade of Fiscal Misallocation

Kosuke Aoki[1] Ippei Fujiwara[1,2] Zhenhe Lin[3]

Zheng (Michael) Song[3] Chendong Wang[3]

[1]University of Tokyo

[2]Keio University

[3]The Chinese University of Hong Kong

Macro Public Finance @ NBER Summer Institute

July 23 2026

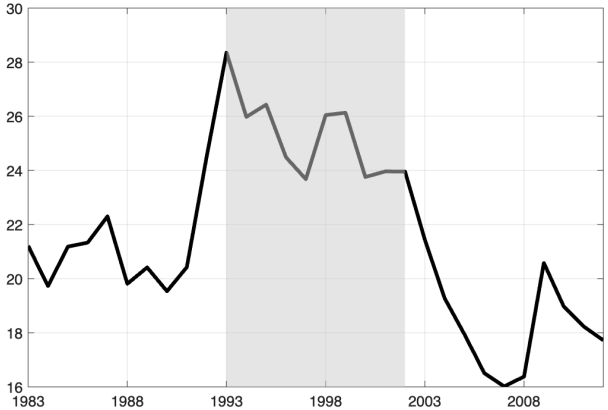
Today's Presentation

- Japan's lost decade
- Decline in interest rates increased government fiscal space
- Increased fiscal space induced spatial misallocation of government investment
  - Data
  - Simple model: why did misallocation happen?
  - Quantitative model and counterfactual simulation: what if the government did not use increased fiscal space?

Facts about Government Sector

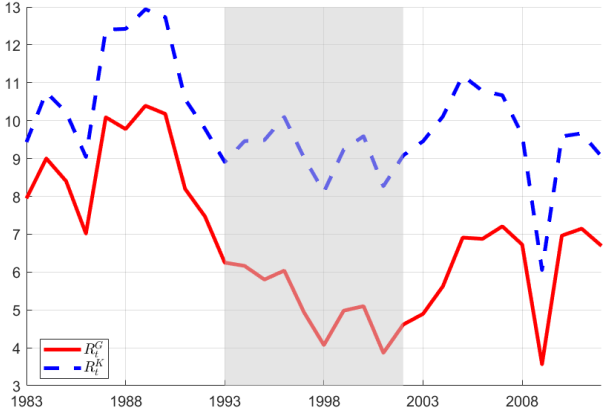
Government Investment

Figure: Government-to-Private Investment Ratios (%)



Misallocation of Government and Private Capital

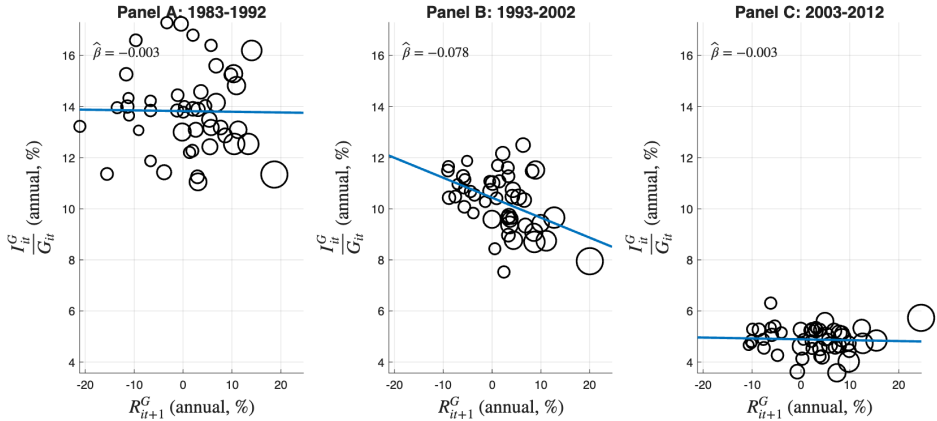
Figure: Aggregate Returns to Government and Private Capital (%)



- Capital Return: $R_t^H \equiv \alpha_H \frac{Y_t}{q_{t-1} H_t} + \frac{q_t}{q_{t-1}} (1 - \delta) - 1$ for $H \in \{G, K\}$ Estimation of α_G

Spatial Misallocation of Government Investment

Figure: $\frac{I^G_{it}}{G_{it}} \sim R^G_{it+1}$



- Capital Return: $R^G_{it} \equiv \frac{\partial Y_t}{q_{t-1}\partial G_{it}} + \frac{q_t}{q_{t-1}}(1-\delta) - 1$, $\frac{\partial Y_t}{\partial G_{it}}$ follows the marginal product formula

Transfers

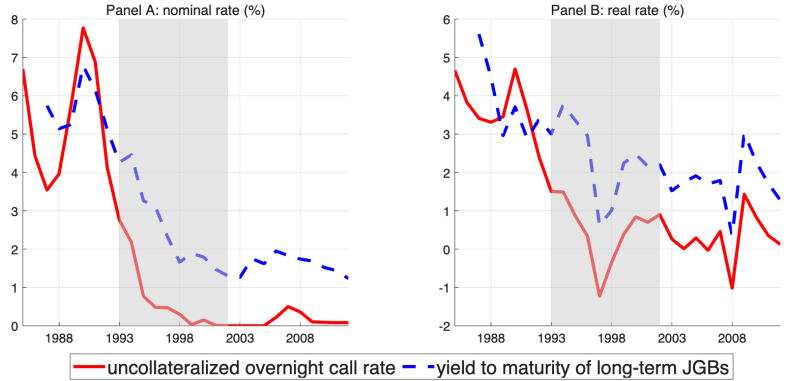
Correlations

Table: $\frac{I^G_{it}}{G_{it}} \sim R^G_{it+1}$

$\frac{I^G_{it}}{G_{it}}$	1983-1992	1993-2002	2003-2012
R^G_{it+1}	-0.003	**-0.078*****	-0.003
	(0.028)	(0.024)	(0.010)
Observations	47	47	47
R^2	0.000	0.190	0.002

Interest Rate Cuts

Figure: Interest Rate



- Real rate = nominal rate - inflation

More Government Borrowing

Figure: Government Debt (% of GDP)

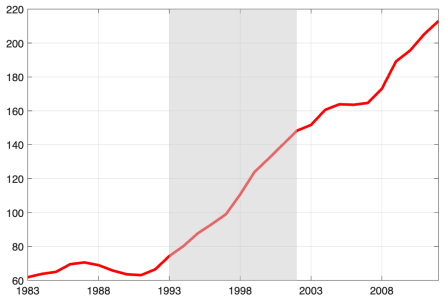
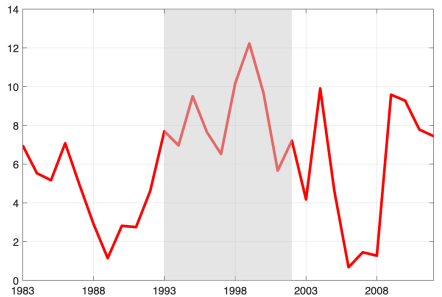


Figure: Government Borrowing (% of GDP)



- Central and local government debt/borrowing (excluding Fiscal Investment and Loan Program (FILP) bonds)

Fiscal Expansion

- Government budget constraint

$$C_t^G + I_t^G + \Phi_t^G = NB_t + B_t - r_t^D D_t$$

  - $B_t \equiv D_{t+1} - D_t$: government borrowing
  - NB_t: government non-borrowing income
  - Φ_t^G: government residual spending (e.g. transfers to social security system)

Table: Nominal Government Budget (% of GDP)

	C_t^G	I_t^G	Φ_t^G	NB_t	B_t	$r_t^D D_t$
1983-1992	9.6	5.7	8.2	23.3	4.2	4.0
1993-2002	10.9	5.9	9.4	21.3	**8.3**	3.5
2003-2012	11.5	3.8	9.0	21.2	5.6	2.4

Expansion of Fiscal Space by Lower Interest Rate

- Flow-to-stock perspective

$$\frac{aD_{t+1}}{Y_t} \leq b$$

- Flow-to-flow perspective

$$\frac{r_{t+1}D_{t+1}}{Y_t} \leq b$$

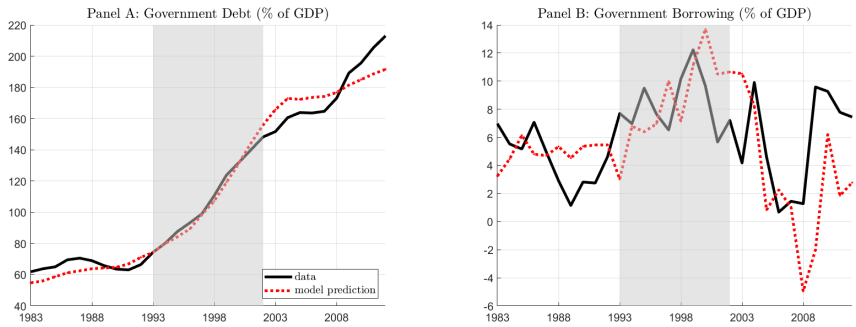
- More generally

$$\frac{(a + r_{t+1})\, D_{t+1}}{Y_t} \leq b$$

Estimation

- Estimating a and b by matching the government debt in the data: $a = 0.014$, $b = 0.048$

Figure: Government Debt and Borrowing



What We Do

- Low interest rate relaxes government borrowing constraint (easy borrowing)
- A simple model to show "fiscal curse of easy borrowing": More resource, more misallocation
- Quantitative results
  - Relaxed government budget largely explains the deterioration in fiscal allocation during the Lost Decade
  - Consuming the extra borrowing revenue: Aggregate TFP increases by 0.43% and welfare by 1.51%

A Simple Politico-Economic Model of Spatial Government Investment

Simple Model

- Two period model
- Exogenous government borrowing limit

Environment

- N regions. Production function for each region i

$$Y_i = A_i G_i^{\alpha}, \quad \alpha \in (0,1)$$

- Regional government capital $\{G_i\}_i$ is allocated in the first period, production takes place in the second period
- The representative household's preferences

$$U^H = u(C_1) + \beta u(C_2)$$

  - u satisfies Inada condition: $\lim_{C \to 0} u' = \infty$, $\lim_{C \to \infty} u' = 0$

- Resource constraint

$$C_1 + \frac{1}{1+r} C_2 + \sum_i G_i = W + \frac{1}{1+r} \sum_i Y_i$$

  - W: exogenous initial wealth
  - r: exogenous interest rate (small open economy)

First-Best Allocation

- Choose $\{C_1, C_2, \{G_i\}_i\}$ to maximize U^H subject to the resource constraint
- FOC w.r.t. G_i yields

$$R_i^G \equiv \frac{\partial Y}{\partial G_i} = 1 + r$$

  - Aggregate TFP, $A \equiv \frac{Y}{G^\alpha}$, is maximized by equalizing R_i^G: $\bar{A} = \left(\sum_i A_i^{\frac{1}{1-\alpha}}\right)^{1-\alpha}$

- FOC w.r.t. C_1 and C_2 yields Euler equation

$$\frac{u'(C_1)}{u'(C_2)} = \beta(1 + r)$$

Political Economy

- Government chooses D and $\{\{G_i\}_i\}$ to maximize:

$$U^G = U^H + \sum_i \kappa_i v(G_i)$$

  - $v' > 0, v'' < 0$
  - $\kappa_i > 0$: local lobbying capacity (e.g., Sato (2002); Ihori (2009))

- Government budget constraints:

$$C_1 + \sum_i G_i = W + D \quad (\text{LM} \equiv \mu_1)$$

$$C_2 = \sum_i Y_i - (1 + r) D \quad (\text{LM} \equiv \mu_2)$$

- Constrained by a maximum debt level $\bar{D}$

$$D \leq \bar{D} \quad (\text{LM} \equiv \lambda)$$

FOCs

- Consumption Euler equation

$$u'(C_1) = \beta(1 + r)u'(C_2) + \lambda$$

  - $\lambda \geq 0$: shadow value of the borrowing constraint

- Government investment

$$u'(C_1) = \beta R_i^G u'(C_2) + \kappa_i v'(G_i)$$

Two Distortions

- Intertemporal distortion (FOC w.r.t. D)

$$\frac{u'(C_1)}{u'(C_2)} = \beta(1+r) + \frac{\lambda}{u'(C_2)}$$

  - C_1 is inefficiently low, so $u'(C_1)$: the shadow value of first-period resources is high

- Intratemporal distortion (FOC w.r.t. G_i)

$$\frac{1 - \frac{\kappa_i v'(G_i)}{u'(C_1)}}{1 - \frac{\lambda}{u'(C_1)}} = \frac{R_i^G}{1+r}$$

  - Aggregate distortion: too much or too little aggregate G
  - Spatial distortion: κ_i not aligned with A_i; R_i^G not equalized

- Note that $u'(C_1) = \mu_1$ (the shadow value of income at time 1)

Intuitions

- No political incentives ($\kappa_i = 0$)

$$\frac{1}{1 - \frac{\lambda}{u'(C_1)}} = \frac{R_i^G}{1 + r}$$

  - Underinvestment due to borrowing constraint

- Borrowing constraint slack ($\lambda = 0$)

$$1 - \frac{\kappa_i v'(G_i)}{u'(C_1)} = \frac{R_i^G}{1 + r} = \frac{\alpha A_i G_i^{\alpha - 1}}{1 + r}$$

  - Overinvestment and Misallocation due to political incentives

Capital Wedge

- The FOCs for consumption and government capital can be rewritten as

$$\left(1 + \underbrace{\frac{\kappa_i v'(G_i)}{u'(C_1)} \frac{(1+r)}{R_i^G} - \frac{\lambda}{u'(C_1)}}_{\text{Capital Wedge}}\right) R_i^G = 1 + r$$

  - 2nd term: local lobbying capacity $\Rightarrow$ overinvestment: $R_i^G < 1 + r$
  - 3rd tern: borrowing constraint $\Rightarrow$ underinvestment: $R_i^G > 1 + r$

"Fiscal Resource Curse"

- FOC w.r.t. G_i

$$1 = \underbrace{\frac{\beta R_i^G u'(C_2)}{u'(C_1)}}_{\text{return motive (efficient)}} + \underbrace{\frac{\kappa_i v'(G_i)}{u'(C_1)}}_{\text{political motive (inefficient)}}$$

- Define $\underline{W}$: lower bound of initial wealth ensuring an interior equilibrium
- As $W \to \underline{W}$, $\{G_i\}_i$ converges to $G_i \propto A_i^{\frac{1}{1-\alpha}}$: efficiency-driven allocation rule
  - $\sum_i Y_i = \sum_i A_i G_i^\alpha > (1+r)\bar{D}$ for feasibility
  - $\lim_{W \to \underline{W}} \kappa_i v'(G_i)/u'(C_1) = 0 \Rightarrow$ efficient allocation
- As $W \to \infty$, $\{G_i\}_i$ converges to $v'(G_i) \propto \frac{1}{\kappa_i}$: politically-driven allocation
  - $\uparrow W \Rightarrow \downarrow u'(C_1) \Rightarrow \uparrow \kappa_i v'(G_i)/u'(C_1)$
  - $\uparrow \kappa_i \Rightarrow \uparrow \kappa_i v'(G_i)/u'(C_1) \Rightarrow \downarrow R_i^G = \alpha A_i G_i^{\alpha-1} \Rightarrow \uparrow G_i$
    - The larger G_i, the lower R_i, so high-κ_i regions receive more G_i until their marginal productivity falls $\Rightarrow$ politically-driven allocation
- *Interpretation: debt service acts as a subsistence level — the allocation is nonhomothetic in fiscal space, and politically driven investment is a luxury good*

Nonhomotheticity

"Fiscal Resource Curse"

- Implications from Proposition 1
  - Assume $W + \bar{D} > G^{FB}$ and $\{\kappa_i\}_i$ is sufficiently large: **Overinvestment** of G relative to the first-best solution G^{FB}
  - **Spatial misallocation**: $\uparrow W \Rightarrow \downarrow u'(C_1)$(shadow price) $\Rightarrow$ allocation tilts from A_i-driven to κ_i-driven $\Rightarrow \uparrow$ dispersion of $R_i^G \Rightarrow \downarrow$ TFP

"Fiscal Curse of Easy Borrowing"

- Assume endogenous debt rule

$$\bar{D} = \frac{bW}{1+r}$$

- $r \in (0, \bar{r})$, sufficiently small W, and sufficiently large $\{\kappa_i\}_i$: Binding borrowing constraint

- Fiscal Curse of Easy Borrowing: Aggregate TFP (A) decreases monotonically with cut of interest rate r

- Implications from Proposition 2

  - **Spatial misallocation**: $\downarrow r \Rightarrow \uparrow W \Rightarrow \downarrow u'(C_1)$(shadow price) $\Rightarrow$ allocation tilts from A_i-driven to κ_i-driven $\Rightarrow \uparrow$ dispersion of $R_i^G \Rightarrow \downarrow$ TFP

  - **Overinvestment**: The gap between G and its first-best level increases as the interest rate r falls

Quantitative Exercise

- To show quantitatively that decline in interest rate caused fiscal misallocation

Sketch of Full-Blown Model

- The central government at period t, facing an exogenous probability of political turnover ($\beta_C = \beta \times p$), allocates C^G_{t+j}, B_{t+j}, and $\{I^G_{i,t+j}\}$ for $j \geq 0$
- Overlapping generations of households choosing region i at birth
- Small open economy with mobile private capital across regions
- Region-specific and time-varying $\kappa_{i,t}$, capital wedge $\tau^K_{i,t}$, and amenity $Z_{i,t}$ calibrated to match $I^G_{i,t}$, $K_{i,t}$ and $L_{i,t}$
- MIT shocks

Household Preference

- Preference for a representative household residing in region i depends on private consumption $c^H_{i,t,t}$, $c^H_{i,t,t+1}$, public consumption $C^G_{i,t}$, $C^G_{i,t+1}$, residential land use $h_{i,t}$ and an region-specific amenity $\bar{Z}_{i,t}$

$$U^H_{i,t} = \log\left(\left(\left(c^H_{i,t,t}\right)^{\gamma}\left(h_{i,t}\right)^{1-\gamma}\right)^{\rho}\left(C^G_{i,t}\right)^{1-\rho}\right) + \beta\log\left(\left(c^H_{i,t,t+1}\right)^{\rho}\left(C^G_{i,t+1}\right)^{1-\rho}\right) + \log\bar{Z}_{i,t}$$

- In equilibrium, $U^H_{i,t}$ is equalized across regions, denoted by $\bar{U}^H_t$

Household Choices

- Young households choose region i and $\left\{c^H_{i,t,t}, c^H_{i,t,t+1}, h_{i,t}, s^H_{i,t}\right\}$, subject to the budget constraint $c^H_{i,t,t} + r^H_{i,t} h_{i,t} + s^H_{i,t} = y^H_{i,t}$ and $c^H_{i,t,t+1} = (1 + r_{t+1})\, s^H_{i,t}$
  - $y^H_{i,t}$: total income
  - $r^H_{i,t}$: residential land rental price
  - r_{t+1} : interest rate
- Passive old individuals

Firms

- Local output by the production of a representative firm

$$Y_{i,t} = A_{i,t} G_{i,t}^{\alpha_G} K_{i,t}^{\alpha_K} L_{i,t}^{\alpha_L}$$

- The firm faces a proportional tax rate τ_t and private capital wedges $\tau_{i,t}^K$

$$\max_{K_{i,t}, L_{i,t}} (1 - \tau_t) Y_{i,t} - \left(1 + \tau_{i,t}^K\right) r_t^K K_{i,t} - w_{i,t} L_{i,t}$$

Spatial Equilibrium

Fiscal Institution

- Central government objective function:

$$U_t^C = \omega^o \bar{U}_{t-1}^H + \sum_{j=0}^{\infty} (\beta_C)^j \left(\bar{U}_{t+j}^H + \sum_{i=1}^{N} \kappa_{i,t+j} \log G_{i,t+j+1} \right)$$

- $\beta_C = \beta p$, $p \in (0,1)$ is the probability of staying in office next period
- $\kappa_{i,t}$: Institutional parameter for local governor's lobbying capacity
- Innocuous spatial allocation of government consumption (e.g., $C_{i,t}^G = \psi_i C_t^G$)

Persistency of ψ_i

- $\omega^o = \frac{\beta}{\beta_C}$: time-consistent preference

Effects of $G_{i,t}$

Budget

- Central government budget constraint

$$C_t^G + \sum_{i=1}^{N} q_t^G I_{i,t}^G + T_t + \Phi_t = \tau_t Y_t + D_{t+1} - (1 + r_t^D) D_t$$

  - Debt follows fiscal rule

$$\frac{(a_t + r_{t+1})\, D_{t+1}}{Y_t} = b$$

- $T_t = \sum_i \psi_t^T w_{i,t} L_{i,t}$: transfer or tax
- Φ_t: Residual component
- The central planner chooses $\{C_{t+j}^G\}_{j=0}^{\infty}$, $\{G_{i,t+j+1}\}_{i=1,j=0}^{N,\infty}$, and $\{D_{t+j+1}\}_{j=0}^{\infty}$ to maximize U_t^C, subject to the budget constraint and the fiscal rule above

Expectation

- Variables for $t > 2$ ($t = 1$ for Lost Decade)
  - $A_{i,t} = \hat{A}_{i,t} A_t$, where A_t grows at the constant rate g_A for $t > 2$
  - $X_t = X_2$ for the other time-varying parameters with $t > 2$
- Expectations
  - Perfect foresight for aggregate TFP growth
  - MIT-shock on interest rates and other variables

$$\mathbb{E}_t \left[X_{t+j} \right] = X_t, \quad \forall j \geq 1$$

Expected Interest Rate

- Expected real interest rate: $\forall j \geq 1$

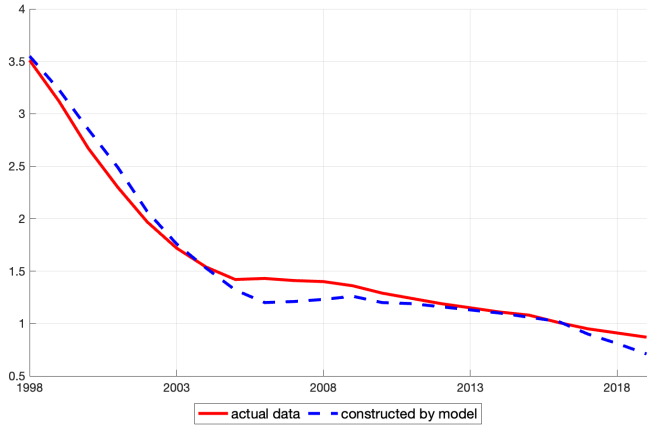
$$\mathbb{E}_t[r^D_{t+j}] = \mathbb{E}_t[i^D_{t+j} - \pi_{t+j}]$$

Table: Expected Interest Rates (%)

	$t = 1$ (93-02)	$t = 2$ (03-12)	$t = 3$ (13-22)
r_t	0.96	0.26	-0.70
$\mathbb{E}_0[r_t]$	-0.66	-0.66	-0.66
$\mathbb{E}_1[r_t]$	-	-0.04	-0.04
$\mathbb{E}_2[r_t]$	-	-	0.13
i^D_t	3.71	1.40	0.95
$\mathbb{E}_0[i^D_t]$	5.03	4.60	4.60
$\mathbb{E}_1[i^D_t]$	-	1.12	0.85
$\mathbb{E}_2[i^D_t]$	-	-	0.96
r^D_t	3.53	1.53	0.94
$\mathbb{E}_0[r^D_t]$	3.24	2.80	2.80
$\mathbb{E}_1[r^D_t]$	-	0.95	0.67
$\mathbb{E}_2[r^D_t]$	-	-	1.09

Forecasts Using Bond Issuance Data

Figure: Nominal borrowing rate



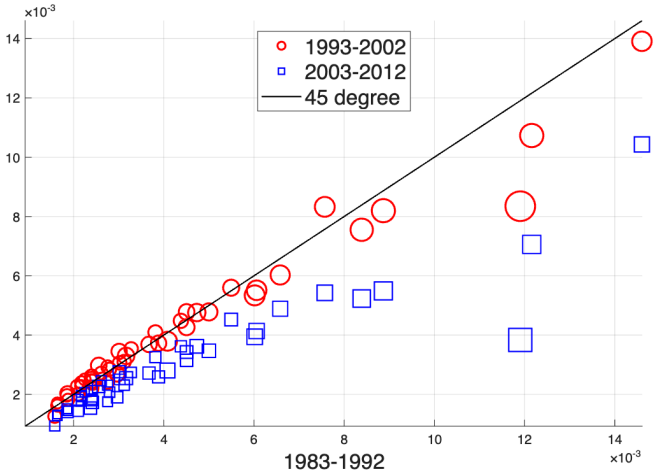
Internal Calibration

- The remaining parameters are internally calibrated to match the observed data
  - $\{\kappa_{i,t}\}_{i=1}^{N}$ to match $\{G_{i,t+1}\}_{i=1}^{N}$
  - Φ_t to match C_t^G
  - T_t to match C_t^H
  - a_t to match D_{t+1}
  - $\{\tau_{i,t}^K\}_i$ from firms' FOC to match $\{K_{i,t}\}_i$
  - $\{Z_{i,t}\}_i$ from spatial equilibrium to match $\{L_{i,t}\}_i$

Calibration 1 Calibration 2

Prefecture-level κ_{it}

Figure: Prefecture-level $\kappa_{i,t}$

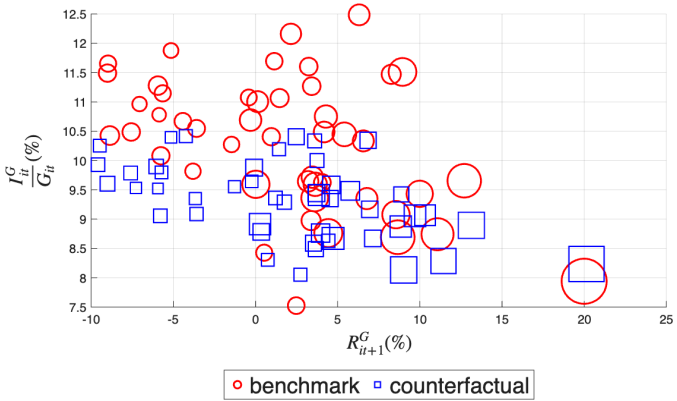


Counterfactual: Lobby Incentives

- Set the local lobby capacity parameter in the lost decade to the average of pre- and post-Lost Decade levels: $\kappa_{i,1} = \frac{1}{2}(\kappa_{i,0} + \kappa_{i,2})$

Counterfactual: Lobby Incentives

Figure: $\kappa_{i,1} = \frac{\kappa_{i,0}+\kappa_{i,2}}{2}$



- Does not mitigate misallocation significantly

Counterfactual: Transferring "Fiscal Windfalls"

- Government commits to using "windfalls" perceived during 1993-2002 ($\mathbb{E}_1[\text{Windfall}_{1+j}], j \geq 0$) for consumption, while keeping the shadow price of the fiscal budget intact for government investment
- Government revenue, $\forall j \geq 0$

$$\mathbb{E}_t\left[\text{Windfall}_{t+j}\right] = \Delta\mathbb{E}_t\left[NB_{t+j}\right] + \Delta\mathbb{E}_t\left[B_{t+j}\right] - \Delta\mathbb{E}_t[r^D_{t+j}D_{t+j}]$$

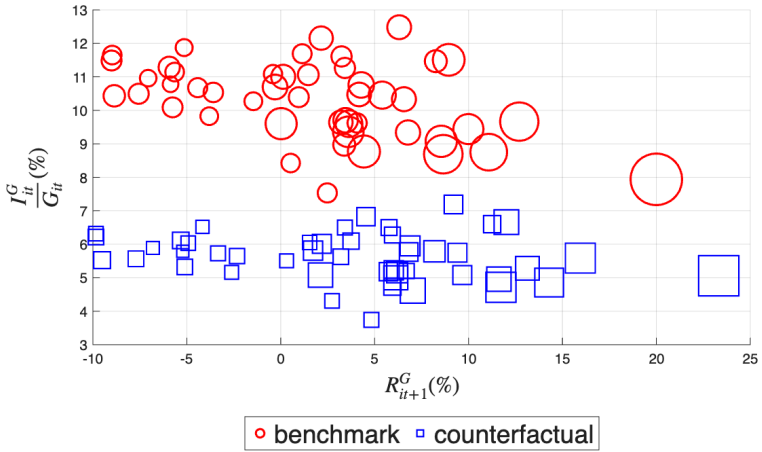
where $NB_t \equiv \tau_t Y_t - \Phi_t - T_t$

Table: Government revenue perceived at 1993-2002 ($t = 1$, in percent of GDP)

	$t+j=1$ (93-02)	$t+j=2$ (03-12)	$t+j=3$ (13-17)	steady state
$\Delta\mathbb{E}_1[NB_{t+j}]$	-0.59	-0.11	-0.26	-0.49
$\Delta\mathbb{E}_1[B_{t+j}]$	7.22	1.92	0.44	0.79
$\Delta\mathbb{E}_1[-r^D_{t+j}D_{t+j}]$	-0.27	0.91	1.10	1.13
$\mathbb{E}_1[\text{Windfall}_{t+j}]$	6.36	2.72	1.28	1.44

Counterfactual: Transferring “Fiscal Windfalls”

Figure: Transferring “Fiscal Windfalls”



Counterfactual: R and Welfare

Table: $\frac{I^G_{i,t}}{G_{i,t}} \sim R^G_{i,t+1}$ at 1993-2002

$\frac{I^G_{i,t}}{G_{i,t}}$	Benchmark	Counterfactuals			
		transfers	$\kappa_{i,t} = \kappa_i$	$\tau^K_{i,t} = \tau^K_i$	$Z_{i,t} = Z_i$
$R^G_{i,t+1}$	-0.078***	-0.020	-0.051***	-0.113***	-0.086***
	(0.024)	(0.014)	(0.013)	(0.040)	(0.025)
Obs.	47	47	47	47	47
R^2	0.190	0.044	0.258	0.152	0.203

Table: Aggregate TFP, output and welfare changes

	Counterfactuals			
	transfers	$\kappa_{i,t} = \kappa_i$	$\tau^K_{i,t} = \tau^K_i$	$Z_{i,t} = Z_i$
Aggregate TFP change at 2003-2012 (%)	0.43	0.34	-0.59	-0.10
Aggregate output change at 2003-2012 (%)	-3.99	-0.93	0.10	-0.24
Household income change in 1993-2002 (%)	10.11	0	-0.92	-0.40
Welfare change (φ, %)	1.51	-0.08	-0.02	-0.16

- Welfare consequences of misallocating fiscal windfall
  - Aggregate TFP loss
  - Distorting government and private consumption
  - Subsidizing future generations by more government investments

Conclusion

- Low-interest-induced misallocation as an understudied channel
  - Complementary to the literature on low interest rate and stagnation (zombie lending, Caballero, Hoshi, and Kashyap (2008); overvalued (intangible) assets, Kiyotaki and Zhang (2021); misallocation via financial frictions, Asriyan et al. (2025))
  - Potential fiscal misallocation and welfare losses by debt swap and low interest rate

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Appendix

Estimating α_G

- Calibrate α_K and α_L by matching income shares of K and L, then obtain Solow residuals:

$$\text{Solow Residual}_{i,t} = \log Y_{i,t} - \alpha_K \log K_{i,t} - \alpha_L \log L_{i,t}$$

- Allowing for measurement errors

$$\text{Solow Residual}_{i,t} = \alpha_G \log G_{i,t} + \log A_{i,t} + \varepsilon_{i,t}$$

- Estimate α_G using the proxy-variable framework inspired by Olley and Pakes (1996), Ackerberg, Caves, and Frazer (2015)

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Why Is Political Allocation a Luxury Good?

- Without debt ($\bar{D} = 0$): model is scale-invariant — shares independent of W(log + Cobb–Douglas). Scarcity alone disciplines nothing
- $(1 + r)\,\bar{D}$: an inelastic obligation payable only from output $\Rightarrow$ subsistence level inside the constraint
- Hierarchy of claims: debt (hard, floors G) $\succ$ consumption (residual, $u'(C) \to \infty$) $\succ$ politics (soft, $v(G_i)$ bounded)
- Stone–Geary structure: debt service works like a subsistence level — resources first meet the obligation, and only the surplus is allocated by preferences $\Rightarrow$ political investment is the luxury good
- Unlike textbook Stone–Geary, the committed bundle is endogenous: it solves a cost-minimization problem — produce $(1 + r)\,\bar{D}$ with minimal resources — hence its composition is efficient

$$\sum_i A_i G_i^{\alpha} \geq (1 + r)\,\bar{D}$$

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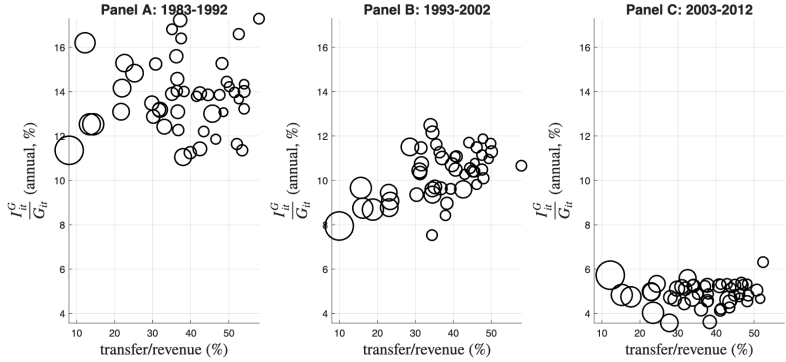
Central Government Transfers

- Calculate the share of central government transfers in total local government revenue; positively correlated with $I^G_{i,t}/G_{i,t}$ in the Lost Decade

Figure: $\frac{I^G_{it}}{G_{it}} \sim \frac{\text{Transfer}_{it}}{\text{Revenue}_{it}}$



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Spatial Equilibrium

- Equalized $U^H_{i,t}$ implies

$$y^H_{i,t} \propto \left(\bar{Z}_{i,t} \left(C^G_{i,t} \left(C^G_{i,t+1} \right)^{\beta} \right)^{(1-\rho)} \right)^{-\frac{1}{\rho(\beta+\gamma)}} \left(\frac{\bar{H}_{i,t}}{L_{i,t}} \right)^{-\frac{1-\gamma}{\beta+\gamma}}$$

- Combine with labor demand condition from firm FOC, equilibrium labor allocation follows:

$$L_{i,t} \propto \left(\left(Z_{i,t} \right)^{\frac{1}{\rho(\beta+\gamma)}} \left(\frac{A_{i,t}}{\left(1 + \tau^K_{i,t} \right)^{\alpha_K}} \right)^{\frac{1}{1-\alpha_K}} \right)^{\frac{(1-\alpha_K)\eta}{\alpha_G}} \left(C^G_{i,t} \left(C^G_{i,t+1} \right)^{\beta} \right)^{\frac{(1-\rho)(1-\alpha_K)\eta}{\rho(\beta+\gamma)\alpha_G}} \left(G_{i,t} \right)^{\eta}$$

where $Z_{i,t} \equiv \bar{Z}_{i,t} \left(\bar{H}_{i,t} \right)^{\rho(1-\gamma)}$ and $\eta \equiv \frac{\alpha_G}{1-\alpha_K-\alpha_L+\frac{1-\gamma}{\beta+\gamma}(1-\alpha_K)}$

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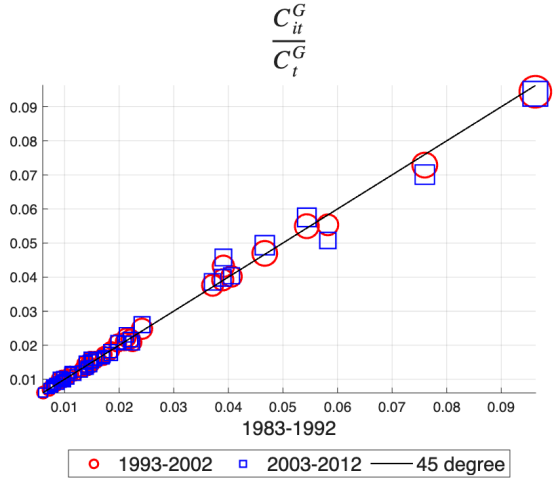
Persistent Government Consumption Allocation



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Effects of G_{it}

- Exogenous $L_t \equiv \sum_i L_{it}$
- Marginal product of G_{it} at the aggregate level is

$$\frac{\partial Y_t}{\partial G_{i,t}} = \frac{\alpha_G}{1-\alpha_K-\alpha_L}\frac{Y_{i,t}}{G_{i,t}} - \underbrace{\left(\frac{(1-\gamma)\,\alpha_L\eta}{(\beta+\gamma)\,(1-\alpha_K-\alpha_L)}\frac{Y_{i,t}}{G_{i,t}} + \frac{\alpha_L\eta}{1-\alpha_K}\frac{L_{i,t}}{L_t}\frac{Y_t}{G_{i,t}}\right)}_{\text{GE effect}}$$

- Marginal effect of G_{it} on $\bar{U}_t^H$

$$\frac{\partial \bar{U}_t^H}{\partial G_{i,t}} = \rho\,(1+\beta)\,\frac{(1-\tau_t)\,(1-\alpha_K)}{Y_t^H}\frac{\partial Y_t}{\partial G_{i,t}} - \rho\,(1+\beta)\,\eta\left(\frac{y_{i,t}^H L_{i,t}}{Y_t^H} - \frac{L_{i,t}}{L_t}\right)\frac{1}{G_{i,t}}$$

  - 1st term: through aggregate output; 2nd term: through labor reallocation

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External Calibration: Time-Invariant Parameters

Table: Externally Calibrated Time-Invariant Parameters

Parameters	Value	Target
α_K	0.406	private capital share
α_G	0.072	Olley and Pakes (1996), Ackerberg, Caves, and Frazer (2015)
α_L	0.559	labor share
γ	0.628	share of land in private consumption = 21.7%
annualized δ	0.089	capital depreciate rate in Hayashi and Prescott (2002)
annualized β	0.980	
annualized β_C	0.800	13% probability of staying in office in a full decade
ρ	0.965	government to household consumption ratio in 1983-1992
annualized g_A	0.005	0.5% annual TFP growth
b	0.048	fiscal rule estimation using annual data

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External Calibration: Time-Varying Parameters

Table: Externally Calibrated Time-Varying Parameters

Parameters	$t = 0$ (83-92)	$t = 1$ (93-02)	$t = 2$ (03-12)	Target
q_t	1.41	1.41	1.45	relative price of fixed capital formation
τ_t (%)	23.26	21.26	21.17	total government revenue to GDP ratio
r_t^K(annualized, %)	6.91	4.44	3.45	rental rate of private capital

Table: Calibration of Regional Parameters

Parameters	Target
$A_{i,t}$	$\log A_{i,t} = \log Y_{i,t} - \alpha_G \log G_{i,t} - \alpha_K \log K_{i,t} - \alpha_L \log L_{i,t}$
$\tau_{i,t}^K$	$1 + \tau_{i,t}^K \propto \frac{Y_{i,t}}{K_{i,t}}$, $\sum_{i=1}^N \tau_{i,t}^K K_{i,t} = 0$
$Z_{i,t}$	labor allocation condition

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