A Lost Decade of Fiscal Misallocation

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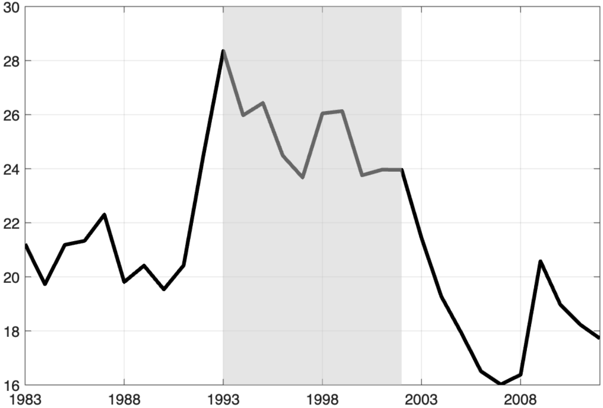
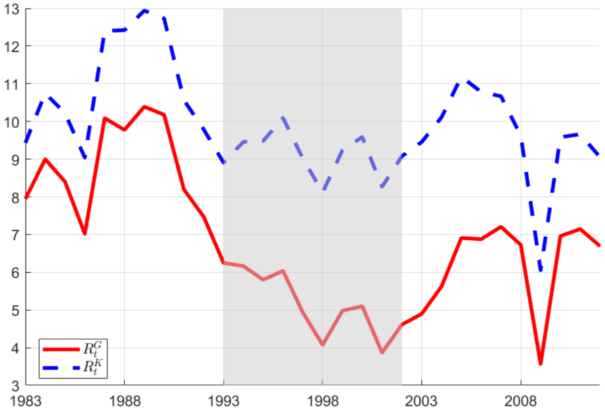
Government Investment

Figure 1: Government-to-Private Investment Ratios (%)



Misallocation of Government and Private Capital

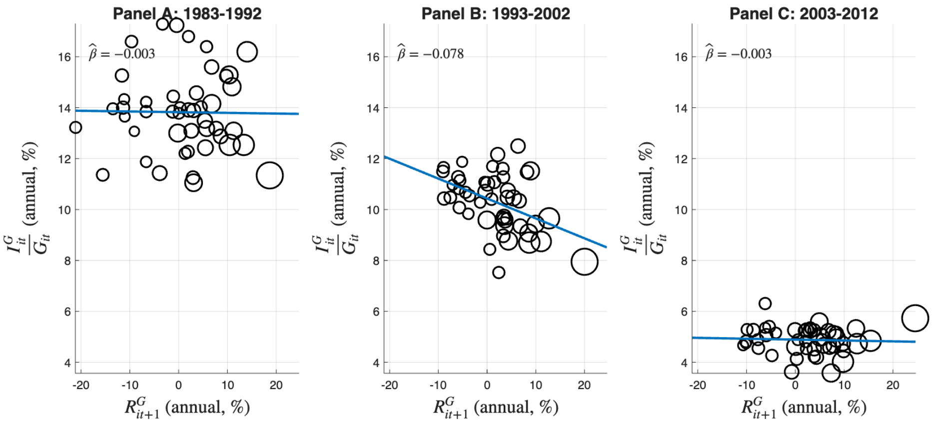
Figure 2: Aggregate Returns to Government and Private Capital (%)



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

Spatial Misallocation of Government Investment

Figure 3: $\frac{I^G_{it}}{G_{it}} \sim R^G_{it+1}$



- 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 equation (21)

Correlations

Table 1: $\frac{I_{it}^G}{G_{it}} \sim R_{it+1}^G$

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

Central Government Transfers

Table 2: $\frac{I^G_{it}}{G_{it}} \sim \frac{\text{Transfer}_{it}}{\text{Revenue}_{it}}$

$\frac{I^G_{it}}{G_{it}}$	1983-1992	1993-2002	2003-2012
$\frac{\text{Transfer}_{it}}{\text{Revenue}_{it}}$	0.009	**0.056***	0.004
	(0.019)	(0.014)	(0.008)
Observations	47	47	47
R^2	0.004	0.255	0.007

More Government Borrowing

Figure 4: Government Debt (% of GDP)

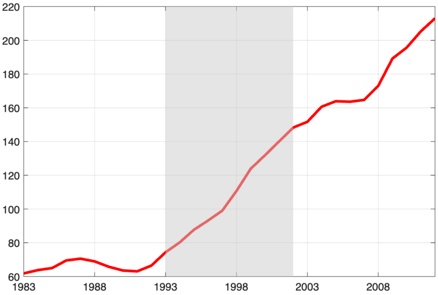
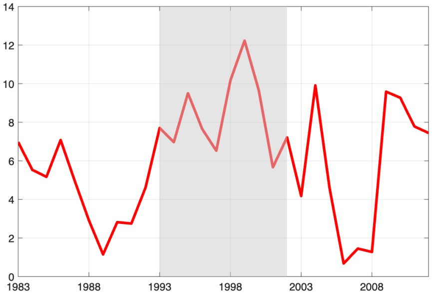


Figure 5: Government Borrowing (% of GDP)



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

Fiscal Expansion

- Government budget constraint

$$C_t^G + I_t^G + \Phi_t^G = NB_t + B_t - r_t^D D_t. \quad (1)$$

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

Table 3: Nominal Government Budget (% of GDP)

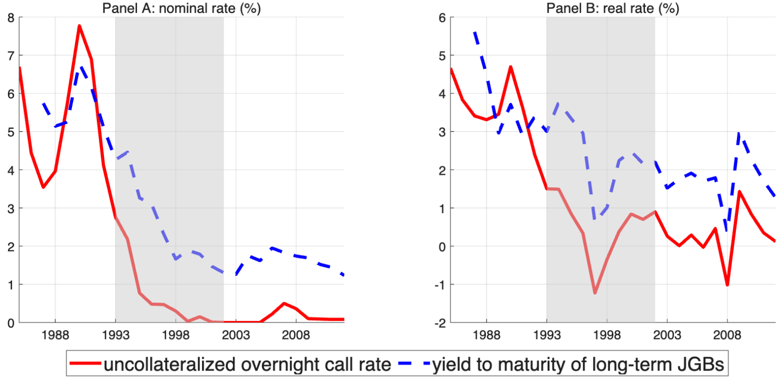
	C_t^G	I_t^G	Φ_t^G	NB_t	B_t	$r_t^D D_t$
1983-1992	9.6	5.7	8.2	23.3	4.2	4.0
1993-2002	10.9	5.9	9.4	21.3	8.3	3.5
2003-2012	11.5	3.8	9.0	21.2	5.6	2.4

In this paper

- A simple model to show "fiscal curse of easy borrowing": Expansion of fiscal space $\Rightarrow$ 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 0.31% during the Lost Decade.

Interest Rate Cuts

Figure 6: Interest Rate



- Real rate = nominal rate - inflation.

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:

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

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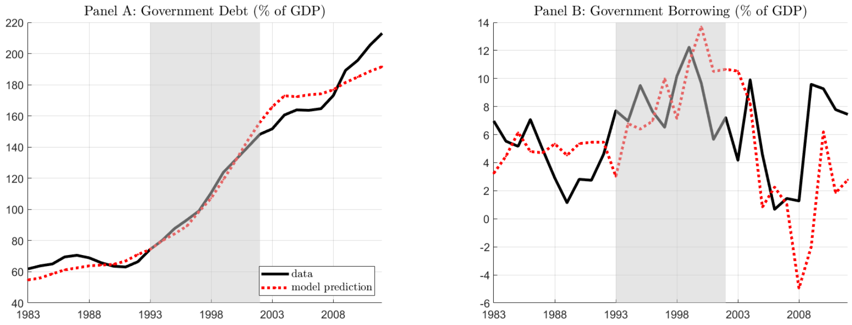
Estimation

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

Figure 7: Government Debt and Borrowing



Simple Model: Two-Period Economy

- Two-period economy with N regions. For each region i, the production function is:

$$Y_i = A_i G_i^{\alpha}, \quad \alpha \in (0,1) \tag{2}$$

- The representative household lives for two periods, with preferences:

$$U^H = u(C_1) + \beta u(C_2), \tag{3}$$

  - $u' > 0$, $u'' < 0$, $\lim_{C \to 0} u' = \infty$, $\lim_{C \to \infty} u' = 0$.

- Regional government capital $\{G_i\}_i$ is allocated in the first period, production takes place in the second period. Resource constraint:

$$C_1 + \frac{1}{1+r} C_2 + \sum_i G_i = W + \frac{1}{1+r} \sum_i Y_i, \tag{4}$$

  - W: exogenously determined 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:

$$R_i^G \equiv \frac{\partial Y}{\partial G_i} = 1 + r, \tag{5}$$

  - 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:

$$\frac{u'(C_1)}{u'(C_2)} = \beta(1 + r). \tag{6}$$

Political Economy

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

$$U^G = U^H + \sum_i \kappa_i v\left(G_i\right), \tag{7}$$

  - $v' > 0$, $v'' < 0$, $\lim_{G\to 0} v' = \infty$, $\lim_{G\to\infty} v' = 0$.
  - $\kappa_i > 0$: local lobbying capacity (e.g., Sato (2002); Ihori et al. (2009)).
- Two-period government budget constraints:

$$C_1 + \sum_i G_i = W + D, \tag{8}$$

$$C_2 = \sum_i Y_i - (1+r)\, D. \tag{9}$$

- Constrained by a maximum debt level $\bar{D}$ (10):

$$D \leq \bar{D}. \tag{10}$$

Political Equilibrium

- Assume $W > \underline{W}$ to ensure existence.
- FOC w.r.t. D is

$$\frac{u'(C_1)}{u'(C_2)} = \beta(1+r) + \frac{\lambda}{u'(C_2)}, \tag{11}$$

  - $\lambda \geq 0$: Lagrangian multiplier on the borrowing constraint.
- FOC w.r.t. G_i becomes

$$\left(1 + \underbrace{\frac{\kappa_i v'(G_i) G_i (1+r)}{u'(C_1) \alpha Y_i} - \frac{\lambda}{u'(C_1)}}_{\text{Capital Wedge}}\right) R_i^G = 1 + r, \tag{12}$$

  - Assume $W + \bar{D} > G^{FB}$ and $\{\kappa_i\}_i$ is sufficiently large: **Overinvestment** of G relative to the first-best solution G^{FB}.

"Fiscal Resource Curse"

- As $W \to \underline{W}$, $\{G_i\}_i$ converges to $G_i \propto A_i^{\frac{1}{1-\alpha}}$: efficiency-driven allocation rule.
- As $W \to \infty$, $\{G_i\}_i$ converges to $v'(G_i) \propto \frac{1}{\kappa_i}$: purely politically-driven allocation.
- When $u(\cdot) = v(\cdot) = \log(\cdot)$:
  - Aggregate TFP A decreases monotonically with W.

"Fiscal Curse of Easy Borrowing"

- Endogeneous Debt Rule: $\frac{(a+r_{t+1})D_{t+1}}{Y_t} \leq b \Rightarrow$

$$\bar{D} = \frac{bW}{1+r}. \tag{13}$$

- $r \in (0, \bar{r})$, 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

Sketch of Full-Blown Model

- The central government at period t, subject to an exogenous exit rate, allocates C^G_{t+j}, B_{t+j}, and $\{I^G_{it+j}\}$ for $j \geq 0$;
- Overlapping generations of households choosing region i at birth;
- Small open economy with mobile private capital across regions; evidence
- Region-specific and time-varying κ_{it}, capital wedge τ^K_{it}, and amenity Z_{it} calibrated to match I^G_{it}, K_{it} and L_{it};
- MIT shocks.

Household Preference

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

$$U^H_{it} = \log\left(\left(\left(c^H_{it,t}\right)^{\gamma}\left(h_{it}\right)^{1-\gamma}\right)^{\rho}\left(C^G_{it}\right)^{1-\rho}\right) + \beta\log\left(\left(c^H_{it,t+1}\right)^{\rho}\left(C^G_{it+1}\right)^{1-\rho}\right) + \log\bar{Z}_{it}. \tag{14}$$

- In equilibrium, U^H_{it} is equalized across regions, denoted by $\bar{U}^H_t$.
- Can be extended to migration model. migration model

Household Choices

- Young households choose region i and $\left\{c_{it,t}^{H}, c_{it,t+1}^{H}, h_{it}, s_{it}^{H}\right\}$, subject to the budget constraint $c_{it,t}^{H} + r_{it}^{H} h_{it} + s_{it}^{H} = y_{it}^{H}$ and $c_{it,t+1}^{H} = (1 + r_{t+1})\, s_{it}^{H}$.
  - y_{it}^{H} : total income
  - r_{it}^{H} : residential land rental price
  - r_{t+1} : interest rate
- Passive old individuals

Firms

- Local output by the production of a representative firm:

$$Y_{it} = A_{it} G_{it}^{\alpha_G} K_{it}^{\alpha_K} L_{it}^{\alpha_L}. \tag{15}$$

- The firm faces a proportional tax rate τ_t and private capital wedges τ_{it}^K :

$$\max_{K_{it}, L_{it}} (1 - \tau_t) Y_{it} - \left(1 + \tau_{it}^K\right) r_t^K K_{it} - w_{it} L_{it} \tag{16}$$

Spatial Equilibrium

- Residential land price:

$$r_{it}^{H} = \frac{1-\gamma}{1+\beta}\frac{y_{it}^{H}}{\bar{H}_{it}}L_{it}, \tag{17}$$

where

$$y_{it}^{H} = \frac{\Pi_{it}}{L_{it}} + w_{it} + \underbrace{\frac{1-\gamma}{1+\beta}y_{it}^{H}}_{\text{land revenue}} + \underbrace{\psi_{t}^{T}w_{it}}_{\text{transfer}} = \frac{1+\beta}{\gamma+\beta}\left(\frac{1-\alpha_K}{\alpha_L} + \psi_{t}^{T}\right)w_{it}, \tag{18}$$

with $\Pi_{it} = (1-\tau_t)(1-\alpha_K-\alpha_L)Y_{it}$ representing firm profit and $\bar{H}_{it}$ is exogenous housing supply.

Spatial Equilibrium

- Equalized U_{it}^{H} implies

$$y_{it}^{H} \propto \left(\bar{Z}_{it} \left(C_{it}^{G} \left(C_{it+1}^{G} \right)^{\beta} \right)^{(1-\rho)} \right)^{-\frac{1}{\rho(\beta+\gamma)}} \left(\frac{\bar{H}_{it}}{L_{it}} \right)^{-\frac{1-\gamma}{\beta+\gamma}} . \tag{19}$$

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

$$L_{it} \propto \left(\left(Z_{it} \right)^{\frac{1}{\rho(\beta+\gamma)}} \left(\frac{A_{it}}{\left(1+\tau_{it}^{K}\right)^{\alpha_K}} \right)^{\frac{1}{1-\alpha_K}} \right)^{\frac{(1-\alpha_K)\eta}{\alpha_G}} \left(C_{it}^{G} \left(C_{it+1}^{G} \right)^{\beta} \right)^{\frac{(1-\rho)(1-\alpha_K)\eta}{\rho(\beta+\gamma)\alpha_G}} \left(G_{it} \right)^{\eta} , \tag{20}$$

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

Effects of G_{it}

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

$$\frac{\partial Y_t}{\partial G_{it}} = \frac{\alpha_G}{1-\alpha_K-\alpha_L}\frac{Y_{it}}{G_{it}} - \underbrace{\left(\frac{(1-\gamma)\,\alpha_L\eta}{(\beta+\gamma)\,(1-\alpha_K-\alpha_L)}\frac{Y_{it}}{G_{it}} + \frac{\alpha_L\eta}{1-\alpha_K}\frac{L_{it}}{L_t}\frac{Y_t}{G_{it}}\right)}_{\text{GE effect}}. \quad (21)$$

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

$$\frac{\partial \bar{U}_t^H}{\partial G_{it}} = \rho\,(1+\beta)\,\frac{(1-\tau_t)\,(1-\alpha_K)}{Y_t^H}\frac{\partial Y_t}{\partial G_{it}} - \rho\,(1+\beta)\,\eta\left(\frac{y_{it}^H L_{it}}{Y_t^H} - \frac{L_{it}}{L_t}\right)\frac{1}{G_{it}}. \quad (22)$$

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

Fiscal Institution

- Central government objective function:

$$U_t^C = \omega^o \bar{U}_{t-1}^H + \sum_{j=0}^{\infty} (\beta_C)^j \left(\bar{U}_{t+j}^H + \sum_{i=1}^{N} \kappa_{it+j} \log G_{it+j+1} \right), \tag{23}$$

- $\beta_C = \beta p$, $p \in (0,1)$ is the probability of staying in office next period.
- κ_{it}: Institutional parameter for local governor's lobbying capacity.
- Innocuous spatial allocation of government consumption (e.g., $C_{it}^G = \psi_i C_t^G$)

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

Budget

- Central government budget constraint:

$$C_t^G + \sum_{i=1}^{N} q_t^G I_{it}^G + T_t + \Phi_t = \tau_t Y_t + D_{t+1} - (1 + r_t^D) D_t \tag{24}$$

  - Debt follows fiscal rule

$$\frac{(a_t + r_{t+1}) D_{t+1}}{Y_t} = b \tag{25}$$

- $T_t = \sum_i \psi_t^T w_{it} L_{it}$: transfer or tax
- Φ_t: Residual component.

Government Optimization

- The central planner chooses $\{C^G_{t+j}\}_{j=0}^{\infty}$, $\{G_{it+j+1}\}_{i=1,j=0}^{N,\infty}$, and $\{D_{t+j+1}\}_{j=0}^{\infty}$ to maximize U^C_t, subject to (24) and (25).

$$\begin{aligned}\frac{C^G_{t+j+1}}{C^G_{t+j}} = & \frac{\beta_C}{q^G_{t+j}}\left(\left(\tau_{t+j+1} + \frac{\partial D_{t+j+2}}{\partial Y_{t+j+1}}\right)\frac{\partial Y_{t+j+1}}{\partial G_{it+j+1}} + q^G_{t+j+1}\left(1-\delta_G\right)\right) \\ & - \frac{\beta_C^2}{q^G_{t+j}}\frac{C^G_{t+j+1}}{C^G_{t+j+2}}\left(1 + r^D_{t+j+2}\right)\frac{\partial D_{t+j+2}}{\partial Y_{t+j+1}}\frac{\partial Y_{t+j+1}}{\partial G_{it+j+1}} \\ & + \frac{C^G_{t+j+1}}{\left(1+\beta/\beta_C\right)\left(1-\rho\right)q^G_{t+j}}\left(\beta_C\frac{\partial \bar{U}^H_{t+j+1}}{\partial G_{it+j+1}} + \kappa_{it+j}\frac{1}{G_{it+j+1}}\right)\end{aligned} \tag{26}$$

- RHS of equation (26): Capital returns; Marginal household utility; Political gains.

Calibration: Estimating α_G

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

$$\text{Solow Residual}_{it} = \log Y_{it} - \alpha_K \log K_{it} - \alpha_L \log L_{it}.$$

- Allowing for measurement errors

$$\text{Solow Residual}_{it} = \alpha_G \log G_{it} + \log A_{it} + \varepsilon_{it}, \tag{27}$$

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

back

External Calibration: Time-Invariant Parameters

Table 4: 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

External Calibration: Time-Varying Parameters

Table 5: 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 6: Calibration of Regional Parameters

Parameters	Target
A_{it}	$\log A_{it} = \log Y_{it} - \alpha_G \log G_{it} - \alpha_K \log K_{it} - \alpha_L \log L_{it}$
τ_{it}^K	$1 + \tau_{it}^K \propto \frac{Y_{it}}{K_{it}}, \sum_{i=1}^N \tau_{it}^K K_{it} = 0$
Z_{it}	equation (20)

Expectation

- Variables for $t > 2$ ($t = 1$ for Lost Decade):
  - $A_{it} = \hat{A}_{it} A_t$, 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
    $X_t = \{i_{t+1}, \pi_t, i_t(m), a_t, q_t, \tau_t, r_t^K, \Phi_t, T_t, L_t, \{\tau_{it}^K\}, \{Z_{it}\}, \{\kappa_{it}\}, \{\hat{A}_{it}\}, \{\psi_{it}\}\}$,

$$\mathbb{E}_t\left[X_{t+j}\right] = X_t, \quad \forall j \geq 1. \tag{28}$$

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 7: Expected Interest Rates (%)

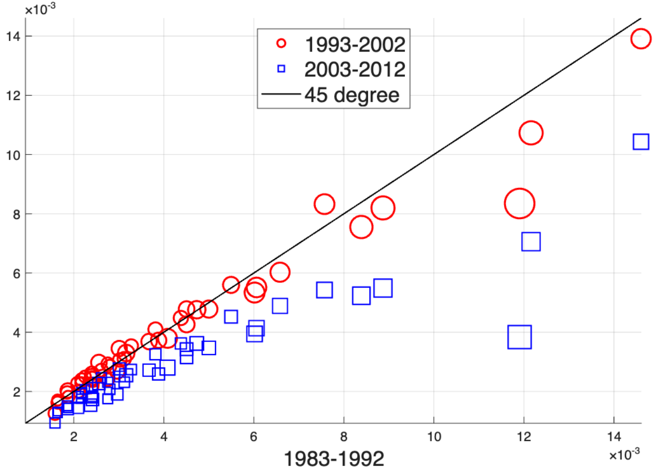
	$t = 1$ (93-02)	$t = 2$ (03-12)	$t = 3$ (13-22)
i^D_t	3.71	1.40	0.95
$\mathbb{E}_0[i^D_t]$	5.03	4.60	4.60
$\mathbb{E}_1[i^D_t]$	-	1.12	0.85
$\mathbb{E}_2[i^D_t]$	-	-	0.96
r^D_t	3.53	1.53	0.94
$\mathbb{E}_0[r^D_t]$	3.24	2.80	2.80
$\mathbb{E}_1[r^D_t]$	-	0.95	0.67
$\mathbb{E}_2[r^D_t]$	-	-	1.09

Internal Calibration

- The remaining parameters are interally calibrated to match the observed data:
  - $\{\kappa_{it}\}_{i=1}^{N}$ to match $\{G_{it+1}\}_{i=1}^{N}$;
  - Φ_t to match C_t^G;
  - T_t to match C_t^H;
  - a_t to match D_{t+1};

Prefecture-level κ_{it}

Figure 8: Prefecture-level κ_{it}



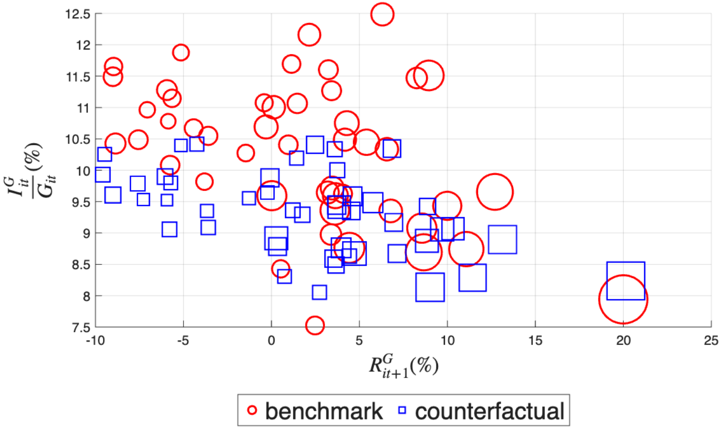
Counterfactual: Lobby Incentives and Prefecture-level Wedges

- Set the local lobby capacity parameter in the lost decade to the average of pre- and post-Lost Decade levels: $\kappa_{i1} = \frac{1}{2}(\kappa_{i0} + \kappa_{i2})$

- Set the local private capital wedge in the lost decade to the average of pre- and post-Lost Decade levels: $\tau^K_{i1} = \frac{1}{2}(\tau^K_{i0} + \tau^K_{i2})$

Counterfactual: Lobby Incentives

Figure 9: $\kappa_{i1} = \frac{\kappa_{i0}+\kappa_{i2}}{2}$



Ralaxed Government Budget

- Government revenue, $\forall j \geq 0$:

$$\mathbb{E}_t\left[\text{Windfall}_{t+j}\right] = \Delta\mathbb{E}_t\left[NB_{t+j}\right] + \Delta\mathbb{E}_t\left[B_{t+j}\right] - \Delta\mathbb{E}_t[r^D_{t+j}D_{t+j}] \tag{29}$$

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

Table 8: 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
$\mathbb{E}_1[\text{Gain}_{t+j}]$	6.36	2.72	1.28	1.44

Counterfactual: Transferring "Fiscal Gains"

- Government commits to using "gains" 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 optimizes C^G_{t+j}, $\{G_{it+j+1}\}_i$ and D_{t+j} for $j \geq 0$ in each period $t \geq 1$.

Counterfactual: $I^G_{it} \sim R^G_{it+1}$ at 1993-2002

Figure 10: $\kappa_{i1} = \frac{\kappa_{i0}+\kappa_{i2}}{2}$

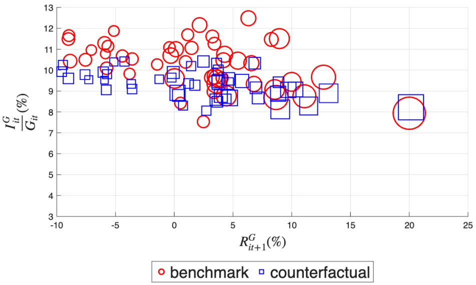
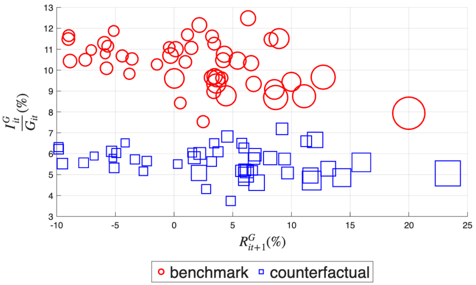


Figure 11: Transferring "Fiscal Windfalls"



Counterfactual: Welfare Analysis

Table 9: Aggregate TFP, output and welfare changes (%)

	$\kappa_{i1} = \frac{\kappa_{i0}+\kappa_{i2}}{2}$ (1)	$\tau^K_{i1} = \frac{\tau^K_{i0}+\tau^K_{i2}}{2}$ (2)	transfers (3)
Aggregate TFP change in 03-12	0.34	-0.59	0.43
Aggregate output change in 03-12	-0.37	-0.93	-3.99
Households income change in 93-02	0	-0.92	10.11
in 03-12	-0.27	-1.04	5.20
Welfare change (φ)	-0.08	-0.02	0.31

Welfare Consequences of Misallocating Fiscal Windfalls

- Aggregate TFP loss
- Distorting government and private consumption
- Subsidizing future generations by more government investments

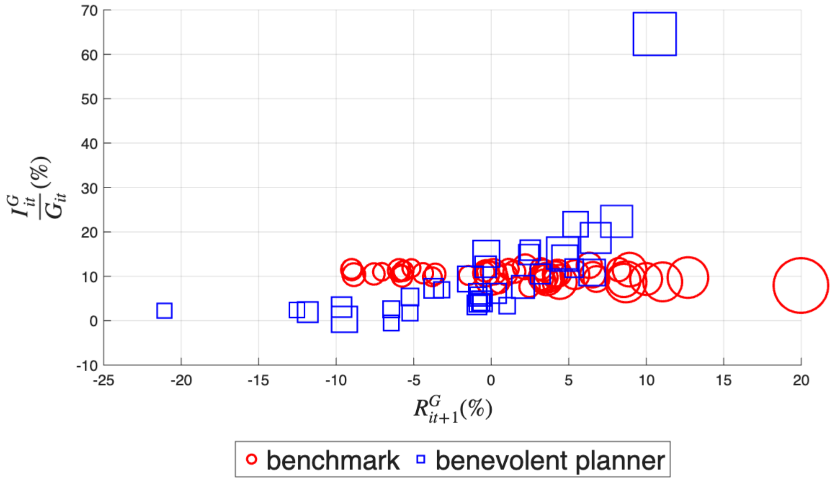
Benevolent Planner

- A planner maximizes social welfare (identical to the central government's objective (23) with $\kappa_{it} = 0$ and $p = 1$).
- FOCs w.r.t. G_{it+1} (26) still apply.
- Optimizing transfer $\{T_{t+j}\}_{j\geq 0}$ to young households.

$$\frac{\sum_i (c^H_{it+j,t+j} + r^H_{it+j} H_{it+j}) L_{it+j}}{C^G_{t+j}} = \frac{\rho}{2(1-\rho)}.$$

Benevolent Planner: Spatial Allocation

Figure 12: Spatial Allocation



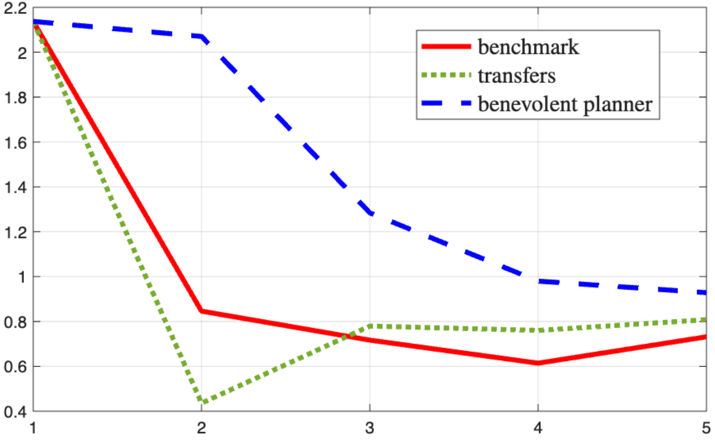
Benevolent Planner: TFP and Welfare

Table 10: Aggregate TFP, output and welfare changes (%)

	transfers (1)	benevolent planner (2)
Aggregate TFP change in 03-12	0.43	9.22
Aggregate output change in 03-12	-3.99	12.82
Households income change in 93-02	10.11	10.57
in 03-12	5.20	27.88
Welfare change (φ)	1.51	11.93

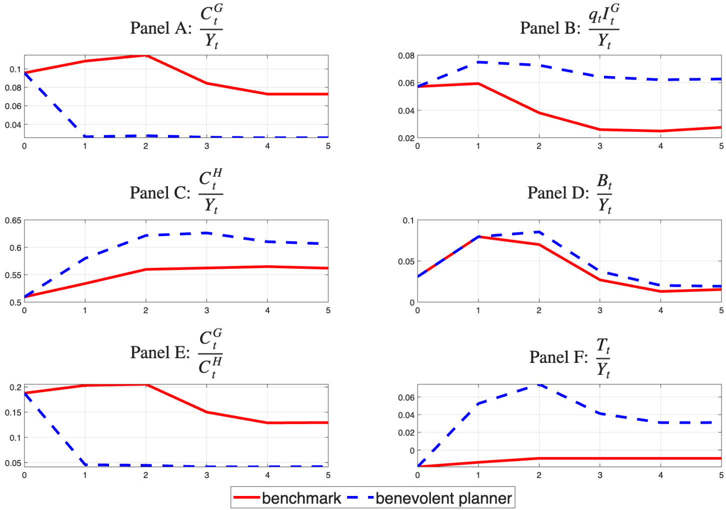
Benevolent Planner: Output Growth

Figure 13: Output Growth (annualized, %)



Benevolent Planner: Transitional Dynamics

Figure 14: Transitional Dynamics



The End of the Decade of Fiscal Misallocation

- Our story: Low interest rate regime (windfalls are gone)
- FILP Reform
- "Trinity Reforms" on central government transfers to local governments
  - Sticks: Fiscal restructuring (Yubari city)
  - Carrots: "Great Heisei Mergers"

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, Moore and Zhang (2021); misallocation via financial frictions, Asriyan et al. (2024))
- Implications for today's China and beyond
  - Potential fiscal misallocation and welfare losses by debt swap and low interest rate
  - **Countercyclical government investment: One Stone Two (Multiple) Birds?**

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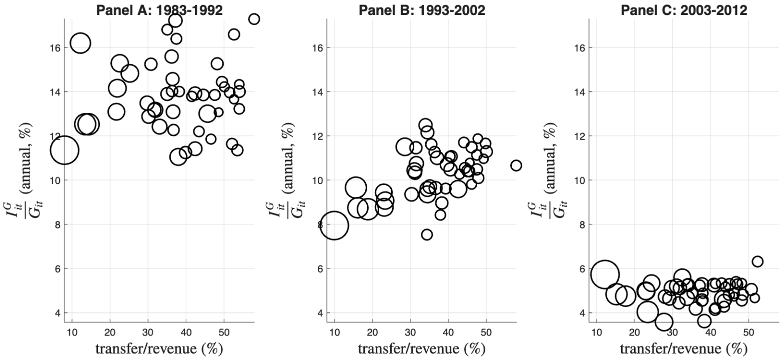
Central Government Transfers

- Calculate the share of central government transfers in total local government revenue; positively correlated with I_{it}^{G}/G_{it} in the Lost Decade.

Figure 15: $\frac{I_{it}^{G}}{G_{it}} \sim \frac{\text{Transfer}_{it}}{\text{Revenue}_{it}}$



Individual Preference

- Preference for individual ω residing in region i depends on private consumption $c_{it,t}^{H}(\omega), c_{it,t+1}^{H}(\omega)$, public consumption C_{it}^{G}, C_{it+1}^{G}, residential land use $h_{it}(\omega)$ and an idiosyncratic amenity shock $b_{it}(\omega)$:

$$
\begin{aligned}
u_{it}^{H}(\omega) = \log & \left(\left(\left(c_{it,t}^{H}(\omega) \right)^{\gamma} \left(h_{it}(\omega) \right)^{1-\gamma} \right)^{\rho} \left(C_{it}^{G} \right)^{1-\rho} \right) \\
& + \beta \log \left(\left(c_{it,t+1}^{H}(\omega) \right)^{\rho} \left(C_{it+1}^{G} \right)^{1-\rho} \right) + \log \left(b_{it}(\omega) \right).
\end{aligned}
\tag{30}
$$

- The amenity shocks are drawn independently across regions and individuals from a Fréchet distribution: $F_{it}(b) = e^{-\bar{Z}_{it} b^{-\epsilon}}$.
  - $\bar{Z}_{it}$: average amenities for region i.
  - ϵ: dispersion of amenities across individuals for each region.

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Individual Choices

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

Location Choice and Expected Utility

- Labor allocation:

$$\frac{L_{it}}{L_t} = \frac{Z_{it}\left(v_{it}\right)^{\epsilon}}{\sum_n Z_{nt}\left(v_{nt}\right)^{\epsilon}}, \tag{31}$$

  where

$$v_{it} \equiv \frac{\left(y_{it}^{H}\right)^{\rho+\beta}\left(C_{it}^{G}\right)^{(1-\rho)}\left(C_{it+1}^{G}\right)^{\beta(1-\rho)}}{\left(r_{it}^{H}\right)^{\rho(1-\gamma)}}. \tag{32}$$

- Expected utility (w/o constant):

$$\bar{U}_t^H = \frac{1}{\epsilon}\log\left(\sum_i Z_{it} v_{it}^{\epsilon}\right) + \beta\log(1 + r_{t+1}). \tag{33}$$

Spatial Equilibrium

- Exogenous $L_t \equiv \sum_i L_{it}$ and $\bar{H}_{it}$.
- The gravity equation (31) implies labor supply:

$$L_{it} \propto \left(Z_{it} \left(\bar{H}_{it}\right)^{\epsilon\rho(1-\gamma)} \left(C_{it}^{G}\right)^{\epsilon(1-\rho)} \left(C_{it+1}^{G}\right)^{\epsilon\beta(1-\rho)} \left(w_{it}\right)^{\epsilon\rho(\gamma+\beta)} \right)^{\frac{1}{1+\epsilon\rho(1-\gamma)}}. \quad (34)$$

- w_{it} pinned down by labor supply and demand (from firm FOC).

Spatial Equilibrium

- Residential land price:

$$r_{it}^{H} = \frac{1-\gamma}{1+\beta} \frac{y_{it}^{H}}{\bar{H}_{it}} L_{it}, \tag{35}$$

where

$$y_{it}^{H} = \frac{\Pi_{it}}{L_{it}} + w_{it} + \underbrace{\frac{1-\gamma}{1+\beta} y_{it}^{H}}_{\text{land revenue}} + \underbrace{\psi_t^T w_{it}}_{\text{transfer}} = \frac{1+\beta}{\gamma+\beta} \left(\frac{1-\alpha_K}{\alpha_L} + \psi_t^T \right) w_{it}, \tag{36}$$

with $\Pi_{it} = (1-\tau_t)(1-\alpha_K-\alpha_L) Y_{it}$ representing firm profit.

Effects of G_{it}

- Spatial equilibrium labor allocation implies $\frac{\partial w_{nt}}{\partial G_{it}}$ and $\frac{\partial L_{nt}}{\partial G_{it}}$ $\forall n, i$.
- Returns to G_{it}:

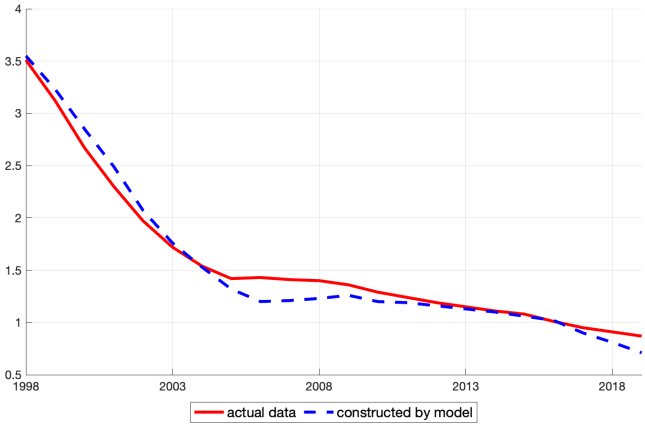
$$\frac{\partial Y_t}{\partial G_{it}} = \frac{\alpha_G}{1-\alpha_K-\alpha_L} \sum_n \left(1_{\{n=i\}} \frac{Y_{nt}}{G_{it}} - \frac{\alpha_L}{\alpha_G} \frac{Y_{nt}}{G_{it}} \frac{\partial w_{nt}/w_{nt}}{\partial G_{it}/G_{it}} \right). \tag{37}$$

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

$$\frac{\partial \bar{U}_t^H}{\partial G_{it}} = \sum_n \frac{L_{nt}}{L_t} \left(\frac{\beta+\rho\gamma}{G_{it}} \frac{\partial w_{nt}/w_{nt}}{\partial G_{it}/G_{it}} - \frac{\rho\,(1-\gamma)}{G_{it}} \frac{\partial L_{nt}/L_{nt}}{\partial G_{it}/G_{it}} \right). \tag{38}$$

Forecasts Using Bond Issuance Data

Figure 16: Nominal borrowing rate



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Mobile Factors

Table 11: Cross-Region Allocation

	1978-82	1983-87	1988-92	1993-97	1998-02	2003-07	2008-12	2013-17
				log K_{it}				
log G_{it}	1.091***	1.126***	1.188***	1.225***	1.230***	1.266***	1.276***	1.270***
	(0.072)	(0.075)	(0.081)	(0.086)	(0.088)	(0.099)	(0.104)	(0.107)
Observations	47	47	47	47	47	47	47	47
R^2	0.838	0.834	0.828	0.818	0.813	0.784	0.770	0.758
				log L_{it}				
log G_{it}	1.030***	1.108***	1.184***	1.186***	1.194***	1.249***	1.284***	1.291***
	(0.046)	(0.051)	(0.057)	(0.057)	(0.062)	(0.073)	(0.075)	(0.076)
Observations	47	47	47	47	47	47	47	47
R^2	0.918	0.912	0.904	0.907	0.892	0.868	0.867	0.865

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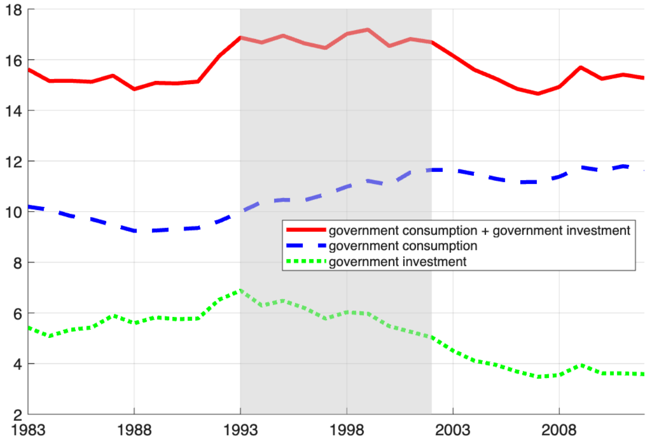
Government Expenditure GDP Ratio

Figure 17: Government Expenditure GDP Ratio (%)



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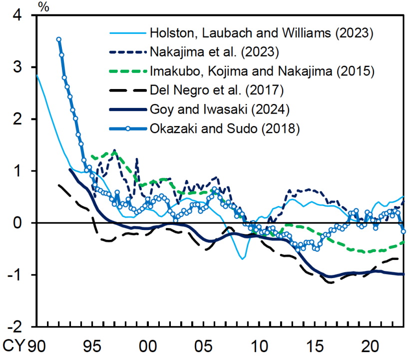
Nature Rate of Interest and Expected Growth Rate

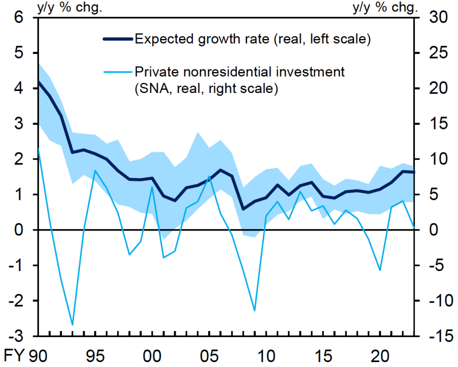
Figure 18: Natural Rate of Interest and Expected Growth Rate

Chart 1-1-1: Natural Rate of Interest



Sources: Bank of Japan; Ministry of Finance; Ministry of Health, Labour and Welfare; Cabinet Office; Ministry of Internal Affairs and Communications; Bloomberg; Consensus Economics Inc., "Consensus Forecasts."
Note: The estimates are based on staff calculations using the models proposed in the different papers.

Chart 1-1-4: Expected Growth Rate



Source: Cabinet Office.
Note: The "expected growth rate" is the average of firms' forecasts of the real growth rate of industry demand over the next five years. The shaded area indicates the 20-80 percentile band of the expected growth rate.

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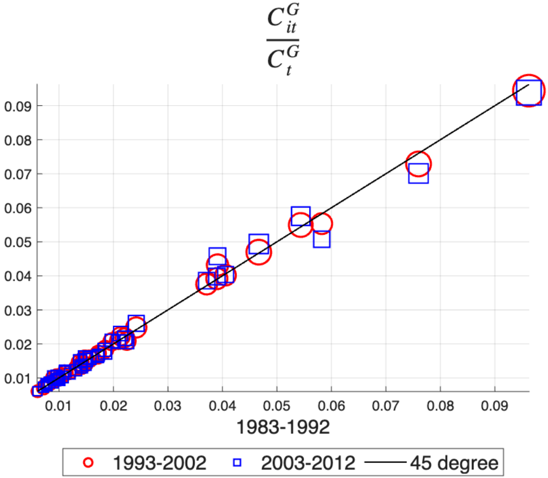
Persistent Government Consumption Allocation

Figure 19: $\frac{C^G_{it}}{C^G_t}$



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Matrix of Elasticity

- We define the matrix $\boldsymbol{\varepsilon}^{L}_{G,t} \equiv [\varepsilon^{L}_{G,ijt}]_{ij}$, $\boldsymbol{\varepsilon}^{w}_{G,t} \equiv [\varepsilon^{w}_{G,ijt}]_{ij}$, where $\varepsilon^{L}_{G,ijt} \equiv \frac{\partial \log L_{it}}{\partial \log G_{jt}}$, $\varepsilon^{w}_{G,ijt} \equiv \frac{\partial \log w_{it}}{\partial \log G_{jt}}$ and $\varepsilon^{v}_{G,ijt} \equiv \frac{\partial \log v_{it}}{\partial \log G_{jt}}$.
- $\boldsymbol{L}_t$ is the $N \times N$ matrix where each row equals $(\frac{L_{1t}}{L_t}, \ldots, \frac{L_{Nt}}{L_t})$.

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Matrix of Elasticity Con't

- The solutions are

$$\varepsilon^{w}_{G,t} = \frac{\alpha_G}{1-\alpha_K-\alpha_L}\left(\frac{1-\alpha_K}{1-\alpha_K-\alpha_L}\boldsymbol{Z}_{1t}+\boldsymbol{Z}_{2t}\right)^{-1}\boldsymbol{Z}_{1t}, \tag{39}$$

$$\varepsilon^{L}_{G,t} = \boldsymbol{Z}_{1t}^{-1}\boldsymbol{Z}_{2t}\varepsilon^{w}_{G,t}, \tag{40}$$

where

$$\boldsymbol{Z}_{1t} \equiv \boldsymbol{I} - \frac{\epsilon\rho\left(1-\gamma\right)}{1+\epsilon\rho\left(1-\gamma\right)}\boldsymbol{L}_t, \tag{41}$$

$$\boldsymbol{Z}_{2t} \equiv \frac{\epsilon\rho\left(\gamma+\beta\right)}{1+\epsilon\rho\left(1-\gamma\right)}\left(\boldsymbol{I}-\boldsymbol{L}_t\right), \tag{42}$$

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