Growth with Regional Redistribution

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Febuary 5, 2026

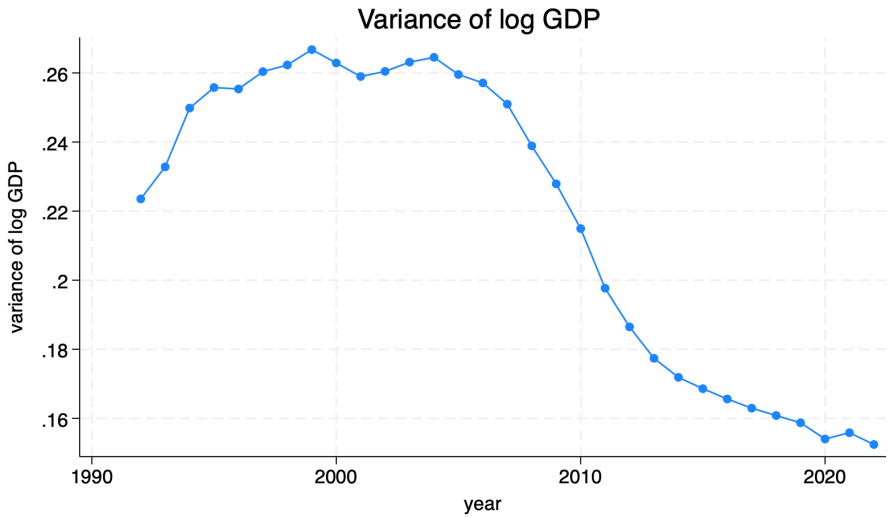
Fact 1: Increased Regional Redistribution

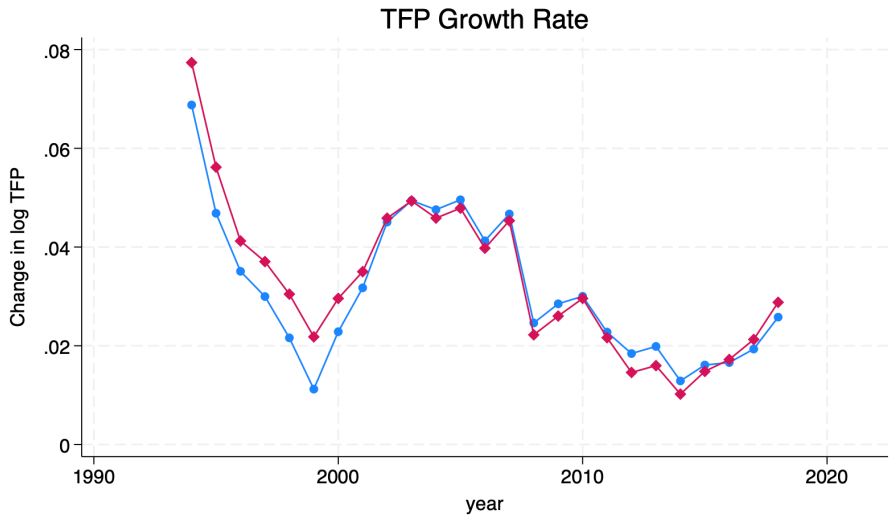
- Novel fact: China massively increased inter-government redistribution.
  - Net flows from rich regions to central government and from central government to poor regions are large and growing.

	2000		2010	
	Gansu	Shanghai	Gansu	Shanghai
GDP	507	3,712	2,303	11,991
Taxes paid to central govt.	24.2	681.9	219.2	3,139
Transfers from central to local govt.	60.4	91.0	595.0	247.9
(Transfers − Taxes)/GDP	+7%	-16%	+17%	-24%

Note: per capita USD (nominal)

Fact 2: Regional Convergence and TFP Growth Slowdown





- Rapid decline in variance of log provincal GDP p.c.
- Decline in aggregate TFP growth rate [1]

[1] Blue circles: $\log(\text{GDP}) - 0.185\log(\text{Infras. Capital}) - 0.315\log(\text{Non-infras. Capital})$
Red diamonds: $\log(\text{GDP}) - 0.5\log(\text{Capital})$.

Research Questions

What are economic effects of increased regional redistribution?

- How does redistribution affect local fiscal allocation (consumption vs investment) and growth?
  - Document effects on local fiscal policy, infrastructure investment, and regional economic growth.
  - Use 2002 tax reform as natural experiment to identify causal effects of increased redistribution on local fiscal policy and regional economic growth.
- How much of the regional convergence and TFP growth slowdown can be explained by the increased redistribution?
  - Build a GE model to quantify the equity-efficiency trade-off.
  - Study determinants of optimal redistribution policy.

Key Findings

- Empirical analysis
  - Progressivity of taxes on local fiscal income increased from 0.2 in 1998 to 0.5 in 2017
    (average marginal tax rate increased from 28% to 40%).
  - Increased redistribution shifts local fiscal spending from investment to consumption and lowers regional economic growth.
- Quantitative analysis
  - Rising progressivity contributes to 43% of declining variance of log GDP p.c. and reduces aggregate TFP by 0.5 ppt.
  - Redistribution system (2013-2017) is close to utilitarian optimal.

Related Literature

- BHSV log-linear tax function
  - Benabou (2002); Heathcote et al. (2017)

  $\Rightarrow$ Apply BHSV tax function to model regional redistribution
- Government investment as a driver of growth
  - Barro (1990); Bom and Ligthart (2014); Song and Xiong (2023)
- Capital misallocation and economic growth
  - Accounting framework: Chari et al. (2007); Restuccia and Rogerson (2008); Hsieh and Klenow (2009)
  - Capital misallocation: Song et al. (2011); Tombe and Zhu (2019)
  - Regional convergence: Hao et al. (2020); Brandt et al. (2025)

  $\Rightarrow$ The first to identify regional redistribution as a main source of distortions and quantify its effects on regional convergence and aggregate efficiency through local fiscal investment.

Roadmap

1. Measurement of Progressivity
2. Empirical Analysis
3. Quantitative Analysis
    - Positive Analysis
    - Normative Analysis

Tax Reforms

Time	Key Points
1994	Central tax: excise tax, tariff, and taxes from central SOE. Local tax: business taxes, personal income taxes, and taxes from local firms. Shared tax: value-added tax (75% for central and 25% for local)
2002	The central government takes 50% of personal income taxes and corporate income taxes additionally from local governments.
2003	Central share of income taxes increased to 60%.

- Central government increased revenue to undeveloped regions!

Tax Share | Tax Categories

Measuring Progressivity

- BHSV tax function

$$T(x) = x - \tilde{x} = x - \lambda x^{1-\phi}$$

$$\tilde{x} = \lambda x^{1-\phi} \quad \Rightarrow \quad \log \tilde{x} = \log \lambda + (1-\phi) \log x$$

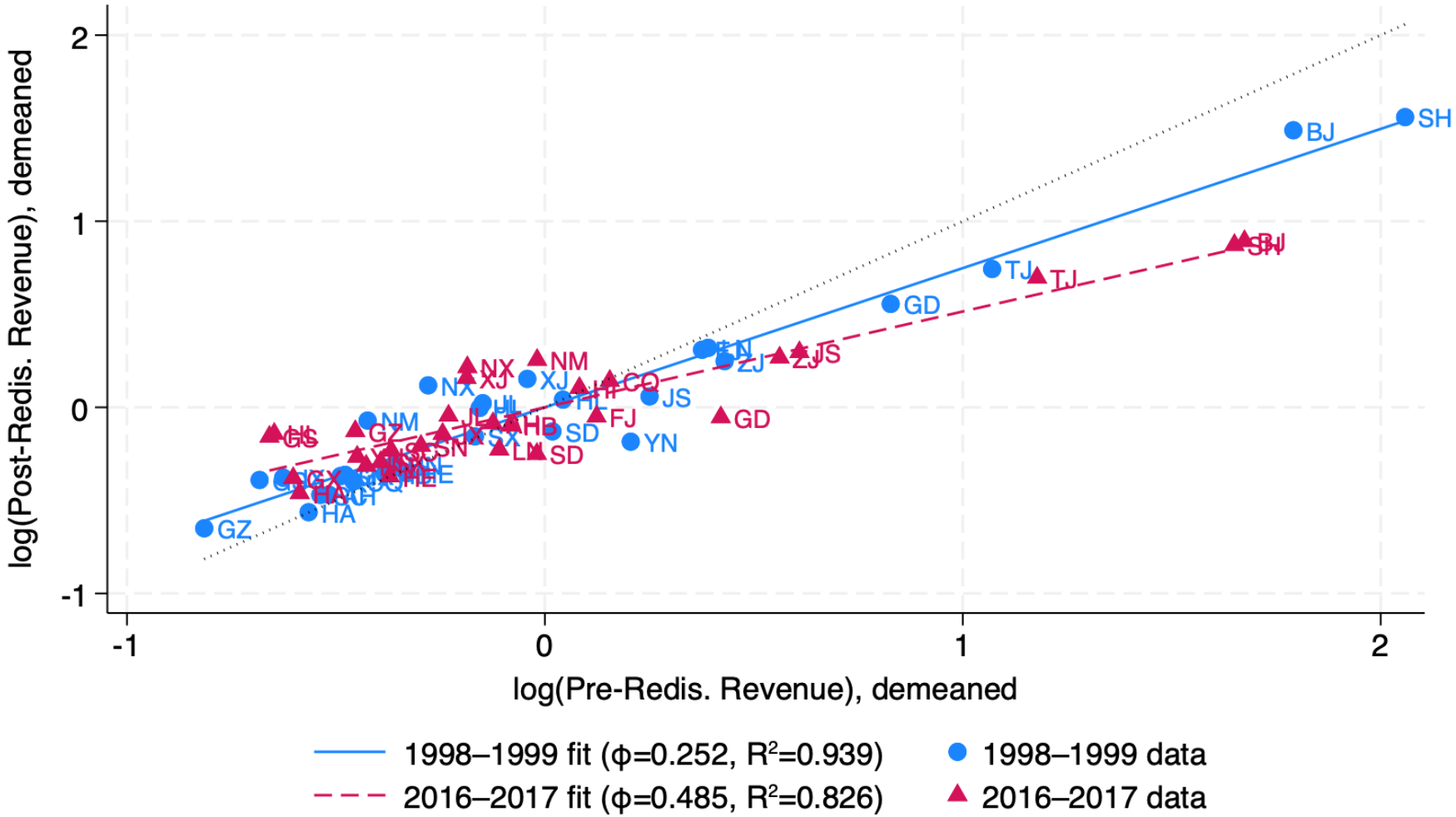
  x: fiscal revenue collected within a region

  $\tilde{x}$: x - central taxes + transfers from the central government

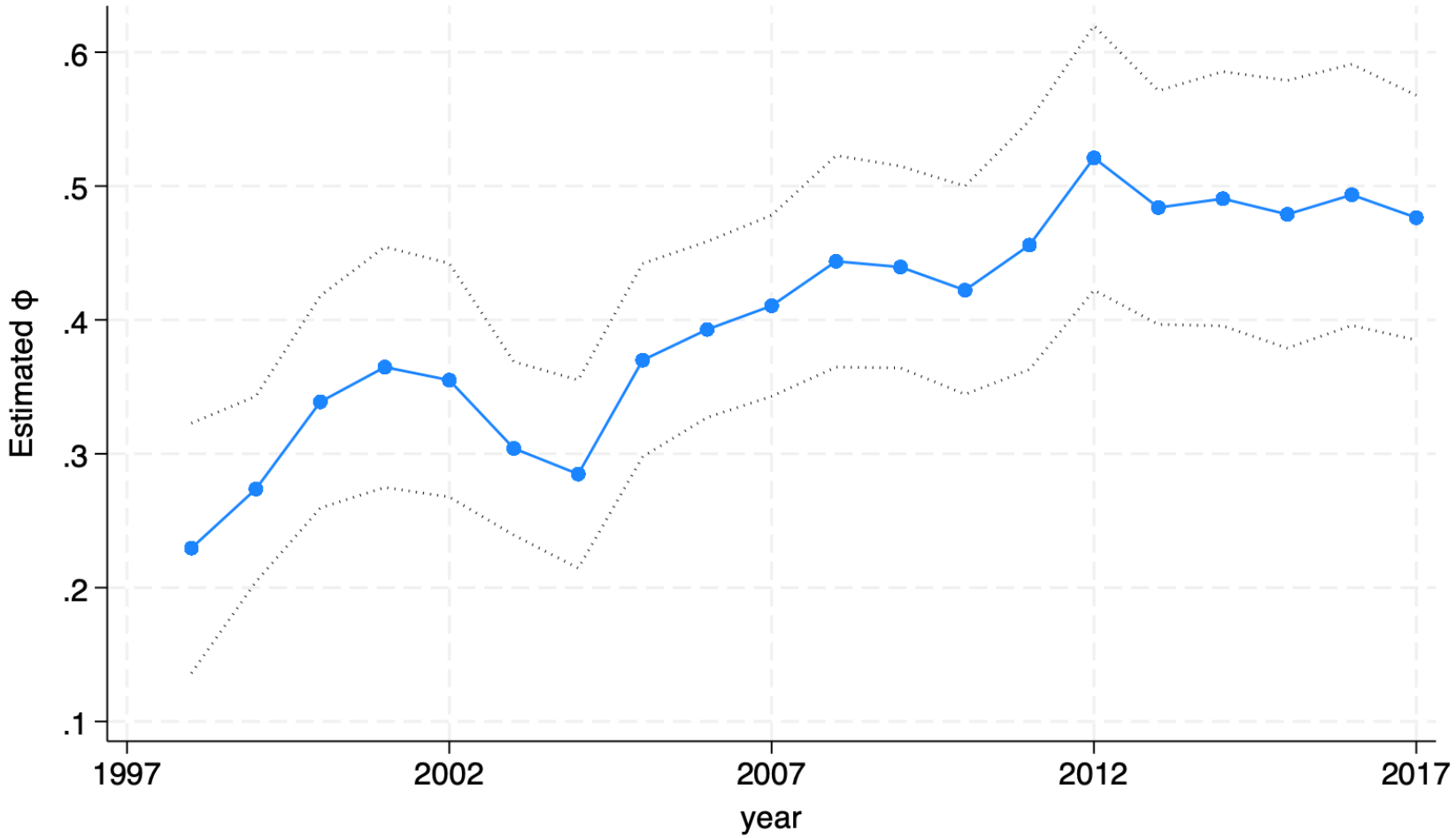
- ϕ determines progressivity
  - $\phi = 0$: $T(x) = (1-\lambda)x$, linear tax
  - $\phi = 1$: $\tilde{x} = \lambda$, uniform post-redistribution fiscal revenue
- Estimate ϕ and λ:

$$\log \tilde{x}_{it} = \log \lambda + (1-\phi) \log x_{it} + \varepsilon_{it}$$

Increased Inter-Government Redistribution



Result 1: Rising Progressivity



Note: The marginal tax rate increases from 28% to 40% on average.

Causal Identification

- The central government started to take 50% of income taxes in 2002.
- Treatment variable: pre-reform share of income taxes

$$Z_i = \frac{\text{Corporate Income Tax}_{it_0} + \text{Personal Income Tax}_{it_0}}{\text{Total Tax Revenue}_{it_0}}$$

Mechanism: $Z_i \uparrow \Rightarrow$ more taxes taken $\Rightarrow$ lower return to govt. inves. $\Rightarrow$ infras. capital $\downarrow \Rightarrow$ output $\downarrow$

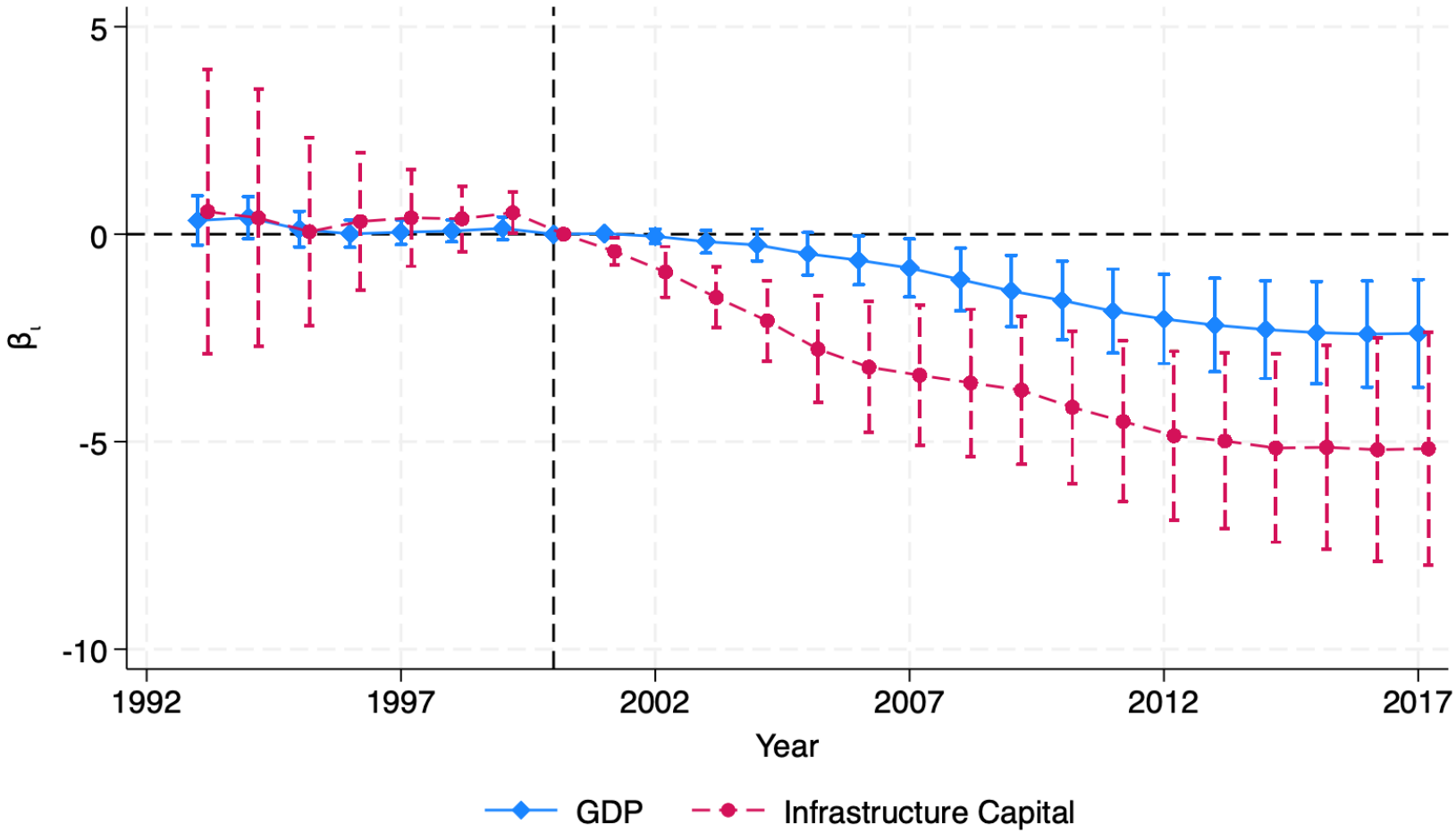
- Identification Strategy

$$\text{outcome}_{it} = \zeta_i + \nu_t + \sum_{\iota \neq t_0} \beta_\iota Z_i \times \mathbb{1}\{t = \iota\} + \epsilon_{it}$$

outcome variables: log GDP p.c. and log infras. capital p.c.

- Base year: $t_0 = 2000$.

Result 2: More Tax Taken, Lower Infras. & GDP Growth



- Output elasticity of infras. capital: 0.185

Scatter Plot | Placebo Test | Additional Results | Other Elasticity

Theoretical Framework

- Aim of the model
  - Characterize the mechanism by which regional redistribution distorts local fiscal policy and affects growth.
  - Quantify the effects of rising progressivity on regional convergence and aggregate efficiency.
  - Study determinants of optimal redistribution policy.
- Environment
  - The economy consists of a unit measure of regions, indexed by $i \in [0, 1]$, and a central government.
  - Each region is a small open economy and has
    - Household
    - Firms rent capital at an exogenous interest rate R.
    - Benevolent local government

Timeline

1. The central government sets
   - Redistribution policy: $\{\phi_t, \lambda_t\}_t$
   - Output tax rate: $\{\tau_{yt}\}_t$
   - Central government consumption $\{G_t^C\}_t$. $g_t = G_t^C / Y_t$
2. Given $\{\phi_t, \lambda_t, \tau_{yt}, g_t\}_t$, the local government chooses
   - Local government consumption G_{it}
   - Infrastructure capital k_{Git+1}

   subject to post-redistribution fiscal income
3. Given the local fiscal policy $\{G_{it}, k_{Git}\}_t$
   - The firm produces and pays taxes $\tau_{yt} y_{it}$
   - The household inelastically supplies unit labor.

Preference and Technology

- Production function

$$y_i = \underbrace{\underbrace{A_i}_{\text{regional TFP}} \times \underbrace{k_{Gi}^{\alpha}}_{\text{infras. capital}}}_{\text{exogenous productivity for firm}} \times k_i^{\theta} \times n_i^{1-\alpha-\theta}$$

- Firm's problem

$$\max_{k_i, n_i} \pi_i = (1 - \tau_y) y_i - R k_i - w_i n_i$$

- Household

$$u(c_i, G_i) = \log c_i + \chi^L \log G_i$$

$$\text{s.t.} \quad c_i = w_i + \pi_i$$

Government

- Taking (ϕ, λ, τ_y) as given, local government chooses (k'_G, G) to maximize local household utility:

$$v(A_i, k_{Gi}) = \max_{G_i, k'_{Gi}} \log c_i + \chi^L \log G_i + \beta v(A'_i, k'_{Gi})$$

$$\text{s.t.} \quad G_i + k'_{Gi} \leq \tau_y y_i - T(\tau_y y_i) + (1-\delta) k_{Gi}$$

where

$$T(\tau_y y_i) = \tau_y y_i - \lambda (\tau_y y_i)^{1-\phi}$$

and y_i solves the firm's problem and c_i solves the household problem

- Central government budget constraint

$$\tau_y \int y_i di = \lambda \int (\tau_y y_i)^{1-\phi} di + g \int y_i di$$

λ pinned down in equilibrium

Equilibrium

Definition (Competitive Equilibrium)

Given productivity $\{A_{it}\}_{i,t}$, policy sequence $\{\phi_t, \lambda_t, \tau_{yt}, g_t\}_t$, and interest rate R, a competitive equilibrium consists of wage $\{w_{it}\}_{i,t}$ and allocation $\{c_{it}, y_{it}, k_{it}, n_{it}, G_{it}, k_{Git+1}\}_{i,t}$ such that:

1. Allocations solve the optimization problems
2. Wage rate w_{it} clears local labor market $n_{it} = 1$
3. Central government budget constraint holds.

Definition (Steady-State Equilibrium)

A steady state is an equilibrium with time-invariant $\{A_i\}_i$ and $(\phi, \lambda, \tau_y, g)$ satisfying $k_{Git} = k_{Git+1}$ for all i.

Resource Constraint

Equilibrium Allocation in Steady State

Suppose $\log A_i \sim \mathcal{N}(-\sigma_a^2/2, \sigma_a^2)$:

$$\log y(A;\phi,\tau_y,g) = \underbrace{\log Y^R(\phi,\tau_y,g)}_{(1)} + \underbrace{\frac{1}{1-\theta-\alpha(1-\phi)}\log A}_{(2)} + \underbrace{\Omega^y(\sigma_a^2;\phi)}_{(3)}$$

1. ϕ distorts local fiscal spending from investment towards consumption
   $\Rightarrow$ lower output of representative region Y^R
2. ϕ reduces responsiveness of capital and output to TFP
   $\Rightarrow$ lower regional inequality.
3. Effects of heterogeneity

Complete Expression

Aggregate Quantities in Steady State

- Characterize aggregate output and TFP analytically.

$$Y(\phi, \tau_y, g, \sigma_a^2) = \underbrace{Y^R(\phi, \tau_y, g)}_{(1)} \times \underbrace{\widetilde{\text{TFP}}(\phi, \sigma_a^2)}_{(2)}$$

- Effects of rising ϕ
  1. Distorts fiscal spending away from infrastructure investment
     $\Rightarrow$ lower output of the representative region Y^R
  2. Redistributes capital from high- to low-productivity regions
     $\Rightarrow$ lower aggregate efficiency
     $\Rightarrow$ aggregate TFP maximized at $\phi = 0$

Model Prediction

Compare steady state allocation under more redistribution (Higher ϕ)

- Lower pass-through from productivity to infras. investment
- Weaker correlation between output and infras. capital
- Higher convergence rate and lower output dispersion
- Lower aggregate TFP and output

Proof

Quantitative Analysis

- Consider full transition from 1998 to 2017
- Allow region-specific capital wedges τ_{kit}. Firm in region i solves

$$\max_{k_{it}, n_{it}} \pi_{it} = (1 - \tau_{yt}) y_{it} - (1 + \tau_{kit}) R k_{it} - w_{it} n_{it}$$

- $\{\phi_t, \tau_{yt}, g_t, A_{it}, \tau_{kit}\}_{i, t>1998}$ announced in 1998.
  Assume perfect foresight and constant TFP and policy after 2017.
- Counterfactual: $\phi_t = \phi_{1998}$ for all t.

Data

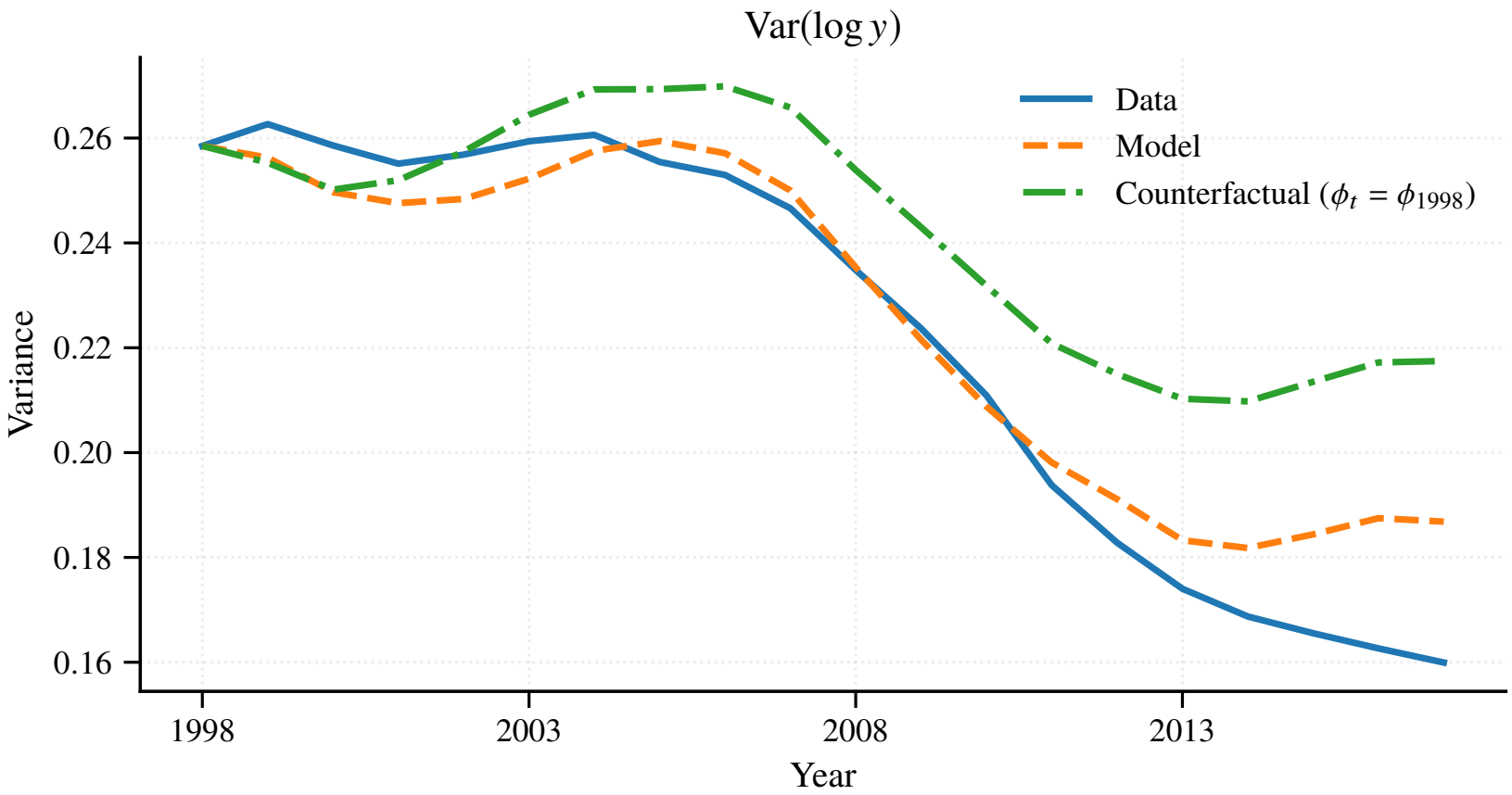
- Fiscal Accounting
  - Central and local government receipt, expenditure, and debt
  - Inter-governmental transfers
  - Source: Yearbook of Finance, Yearbook of Taxation
- Capital Stock
  - Infrastructural and non-infrastructural capital stock
  - Source: Yearbook of Fixed Asset Investment, Yearbook of Statistics

Parameterization

- Policy parameters: $\{\phi_t, \tau_{yt}, g_t\}_t$ estimated from the data
- Set $\beta = 0.96$, $\delta = 0.13$, $R = r + \delta = 0.18$ (Song and Xiong, 2023)
- Technology parameters
  - $\alpha = 0.185$: IV estimation (first stage F-stat: 21)
  - $\theta = 0.315$: 50% labor share in China
- TFP: $\log A_{it} = \log y_{it} - \alpha \log k_{Git} - \theta \log k_{it}$
- Capital wedges: $\log(1 + \tau_{kit}) = \log\left(\frac{\theta(1-\tau_{yt})}{R}\right) + \log\left(\frac{y_{it}}{k_{it}}\right)$
- $\chi^L = 0.23$: SMM to match infrastructure investment-output ratio.

Public Investment-Output Ratio | Correlation between Public Capital and Output

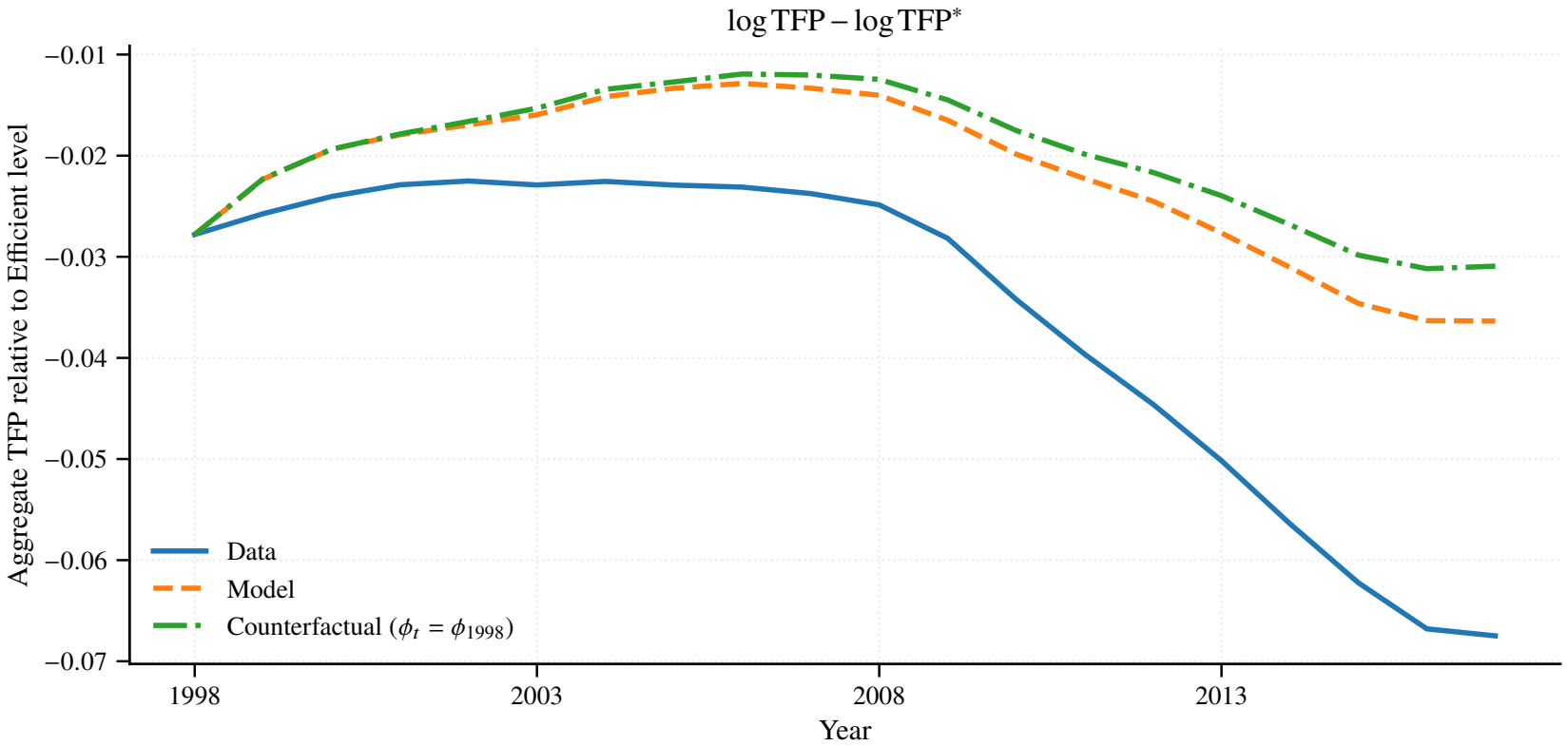
Regional Convergence



- Rising progressivity contributes to 43% of declining variance of log GDP p.c.

β Convergence

Aggregate Efficiency



Note: TFP^* denotes aggregate TFP at the efficient level.

- Rising progressivity reduced aggregate TFP by 0.5 ppt. Aggregate Y and K_G

Normative Analysis

- The central government problem ($\beta \to 1$)

$$\max_{\phi,\tau_y,g} \quad \mathcal{W}(\phi,\tau_y,g) = \int W(a_i)u(c_i,G_i,G^C)dF_a(a)$$

subject to the budget constraint.

$$W(a;\gamma) = \frac{\exp(-\gamma a)}{\int \exp(-\gamma a)dF_a(a)}, \quad a = \log A$$

- Forces determining optimal progressivity
  - Central government consumption G^C: $\phi \downarrow$
  - Redistribution motive: $\phi \uparrow$
  - Efficiency cost: $\phi \to 0$

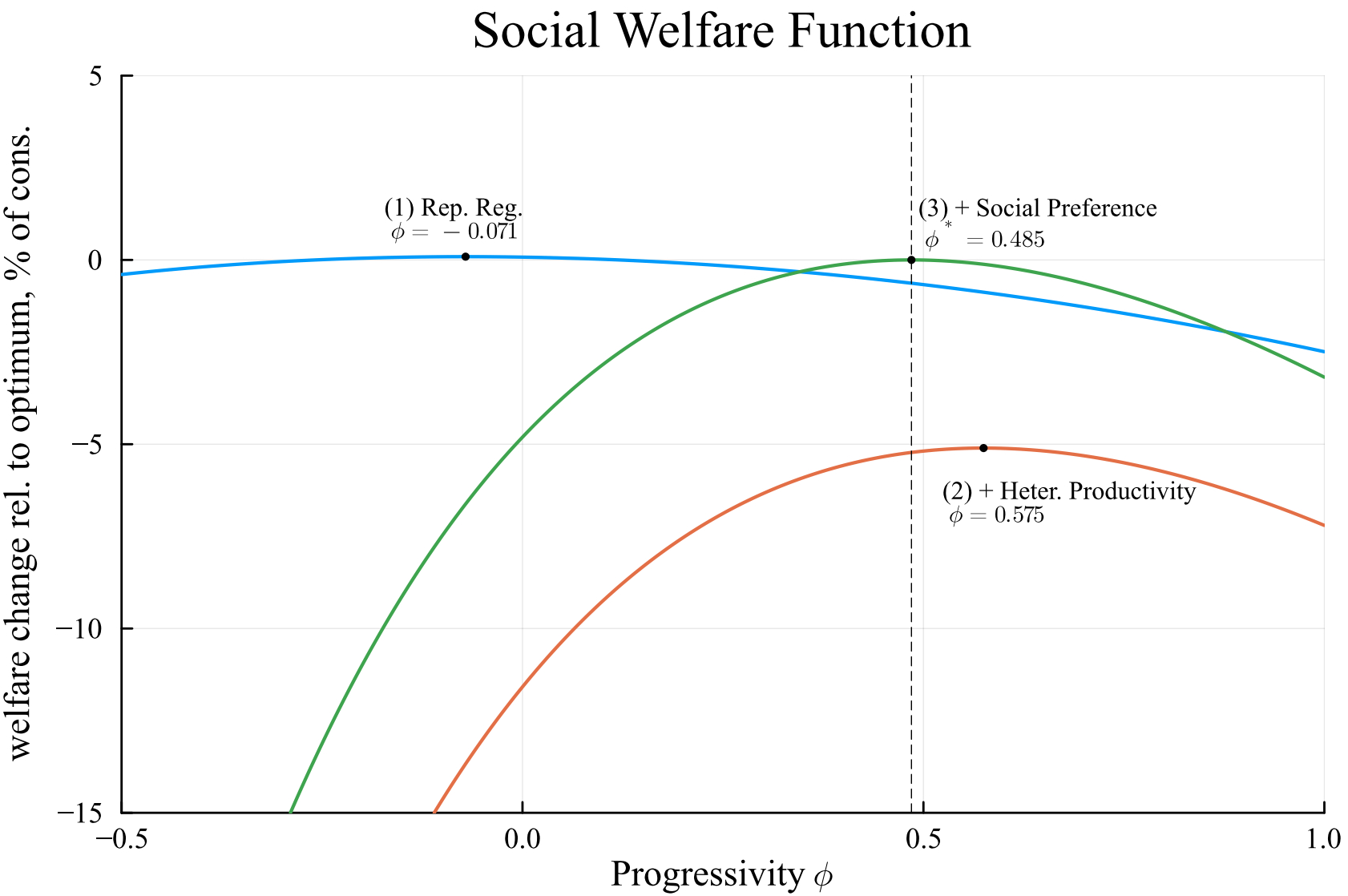
Closed-form Social Welfare Function

Determining Optimal Progressivity

- Representative region model ($\sigma_a^2 = 0$)
  - No need for redistribution
  - To mimic lump-sum transfer: MTR=0
  - To finance central government consumption G^C: ATR=g/τ_y
  - MTR $<$ ATR $\Rightarrow$ Regressivity $\phi^{R*} < 0$
- When should $\phi^* > 0$?
  - Welfare gains from reducing inequality and increasing local public goods exceed welfare loss from depressing govt investment
- Next step: parameterization (2013-2017)
  - (χ^L, χ^C, γ) calibrated to rationalize the observed policy (ϕ, τ_y, g).

Condition for Optimal Progressivity | Mapping from (ϕ, τ_y, g) to (χ^L, χ^C, γ)

Decompose Social Welfare Function, 2013-2017



Optimal Progressivity under Different Parameters

γ	(1) Baseline	(2) $\chi^L = 0$	(3) $\chi^C = 0$	(4) Larger σ_a^2	(5) $\alpha = 0.05$	(6) $\alpha = 0.3$
1. -0.279 (Baseline)	0.485	0.577	0.508	0.531	0.714	0.379
2. 0 (Utilitarian)	0.575	0.695	0.601	0.633	0.838	0.450
3. ∞(Rawlsian)	1.000	1.000	1.000	1.000	1.000	1.000
4. $-\frac{1}{1-\alpha-\theta}$(Laissez-faire)	-0.007	0.000	0.000	-0.003	-0.005	-0.006
5. 0.5	0.741	0.928	0.774	0.827	1.000	0.582
6. -0.5	0.416	0.490	0.436	0.453	0.617	0.324

Conclusion

- I empirically document that:
  - Progressivity of inter-government redistribution increased from 0.2 in 1998 to 0.5 in 2017
  - Increased redistribution depresses local government investment and lowers GDP growth.
  - IV estimate of output elasticity of infrastructure capital: 0.185.
- I build a general equilibrium framework and quantify that:
  - Rising progressivity contributes to 43% of the declining variance of log GDP p.c. from 1998 to 2017.
  - Rising progressivity reduces aggregate TFP by 0.5 ppt.
  - Observed progressivity is close to utilitarian optimal.

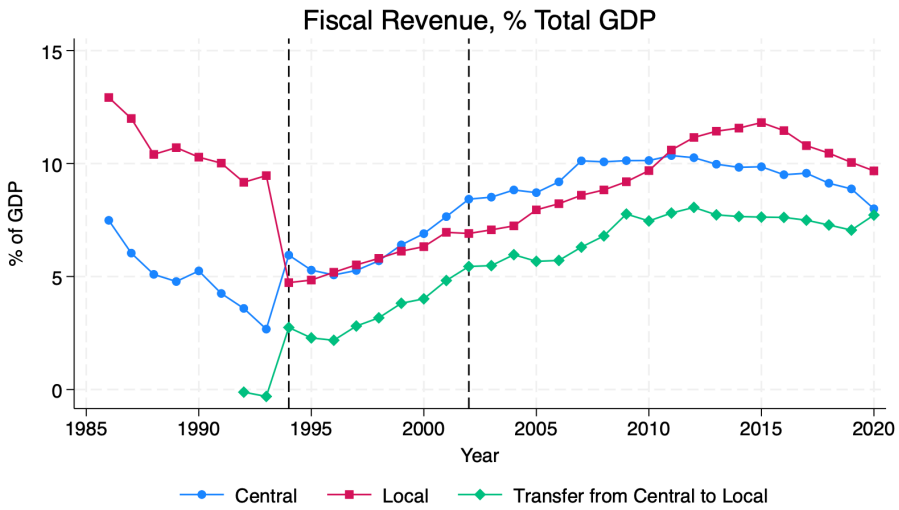
Future Research

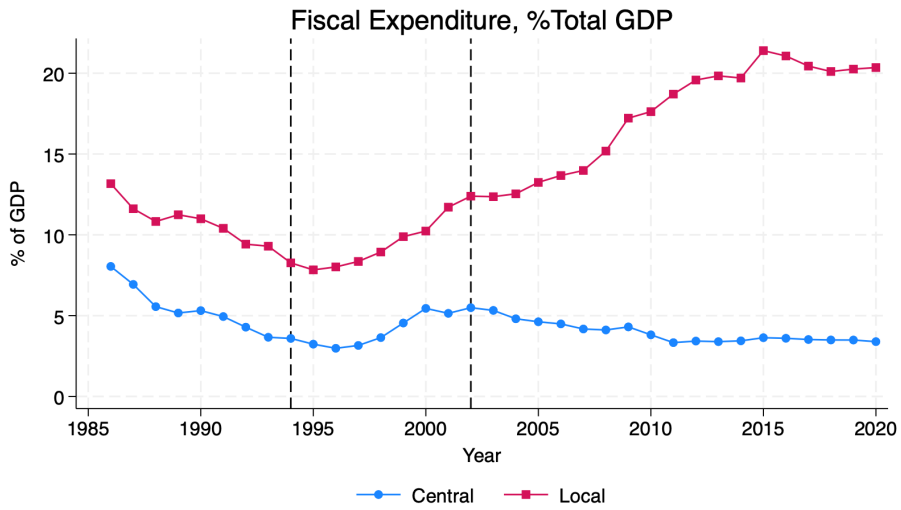
- Politico-growth theory of central and local politics
  - Political economy
    - Young: govt investment vs. Old: public goods
    - Local (no commitment) vs. Central (commitment)
  - Characterize local fiscal policy, regional dynamics, and steady state under progressive redistribution in Markov-perfect equilibrium.
  - Solve for time-varying optimal redistribution policy in a heterogeneous-region environment.
  - Policy implications in aging period
    - Local: purchase more public goods and reduce investment
    - Central: reduce redistribution to strength local investment incentives.

Future Research

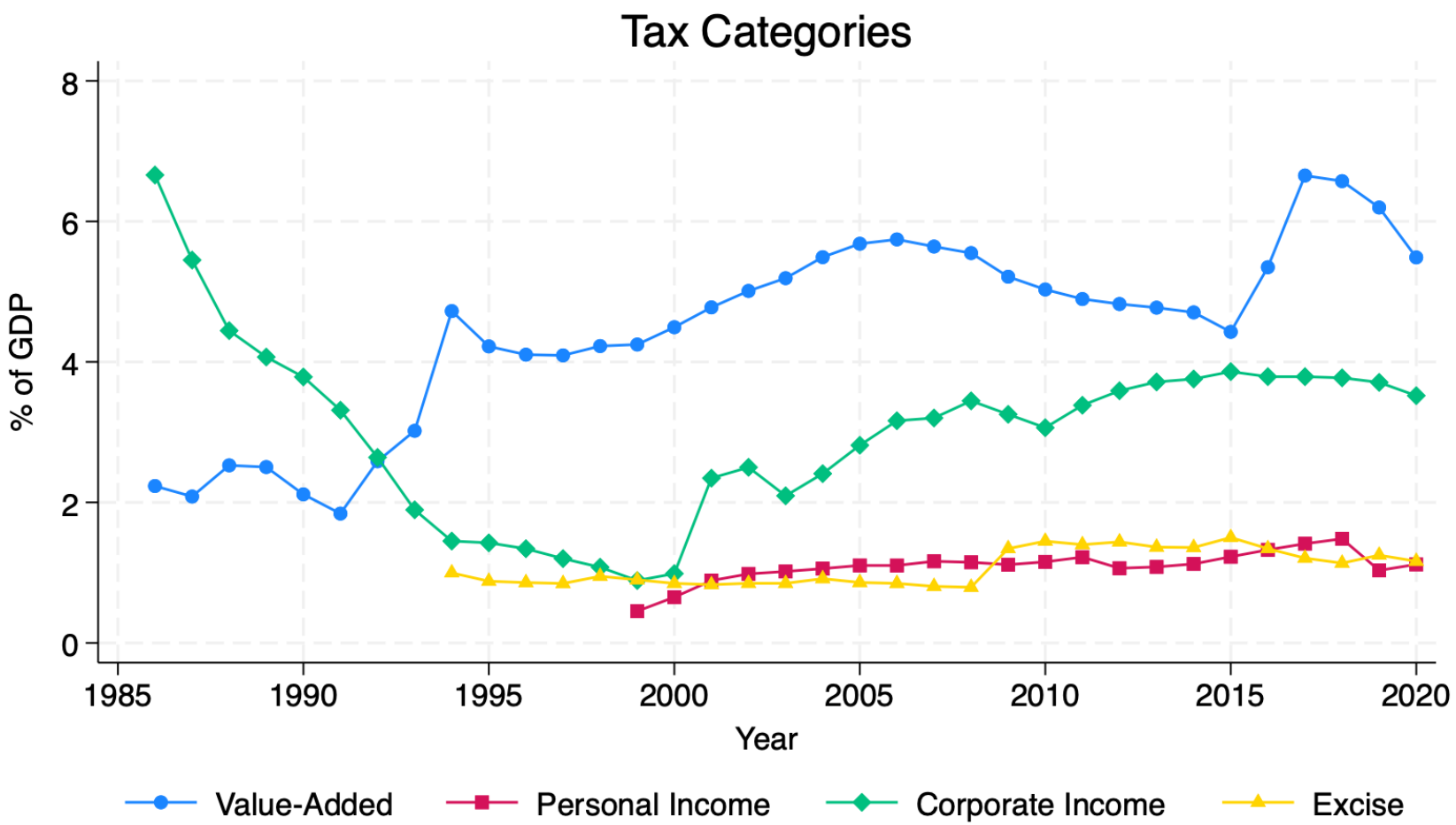
- Redistribution across households vs. across regions
  - Progressivity of regional redistribution increases drastically while progressivity of income taxes is almost unchanged in China.
- Spatial analysis with regional redistribution
  - Positive: redistribution $\Rightarrow$ equalized infrastructure and amenities $\Rightarrow$ industrial agglomeration and labor migration?
  - Normative: high-ability young workers move from low- to high-TFP regions $\Rightarrow$ how to support health and education in low-TFP regions?
- Regional redistribution in different institutions
  - Federal systems: US, Canada, etc.
  - Global organizations: EU, ASEAN

Tax Sharing between the Central and Local Governments





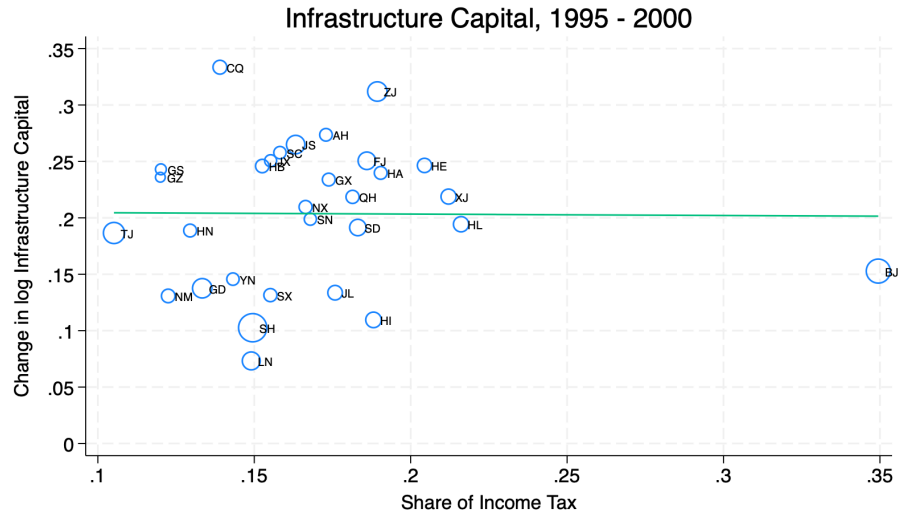
Tax Categories Shared with Central Government

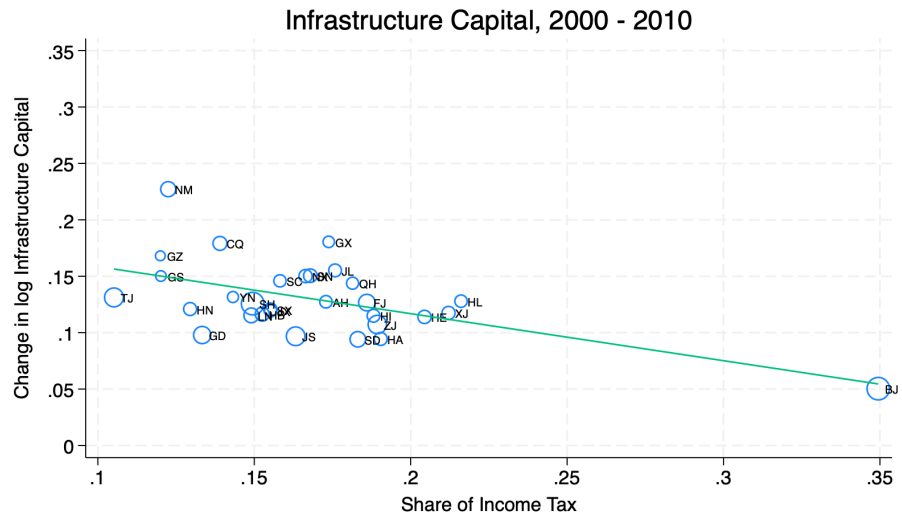


Fiscal Revenue

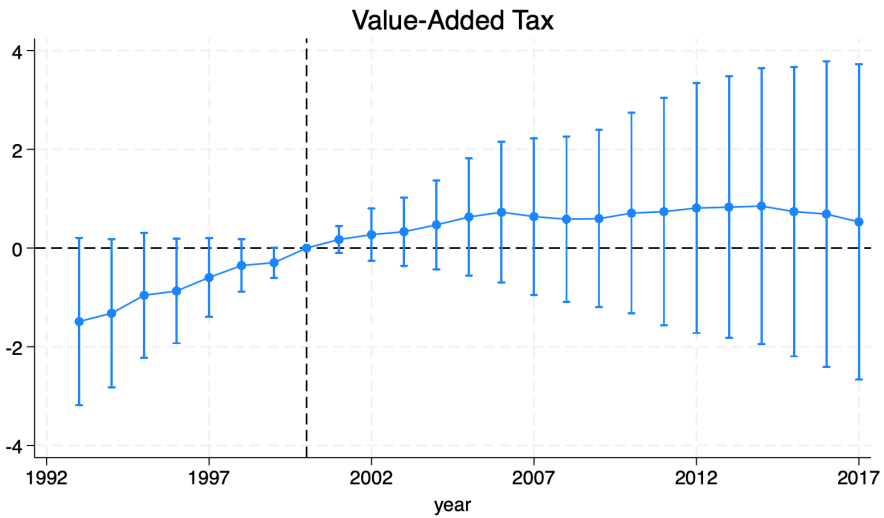
- Budgetary revenue
  - Tax: VAT, excise tax, business tax, income tax, ...
  - Non-tax: administrative charges, fines and penalties, ...
- Extra-budgetary revenue (1995-2010)
- Land-sale revenue (1998-2017)

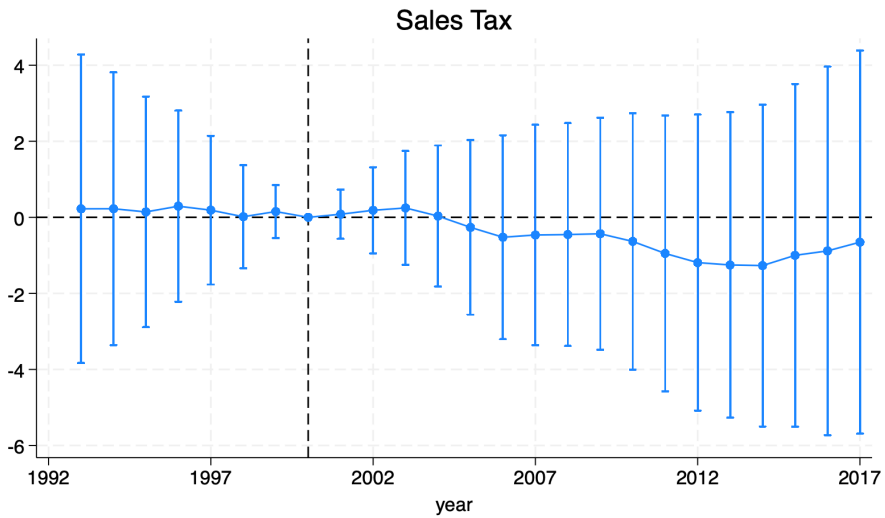
Scatter Plot

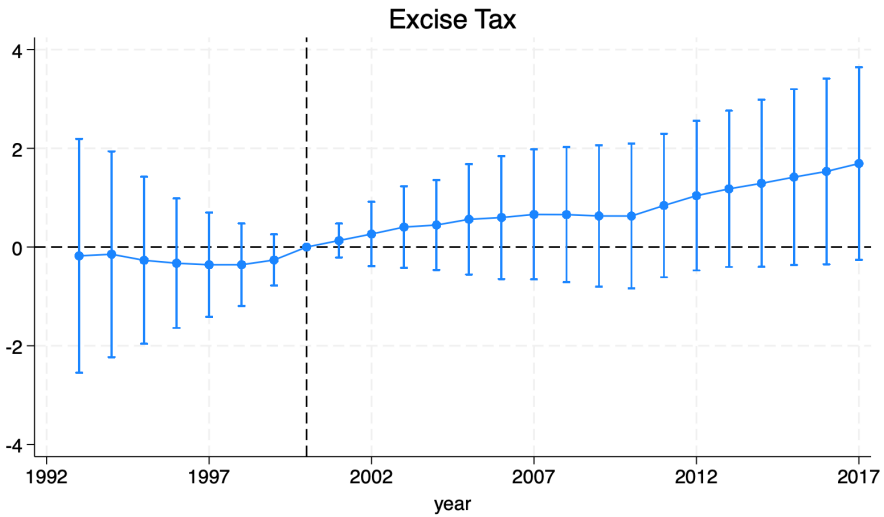


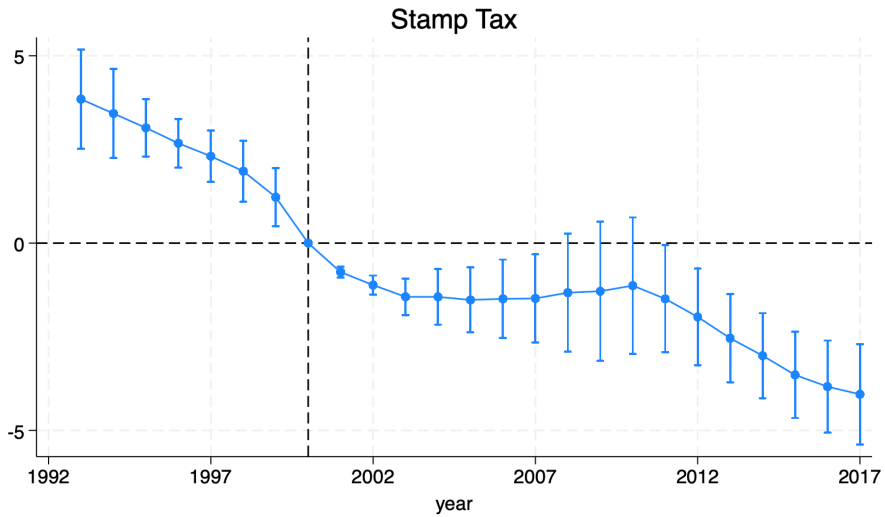


Placebo Test









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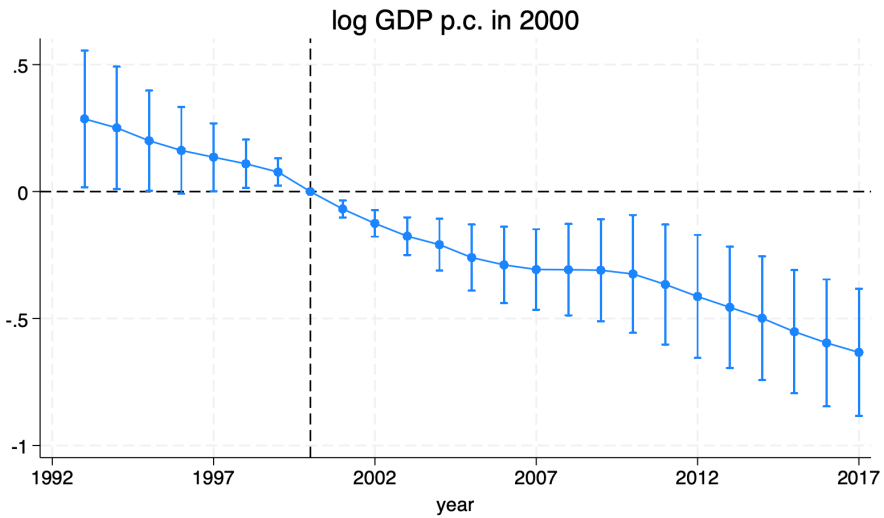
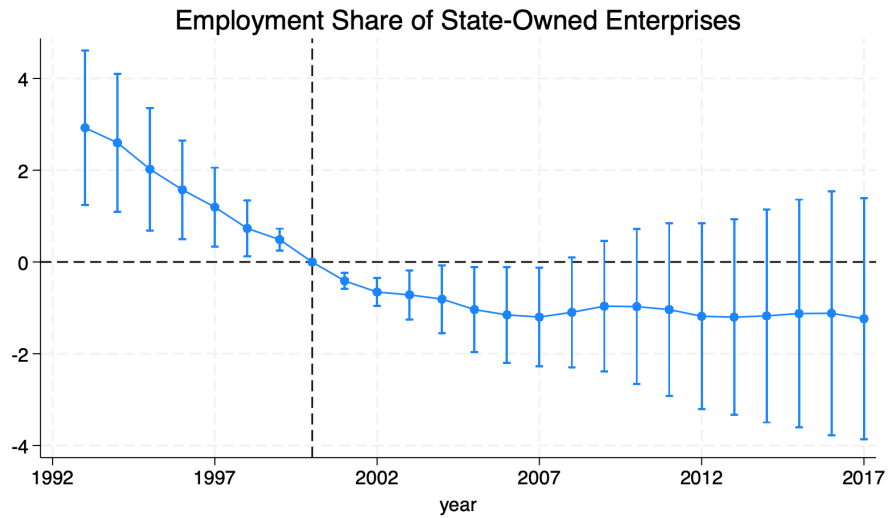
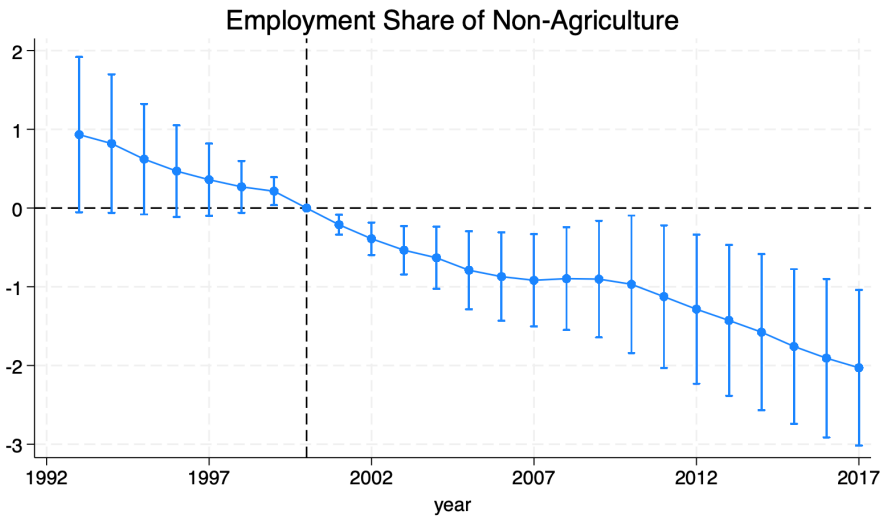
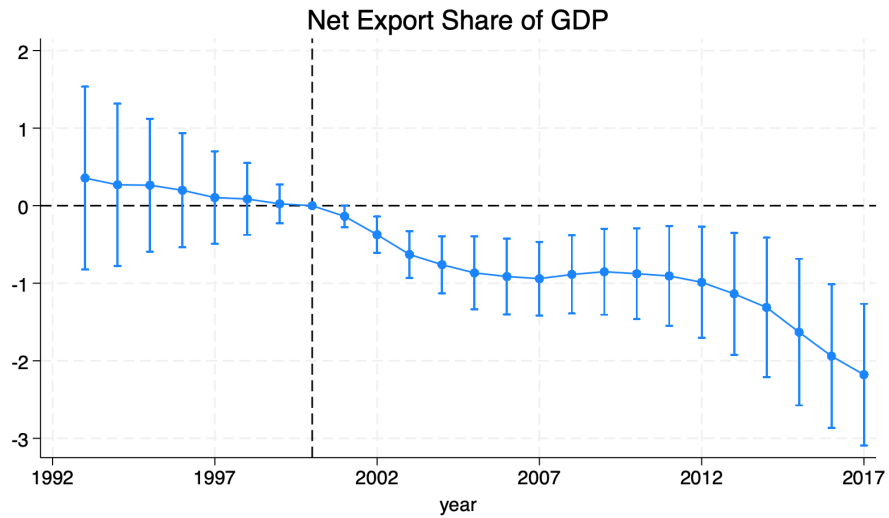
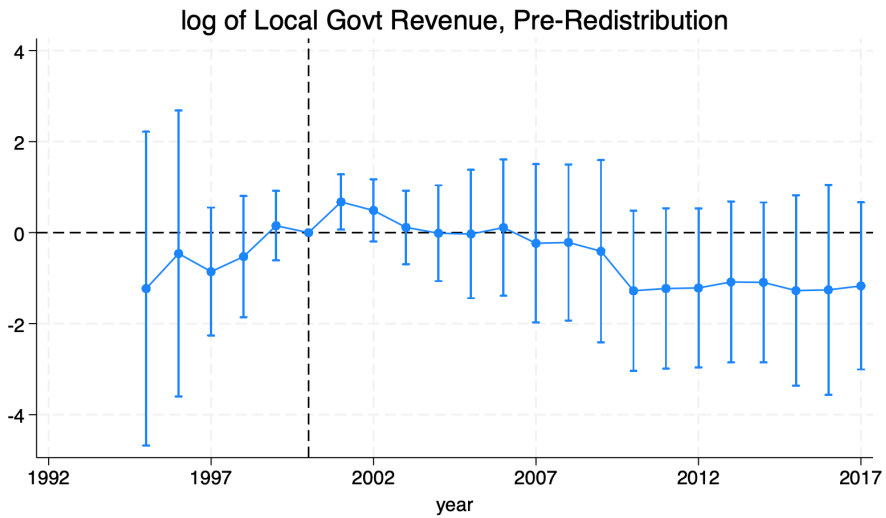


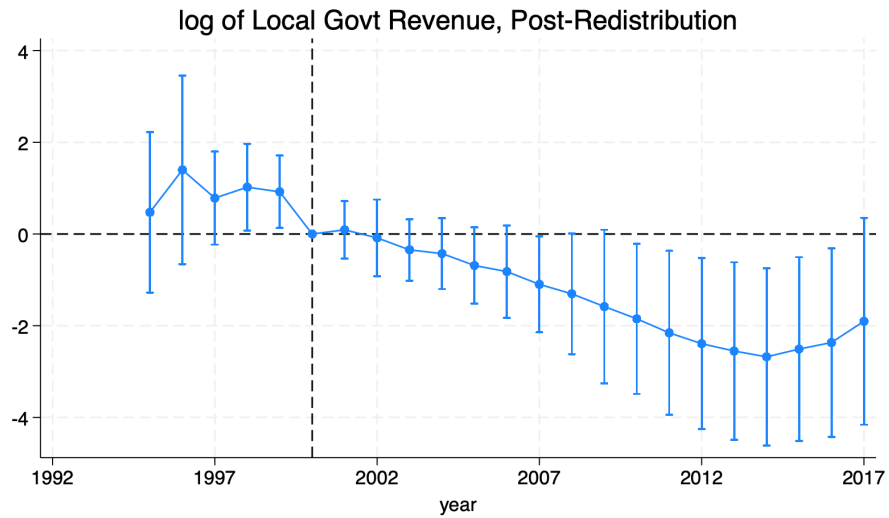


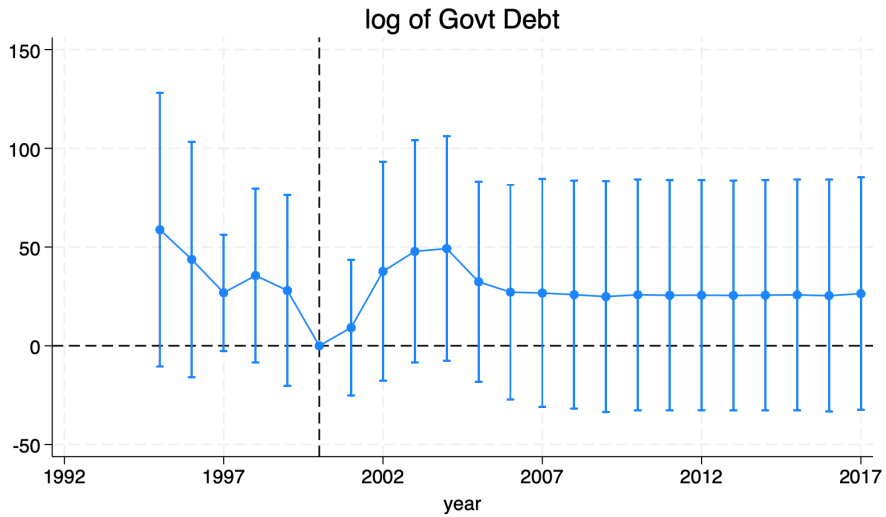


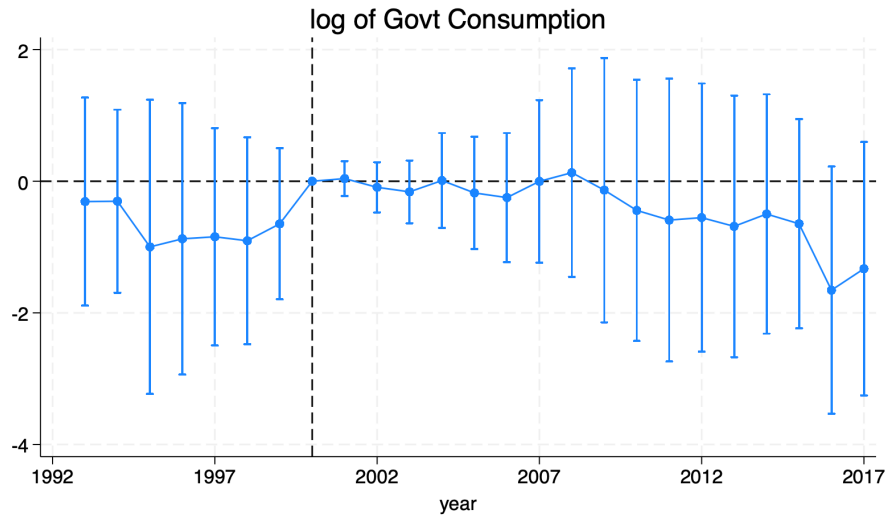


Additional Results of the Event Study









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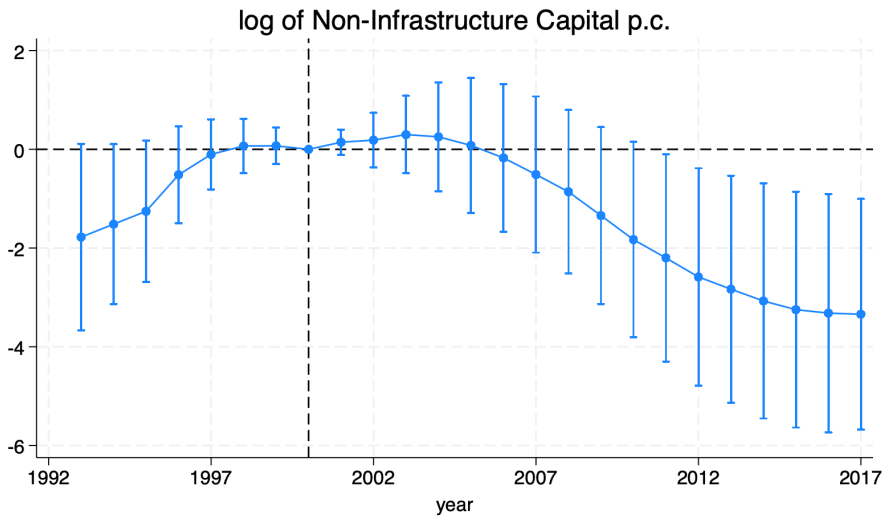
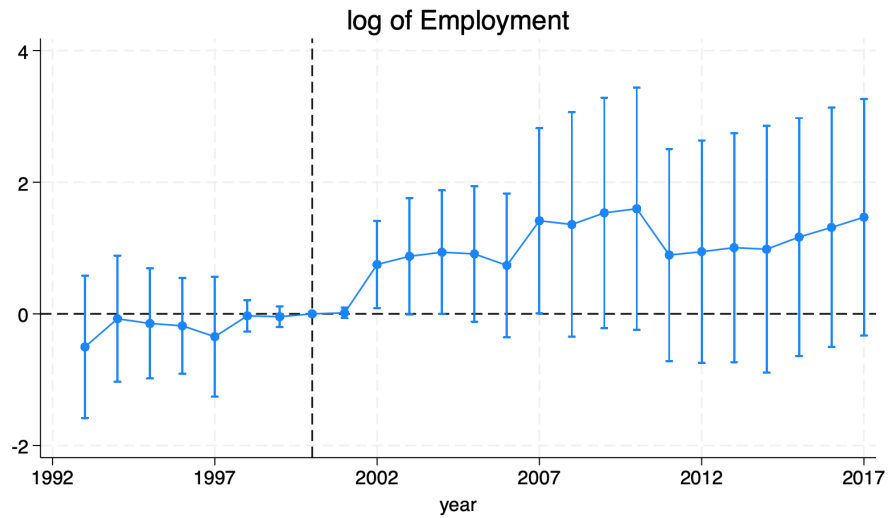
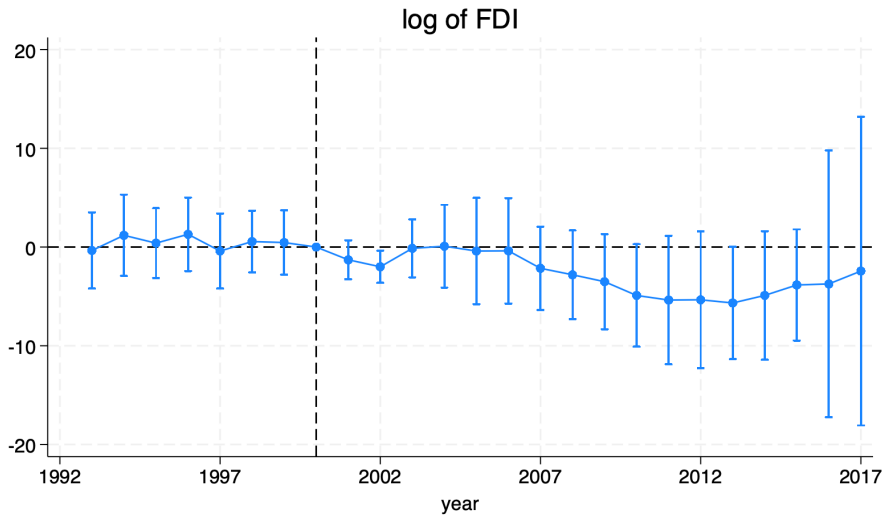
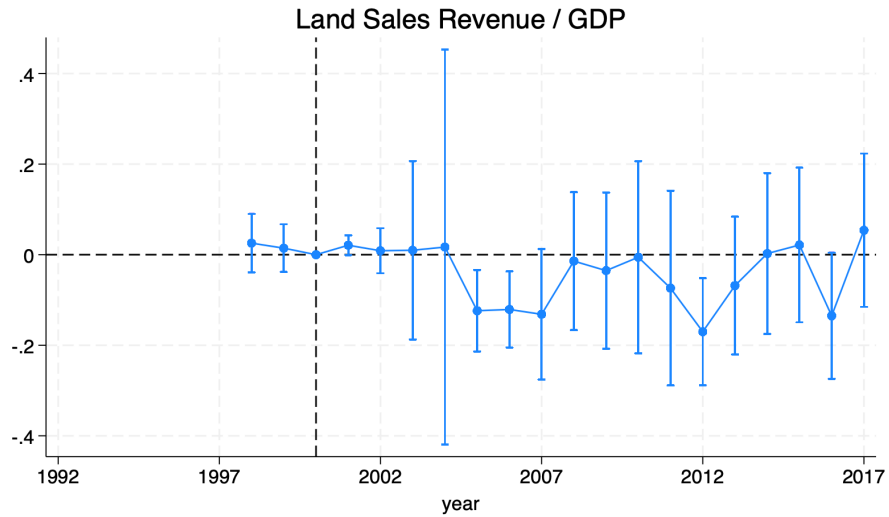








Other Elasticity

- One standard deviation (0.04) increase in pre-reform share of income taxes Z_i reduces infras. capital by 17% and GDP by 6%.
- Fiscal multiplier
  - 1 dollar increase in local government spending p.c. increases GDP p.c. by 1.3 - 2.0 dollars.
  - Weak IV: total government spending are less responsive to IV than govt investment.

Closed-form Steady-State Equilibrium Allocation

- Representative region allocation:

$$\log Y^R(\phi, \tau_y, g) = \frac{\theta}{1-\theta-\alpha} \log\left(\frac{\theta(1-\tau_y)}{R}\right) + \frac{\alpha}{1-\theta-\alpha} \log(\tau_y - g)$$
$$+ \frac{\alpha}{1-\theta-\alpha} \log \underbrace{\left(\frac{\alpha\beta(1+\chi^L(1-\phi))}{\chi^L(1-\theta)(1-\beta(1-\delta))+\alpha\beta\delta}\right)}_{\propto \text{ spending share of investment}}$$

- The effect of heterogeneity

$$\Omega^y(\sigma_a^2;\phi) = -\frac{\alpha\phi[\theta+(1+\alpha)(1-\phi)]}{(1-\theta-\alpha)(1-\theta-\alpha(1-\phi))^2}\frac{\sigma_a^2}{2}$$

Resource Constraint

Aggregate output $Y = \int y_i di$ equals to the sum of

- Houshold consumption: $\int c_i di = \int w_i + \pi_i di$
- Interest payment to foreign lenders: $\int Rk_i di$
- Local government expenditure: $\lambda \int (\tau_y y_i)^{1-\phi} di$
- Central government consumption: G^C

Closed-Form Expression of Aggregate Quantities

- Aggregate output

$$\log Y(\sigma_a^2; \phi, \tau_y, g) = \log Y^R(\phi, \tau_y, g) + \frac{1}{1-\theta-\alpha} \log \mathrm{TFP}(\sigma_a^2; \phi)$$

- Aggregate TFP (Solow residual)

$$\log \mathrm{TFP}(\sigma_a^2; \phi) = \frac{\theta+\alpha}{1-\theta-\alpha}\frac{\sigma_a^2}{2} - \underbrace{\frac{\alpha(1-\theta)\phi^2}{(1-\theta-\alpha(1-\phi))^2(1-\theta-\alpha)}\frac{\sigma_a^2}{2}}_{\text{Distortion}}$$

Proof of Model Prediction

- Correlation between public capital and initial output

$$\frac{\text{cov}(\log k_G(\phi_1), \log y(\phi_0))}{\text{var}(\log y(\phi_0))} = (1-\phi_1)\frac{1-\theta-\alpha(1-\phi_0)}{1-\theta-\alpha(1-\phi_1)}$$

- Higher convergence rate

$$\frac{\text{cov}(\Delta \log y(\phi_1), \log y(\phi_0))}{\text{var}(\log y(\phi_0))} = \frac{\alpha(\phi_0-\phi_1)}{1-\theta-\alpha(1-\phi_1)}$$

- Lower output dispersion

$$\text{var}(\log y(a;\phi,\tau_y,g)) = \frac{\sigma_a^2}{(1-\theta-\alpha(1-\phi))^2}$$

- Lower aggregate output and TFP

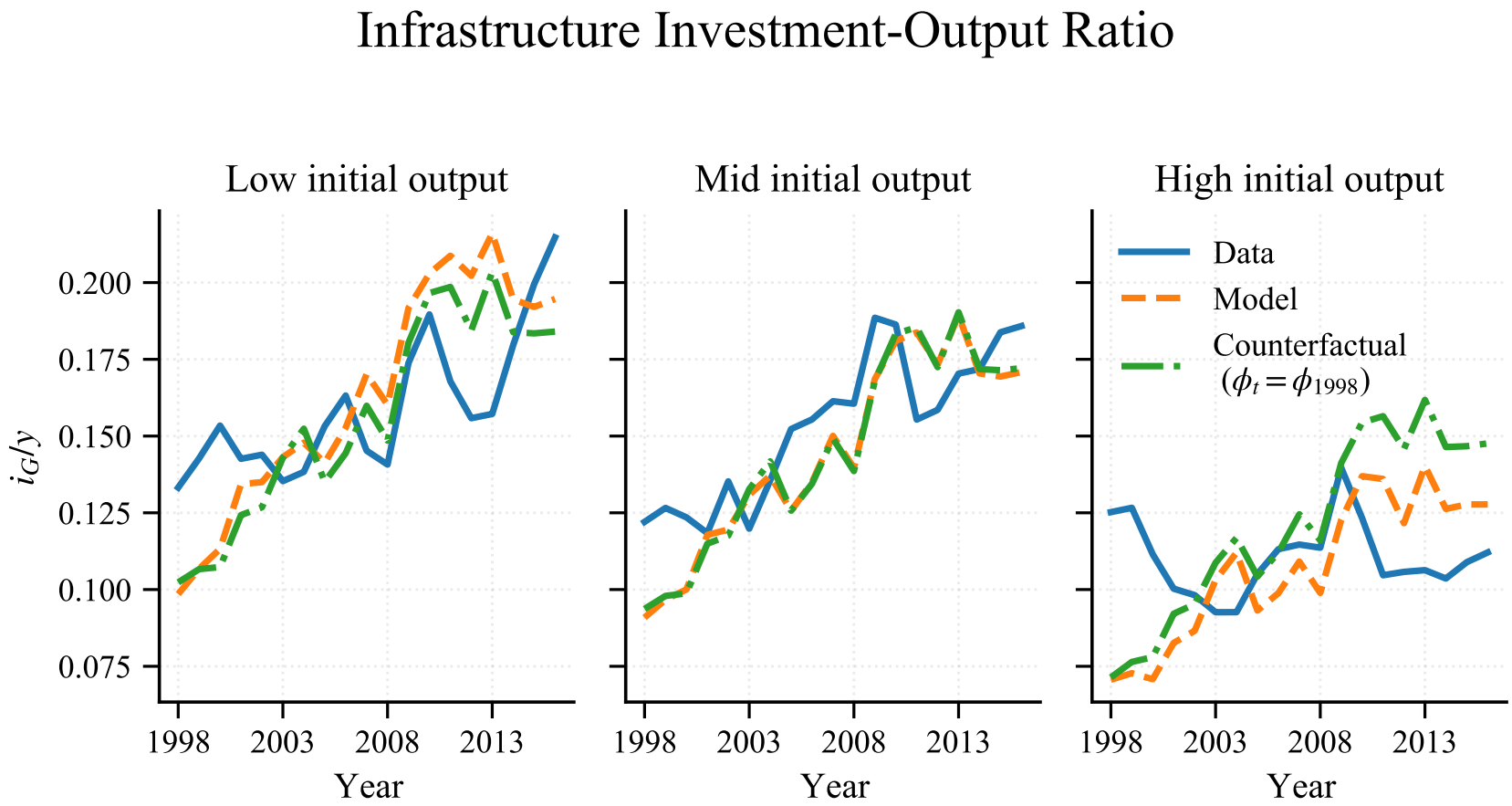
$$\log Y(\sigma_a^2;\phi,\tau_y,g) = \log Y^R(\phi,\tau_y,g) + \frac{1}{1-\theta-\alpha}\log \text{TFP}(\sigma_a^2;\phi)$$

$$\log \text{TFP}(\sigma_a^2;\phi) = \frac{\theta+\alpha}{1-\theta-\alpha}\frac{\sigma_a^2}{2} - \frac{\alpha(1-\theta)\phi^2}{(1-\theta-\alpha(1-\phi))^2(1-\theta-\alpha)}\frac{\sigma_a^2}{2}$$

Results of IV Estimation

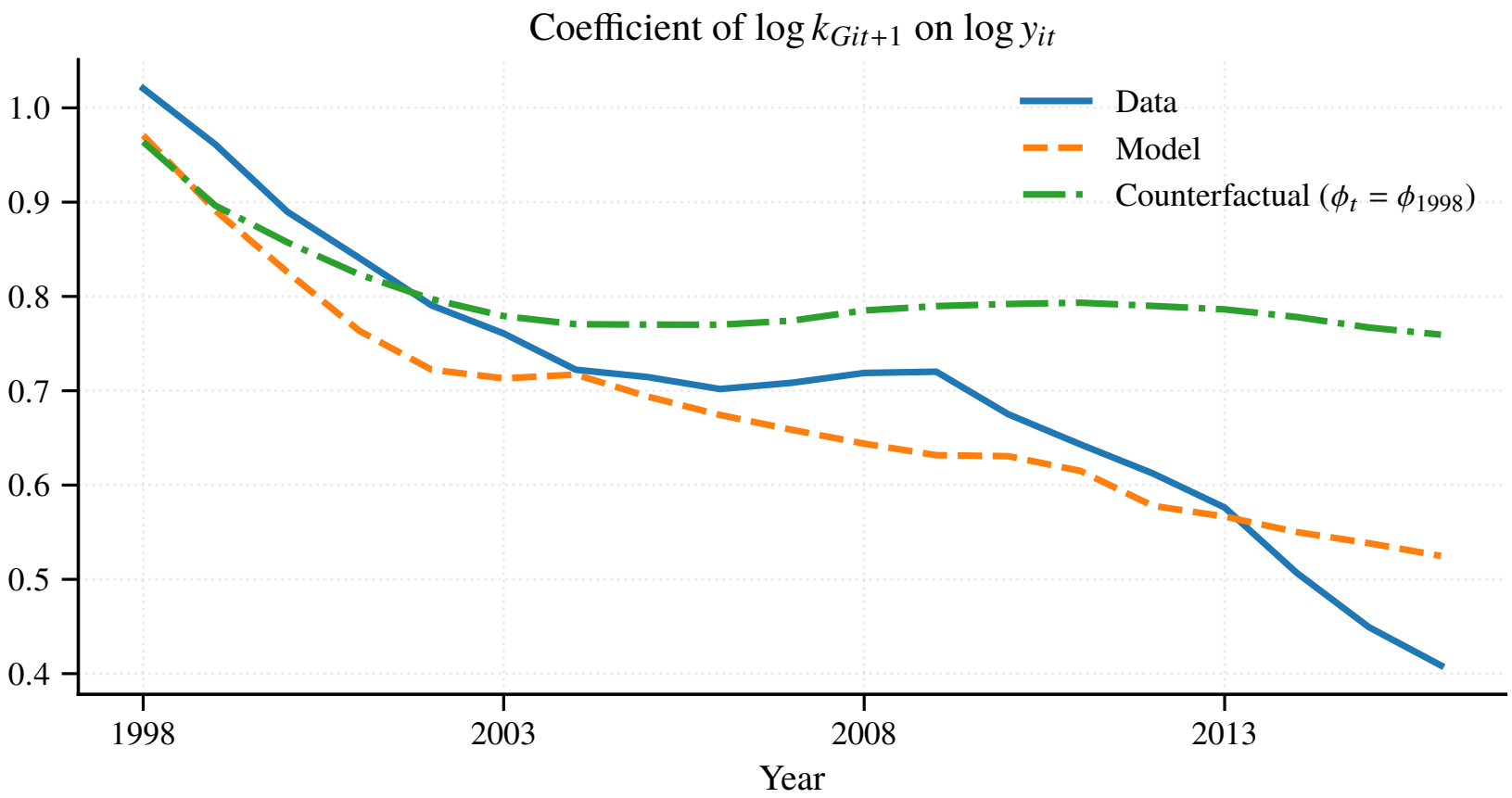
	1993-2000		2001-2010							
	OLS		OLS		OLS First Stage		OLS Second Stage		IV	
	$\Delta \log k_G$	$\Delta \log y$	$\Delta \log y$		$\Delta \log k_G$		$\Delta \log y$		$\Delta \log y$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z_i	-0.153	-0.048			-0.476***	-0.473***	-0.090**	-0.087***		
	(0.200)	(0.050)			(0.105)	(0.104)	(0.041)	(0.032)		
$\Delta \log k_G$			0.117**	0.095**					0.189**	0.185***
			(0.051)	(0.044)					(0.080)	(0.065)
$\Delta \log k$				0.167***		0.184		0.183***		0.149***
				(0.044)		(0.127)		(0.050)		(0.049)
Constant	0.233***	0.088***	0.080***	0.065***	0.217***	0.196***	0.111***	0.091***	0.051***	0.041***
	(0.040)	(0.010)	(0.007)	(0.008)	(0.023)	(0.023)	(0.008)	(0.008)	(0.014)	(0.011)
R^2	0.026	0.078	0.316	0.475	0.307	0.328	0.268	0.467	0.271	0.407
Observations	210	210	300	300	300	300	300	300	300	300
F-stat					20.33	20.69				

Public Investment-Output Ratio



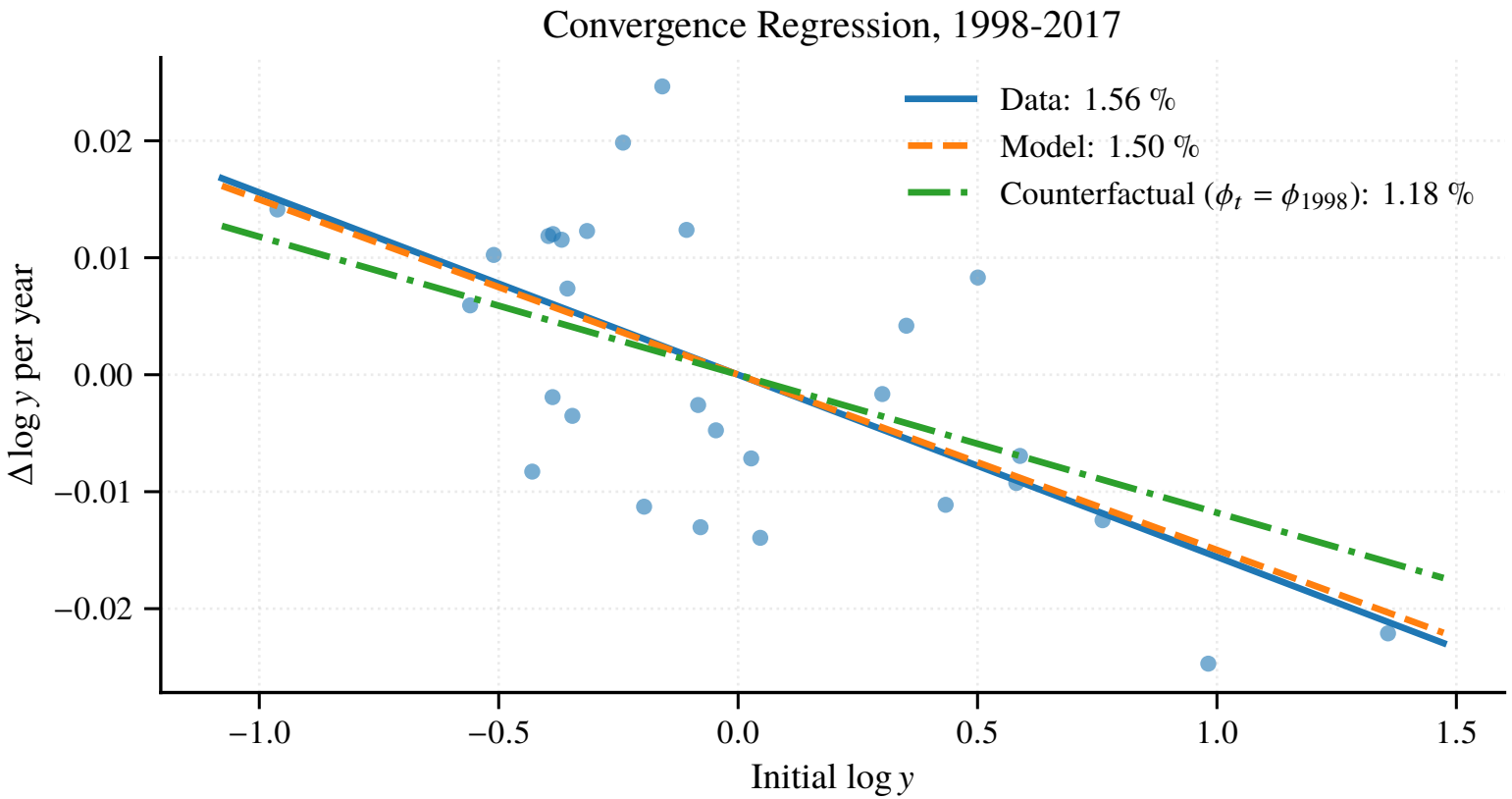
- Rising progressivity reduces the pass-through from productivity to govt. investment.

Correlation between Public Capital and Output



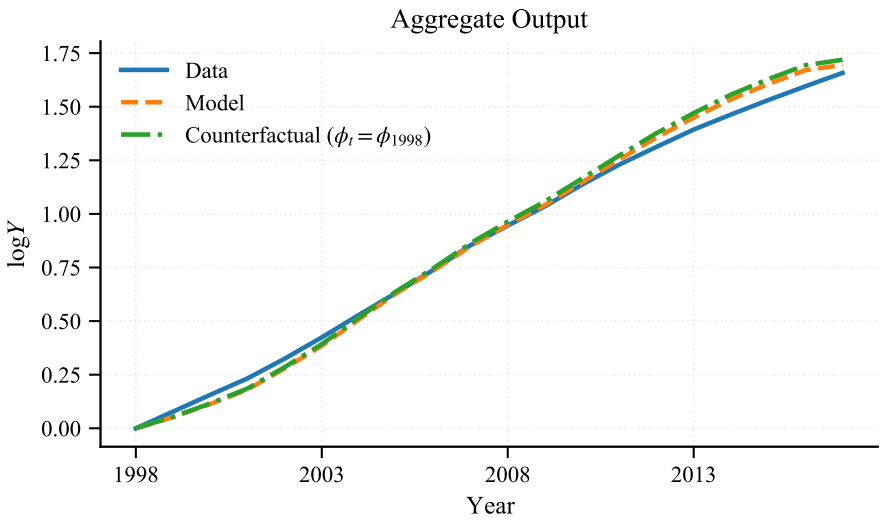
- Rising progressivity explains 54% of reduction in correlation between output and infrastructure capital.

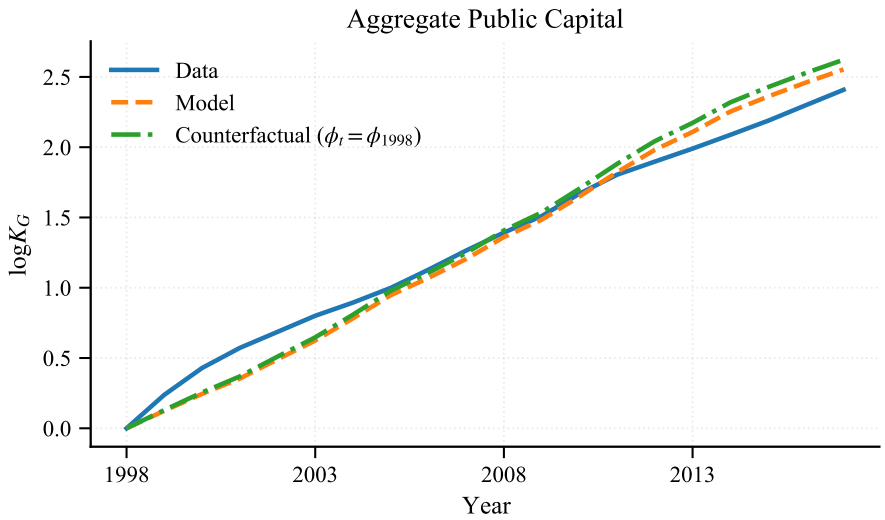
β Convergence



- Rising progressivity contributes to 21% of β convergence.

Aggregate Quantities





Closed-form Social Welfare Function

$$\mathcal{W}(\phi, \tau_y, g) =$$

$$\begin{cases} \dfrac{\alpha(1+\chi^C)+\chi^L(1-\theta)}{1-\theta-\alpha}\log(\tau_y - g) + \dfrac{1-\alpha+\theta(\chi^L+\chi^C)}{1-\theta-\alpha}\log(1-\tau_y) + \chi^C \log g \\ + \dfrac{(1-\theta)\chi^L+\alpha(1+\chi^C)}{1-\theta-\alpha}\log\left(\dfrac{\alpha(1+\chi^L(1-\phi))}{\alpha+\chi^L(1-\theta)}\right) + \chi^L \log\left(\dfrac{\chi^L(1-\theta-\alpha(1-\phi))}{\alpha(1+\chi^L(1-\phi))}\right) \\ + \dfrac{1+\chi^L+\chi^C}{1-\theta-\alpha}\left[\dfrac{\theta+\alpha}{1-\theta-\alpha}\dfrac{\sigma_a^2}{2} - \dfrac{\alpha(1-\theta)\phi^2}{(1-\theta-\alpha)(1-\theta-\alpha(1-\phi))^2}\dfrac{\sigma_a^2}{2}\right] \\ - \dfrac{1}{(1-\theta-\alpha(1-\phi))^2}\dfrac{\sigma_a^2}{2} - \dfrac{\chi^L(1-\phi)^2}{(1-\theta-\alpha(1-\phi))^2}\dfrac{\sigma_a^2}{2} \\ - \dfrac{(1+\chi^L(1-\phi))}{1-\theta-\alpha(1-\phi)}\gamma\sigma_a^2 \end{cases}$$

Optimal Progressivity Results

- In representative region model $\sigma_a^2 = 0$

$$\phi^{R*} = -\frac{(1-\theta-\alpha)\chi^C}{\alpha(1+\chi^C)+(1-\theta)\chi^L}$$

- The optimal level of ϕ should be strictly positive if and only if

$$\underbrace{\frac{\chi^L(1-\theta)+\alpha}{(1-\theta-\alpha)^2}\sigma_a^2}_{\text{(a) less inequality due to TFP dispersion}} + \underbrace{\frac{\chi^L(1-\theta)+\alpha}{1-\theta-\alpha}\gamma\sigma_a^2}_{\text{(b) more redistribution}} + \underbrace{\alpha\chi^L}_{\text{(c) more local govt. cons.}}$$

$$> \underbrace{\frac{\alpha\chi^L}{1+\chi^L}(1+\chi^C+\chi^L)}_{\text{(d) less hh. and govt. cons. due to less } k_G}$$

Mapping from (ϕ, τ_y, g) to (χ^L, χ^C, γ)

- Optimal tax rate

$$\tau_y^* = \frac{\alpha + (1-\theta)(\chi^L + \chi^C)}{1 + \chi^L + \chi^C}$$

- Optimal central government consumption

$$g^* = \frac{(1-\alpha-\theta)\chi^C}{1 + \chi^L + \chi^C}$$

- Infer γ from observed $\hat{\phi}$

$$\begin{aligned}\frac{\chi^L(1-\theta)+\alpha}{(1-\theta-\alpha(1-\hat{\phi}))^2}\sigma_a^2\gamma = {} & \frac{\alpha(1+\chi^L+\chi^C)}{1-\theta-\alpha}\frac{\chi^L}{1+\chi^L(1-\hat{\phi})} - \frac{\alpha\chi^L}{1-\theta-\alpha(1-\hat{\phi})} \\ & + \frac{(1+\chi^L+\chi^C)\alpha(1-\theta)}{1-\theta-\alpha}\frac{\hat{\phi}}{(1-\theta-\alpha(1-\hat{\phi}))^3}\sigma_a^2 \\ & - \frac{\alpha+\chi^L(1-\hat{\phi})(1-\theta)}{(1-\theta-\alpha(1-\hat{\phi}))^3}\sigma_a^2\end{aligned}$$

References I

Barro, Robert J, "Government spending in a simple model of endogeneous growth," *Journal of political economy*, 1990, *98* (5, Part 2), S103–S125.

Benabou, Roland, "Tax and education policy in a heterogeneous-agent economy: What levels of redistribution maximize growth and efficiency?," *Econometrica*, 2002, *70* (2), 481–517.

Bom, Pedro RD and Jenny E Ligthart, "What have we learned from three decades of research on the productivity of public capital?," *Journal of economic surveys*, 2014, *28* (5), 889–916.

Brandt, Loren, Gueorgui Kambourov, and Kjetil Storesletten, "Barriers to entry and regional economic growth in China," *Review of Economic Studies*, 2025, p. rdaf029.

References II

Chari, Varadarajan V, Patrick J Kehoe, and Ellen R McGrattan, "Business cycle accounting," *Econometrica*, 2007, *75* (3), 781–836.

Hao, Tongtong, Ruiqi Sun, Trevor Tombe, and Xiaodong Zhu, "The effect of migration policy on growth, structural change, and regional inequality in China," *Journal of Monetary Economics*, 2020, *113*, 112–134.

Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L Violante, "Optimal tax progressivity: An analytical framework," *The Quarterly Journal of Economics*, 2017, *132* (4), 1693–1754.

Hsieh, Chang-Tai and Peter J Klenow, "Misallocation and manufacturing TFP in China and India," *The Quarterly journal of economics*, 2009, *124* (4), 1403–1448.

References III

Restuccia, Diego and Richard Rogerson, "Policy distortions and aggregate productivity with heterogeneous establishments," *Review of Economic dynamics*, 2008, *11* (4), 707–720.

Song, Zheng and Wei Xiong, "The Mandarin model of growth," 2023.

_ , Kjetil Storesletten, and Fabrizio Zilibotti, "Growing like china," *American economic review*, 2011, *101* (1), 196–233.

Tombe, Trevor and Xiaodong Zhu, "Trade, migration, and productivity: A quantitative analysis of China," *American Economic Review*, 2019, *109* (5), 1843–1872.