Common Goods & Distribution

Public Finance and Environmental Policy in an Unequal World

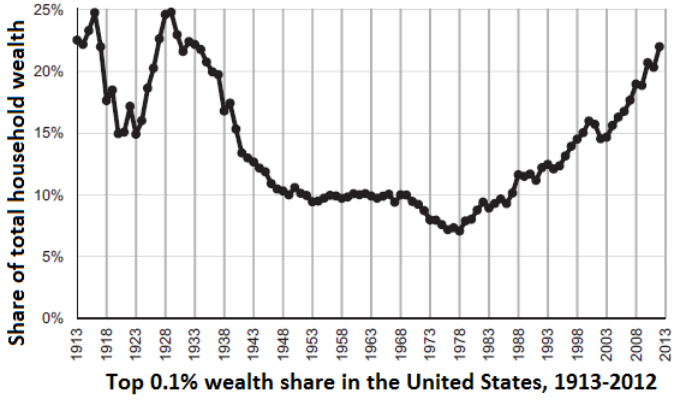
David Christian Klenert

Wissenschaftliche Aussprache

Technische Universität Berlin, 29. September 2016

Three key challenges for tax policy in the 21st century

- Inequality



Saez and Zucman (2016)

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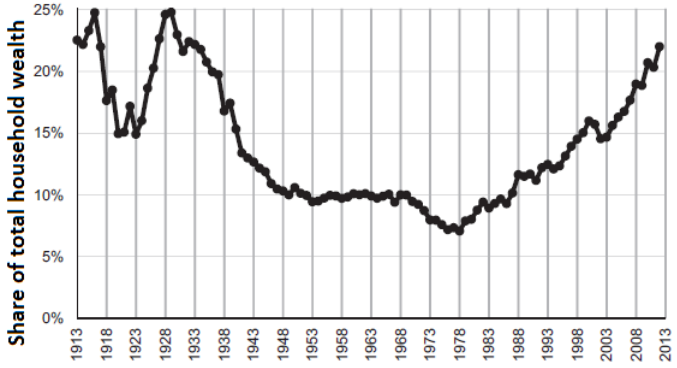

Top 0.1% wealth share in the United States, 1913-2012

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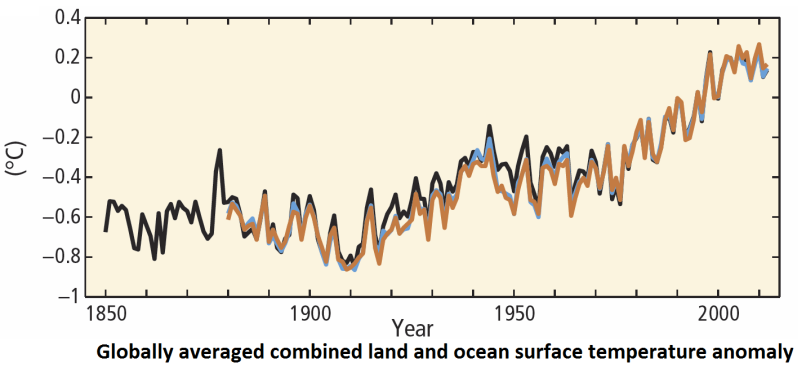
- Climate change



Globally averaged combined land and ocean surface temperature anomaly

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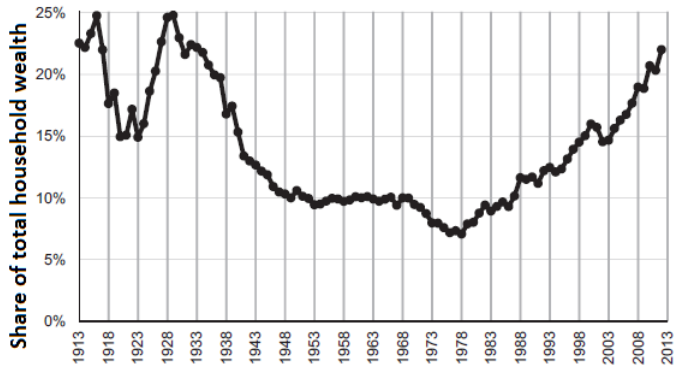

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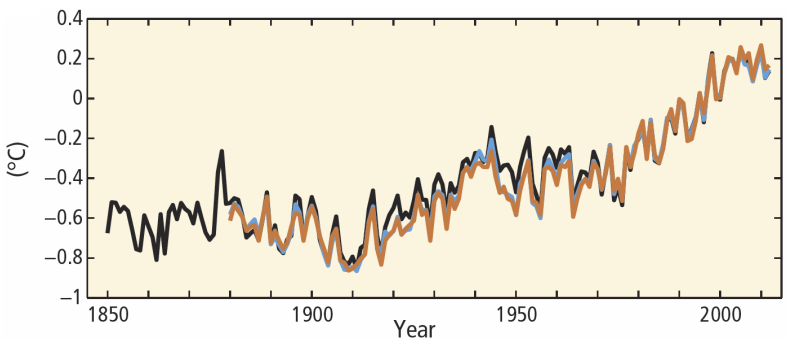

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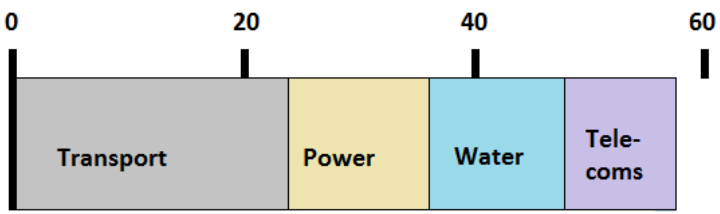

Required investment in global infrastructure, 2013-30, $trn, 2010 prices

The Economist (2014)

Common goods and distribution: main research questions

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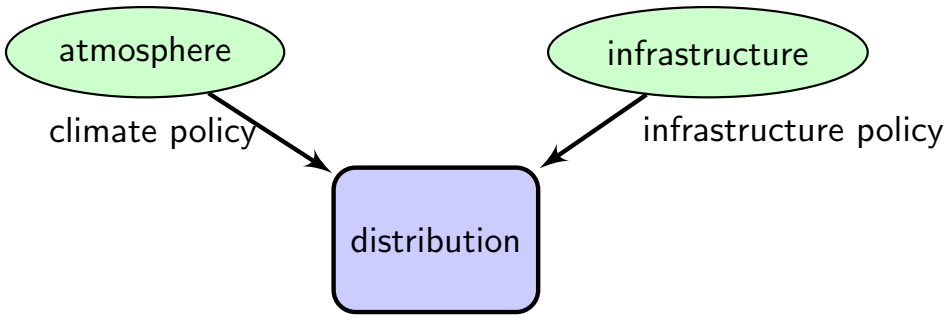

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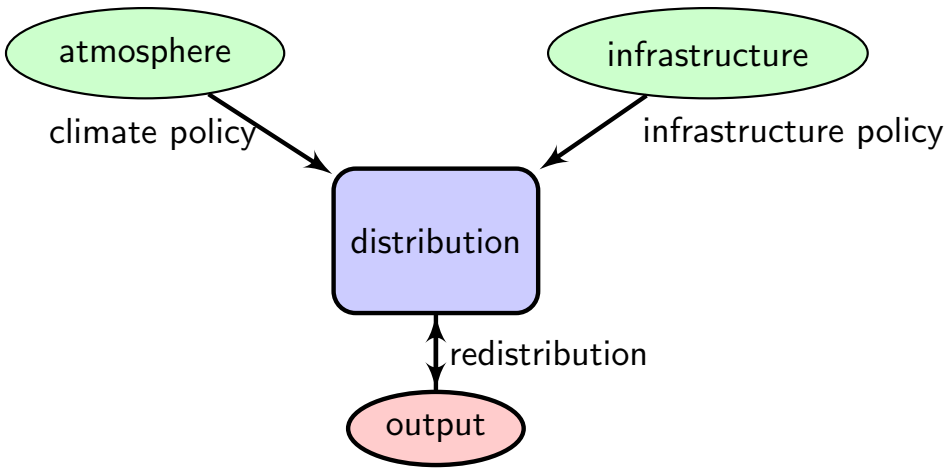
Common goods and distribution: main research questions



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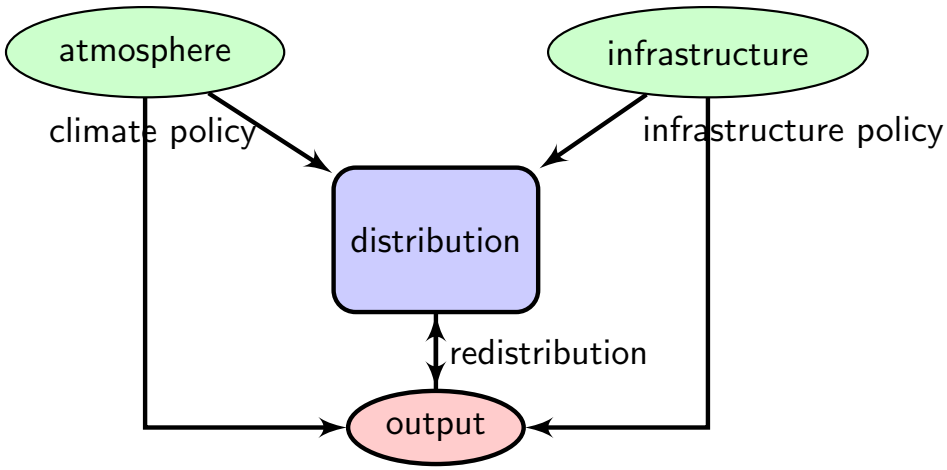

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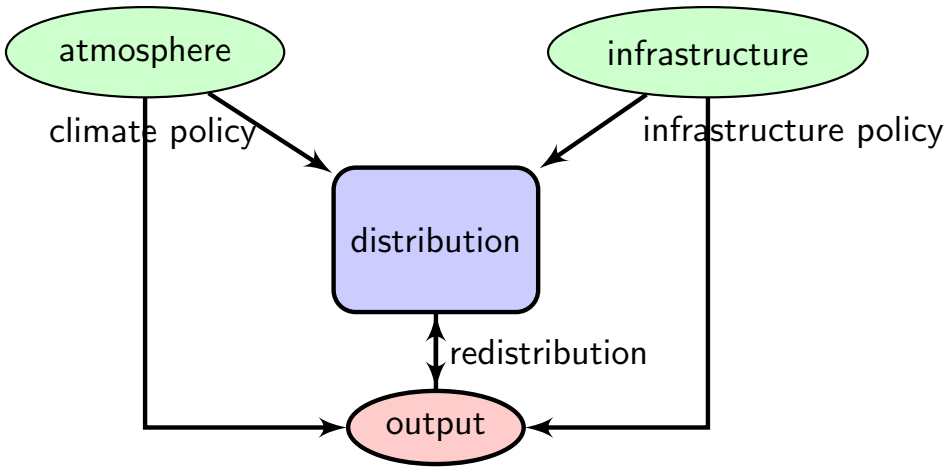

I. **What are the distributional effects of different policies that regulate common goods?**

II. **What are the implications of these policies on the output of an economy?**

III. **Can these policies be designed to be distribution-neutral or progressive (without harming growth)?**

Methods: new models of household heterogeneity

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Part I - the atmosphere

Extend optimal income and externality taxation models to

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- New micro-founded models of saving heterogeneity.
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$\Rightarrow$ Accounting for these types of heterogeneity is central for deriving new insights on common good policies.

Results

Main findings

- Infrastructure investment and climate policy can always be designed to be distribution-neutral.

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Main policy implication

- Distributional considerations do not justify less stringent climate or infrastructure policies.
- By contrast, they might even provide an additional reason for stricter climate policy and increased public investment in infrastructure.

Outline of the thesis

1 Introduction

Part One: The atmosphere as a common good

2 How to make a carbon tax reform progressive: The role of subsistence consumption

3 Carbon taxation, inequality and Engel's law – The double dividend of redistribution

4 The fiscal benefits of climate policy: an overview

Part Two: Infrastructure and inequality

5 Distributional effects of public investment when wealth and classes are back

6 Infrastructure and inequality: Insights from incorporating key economic facts about household heterogeneity

7 Is capital back? The role of land ownership and saving behavior

8 Synthesis and outlook

Outline of the thesis

I. The atmosphere as a common good

Based on:

Klenert, D. and L. Mattauch (2016). How to make a carbon tax reform progressive: The role of subsistence consumption. *Economics Letters*, 138, 100-103. [Ch.2]
and
Klenert, D., Schwerhoff, G., Edenhofer, O. and L. Mattauch (2016). Environmental taxation, inequality and Engel's law – The double dividend of redistribution. *Environmental and Resource Economics,* accepted for publication. [Ch. 3]

Engel's law for carbon intensive goods

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	Q1	Q2	Q3	Q4	Q5
Food & alcohol	17.1	14.4	13.6	10.9	7.4
Energy (electricity, natural gas, w/o transport)	8.6	5.5	3.9	2.8	2.5

In % of total expenditure. U.S. data adapted from Grainger and Kolstad (2010)

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$\Rightarrow$ There also is an Engel's law for energy – existence of subsistence level (in developed countries).
$\Rightarrow$ Pricing carbon would hit poorer households disproportionally hard.
$\Rightarrow$ Popular argument against carbon pricing.

Part I: Research questions and method

Research questions

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Methods

- Model with N households that differ in their skill level ϕ_i.
- Account for subsistence level of carbon-intensive goods.
- Compare different revenue recycling schemes.

Analytical model [Ch. 2]

Households

Maximize $V(C_i, D_i - D_0, l_i)$,
s.t. $C_i \cdot p_C + D_i \cdot p_D \cdot (1 + \tau) = I_i + L$, with $i = 1, .., N$.
Income: $I_i \propto \phi_i$.

...here: C clean consumption, D dirty consumption, D_0 subsistence level of consumption, l leisure, ϕ skill level, p_C and p_D prices of clean and dirty good respectively, w wage rate, τ carbon tax, τ_w labor tax, I income, L lump-sum payment.

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Government

An exogenous increase $\Delta\tau$ in the tax on the dirty good D can be redistributed to the households via

- uniform cash transfers: $\Delta\tau p_D \sum_{i=1}^{N} D_i = NL$.
- linear income tax cuts: $\Delta\tau p_D \sum_{i=1}^{N} D_i = \sum_{i=1}^{N} \phi_i w(1 - l_i)\tau_w$.

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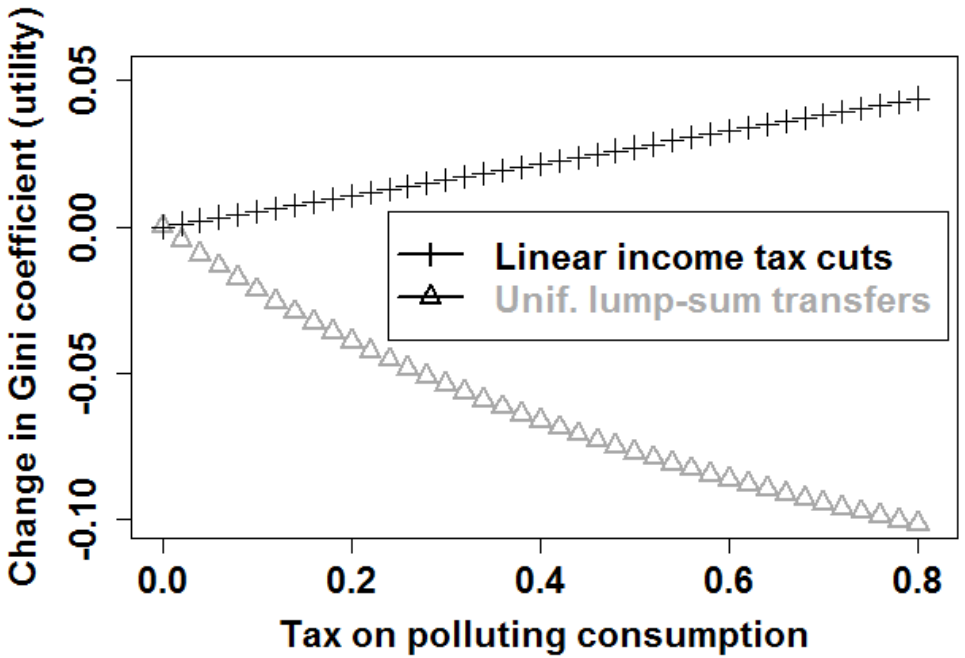
a **progressive**, if revenues are redistributed with uniform lump-sum transfers.



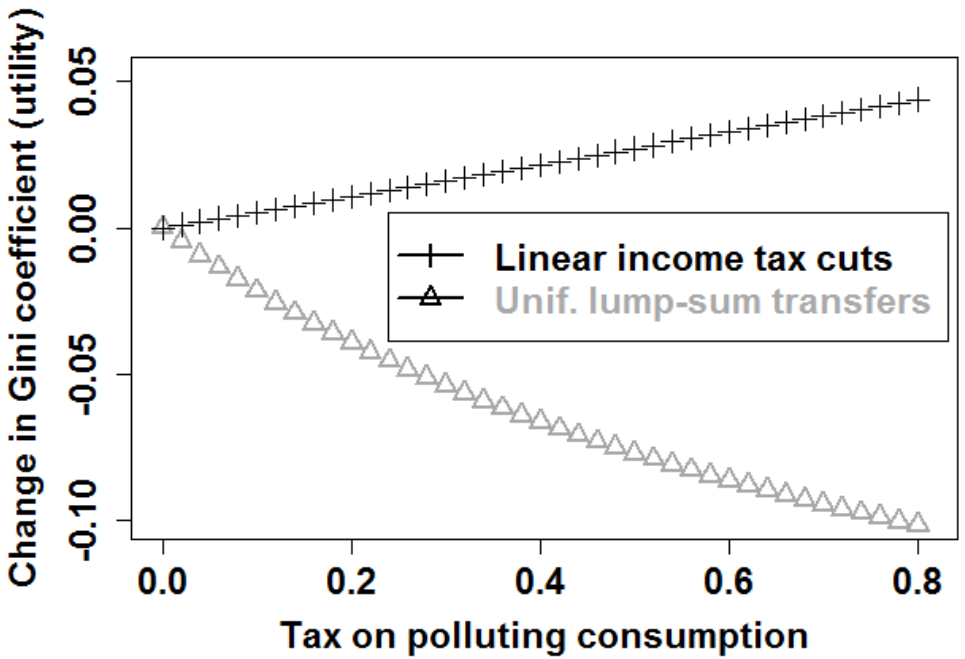
Results from analytical model [Ch.2]

Proposition

The incidence of a tax on polluting good consumption is

a **progressive**, if revenues are redistributed with uniform lump-sum transfers.

b **regressive**, if revenues are redistributed through linear reductions in income taxes.



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$\Rightarrow$ Chapter 3 uses numerical methods to include: firm-side effects, an optimizing government that sets uniform lump-sum transfers, carbon and non-linear income taxes optimally.

Extending the model

Firm

- CES production function with pollution and labor as inputs.
- Price on dirty production input (τ_Z) is set by the government.
- Substitution effects between production factors (Fullerton et al., 2001; Dissou and Siddiqui, 2014).

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- Household i's utility now depends on the environment E: $V(C_i, D_i, l_i, E)$.
- Max. $W = \sum_{i=1}^{N} V(C_i, D_i, l_i, E)$ s.t. FOCs of households and firms,

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- **budget constraint**: $G = -NL + \sum_{i=1}^{N} \tau_{w,i}\phi_i w(T - l_i) + \tau_Z \sum_k Z_k$,
- **incentive constraint**: $U_i \geq U_i^j$, where U_i^j is the utility of household i pretending to be household j.

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Main results I

Compare the tax system before and after an optimal carbon tax reform.

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(a) Optimal initial tax system

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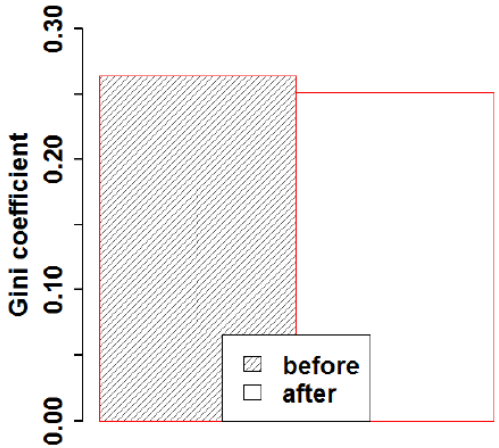

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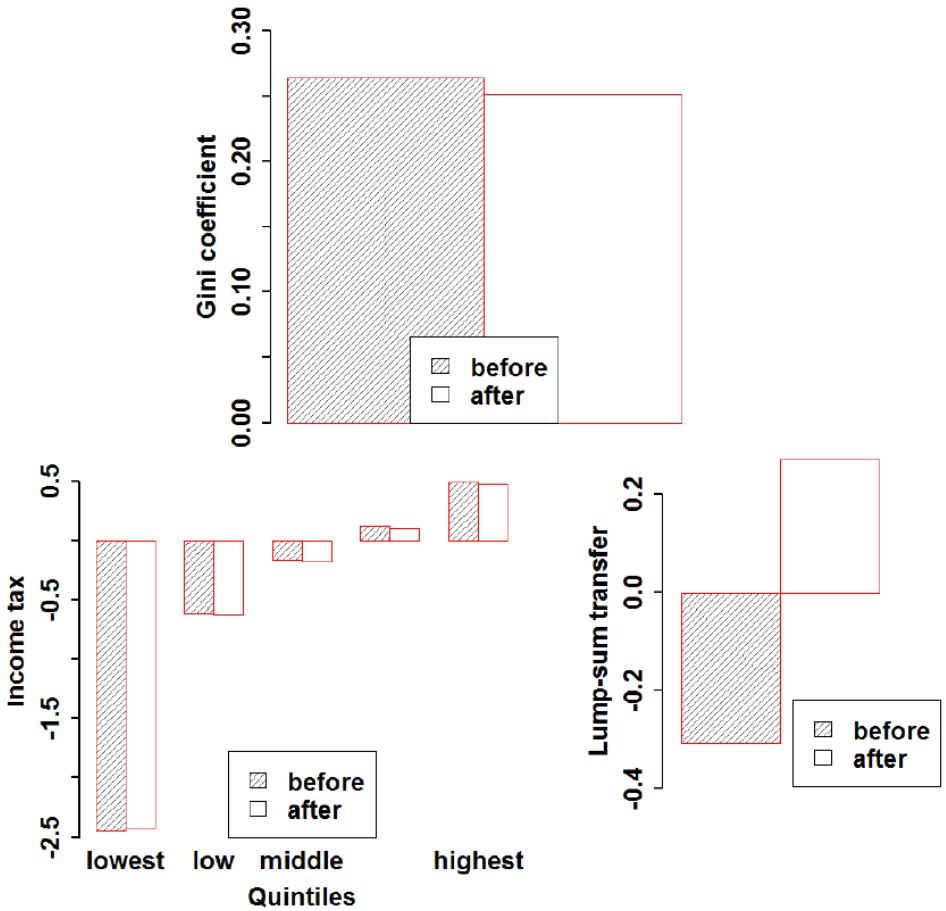

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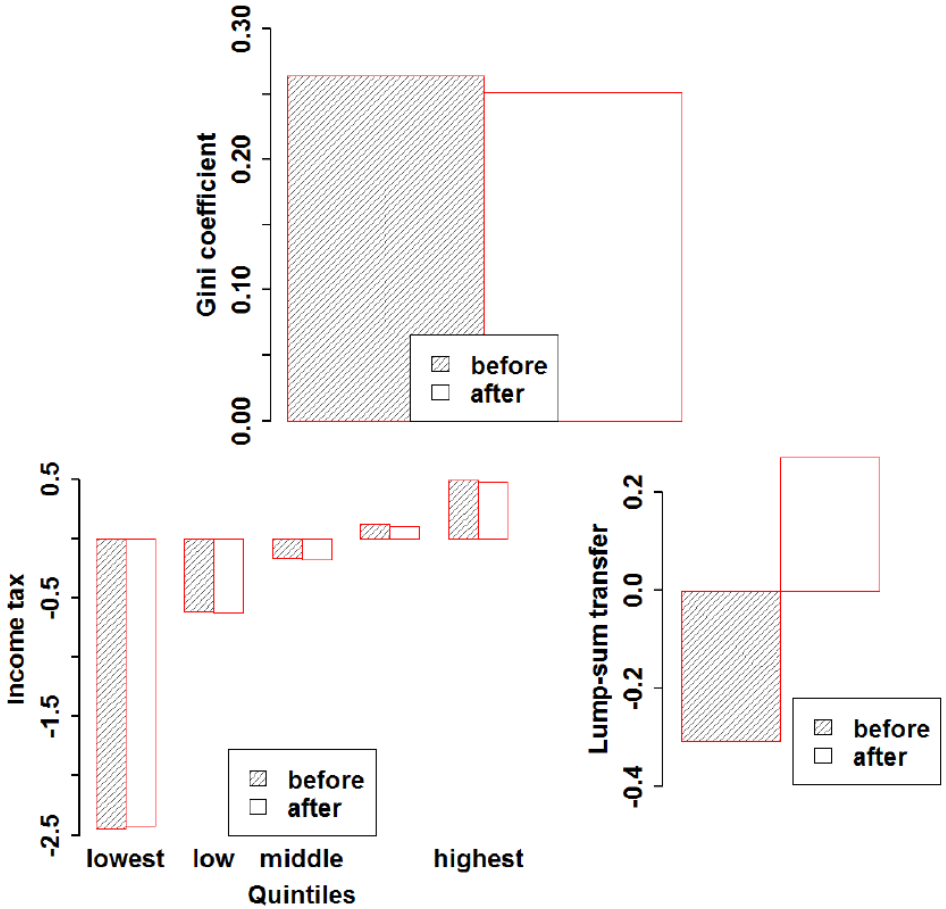
- Most revenue is recycled through uniform cash transfers.
- Recycling through income tax cuts is not superior to uniform lump-sum transfers. $\Rightarrow$ no weak Double Dividend occurs.



Main results II

(b) Non-optimal initial tax system

- Model calibrated to U.S. economy.
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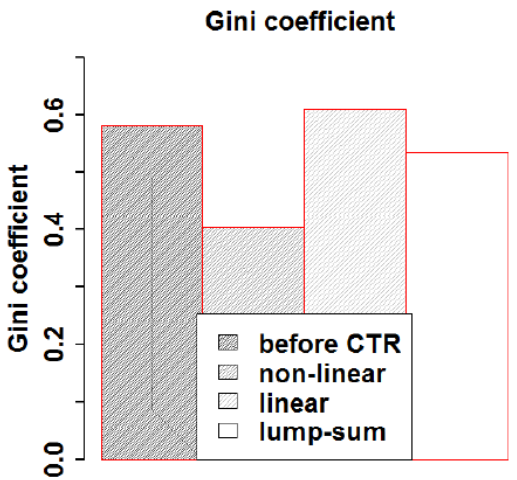
- Recycling through uniform transfers or non-linear tax cuts reduces inequality.



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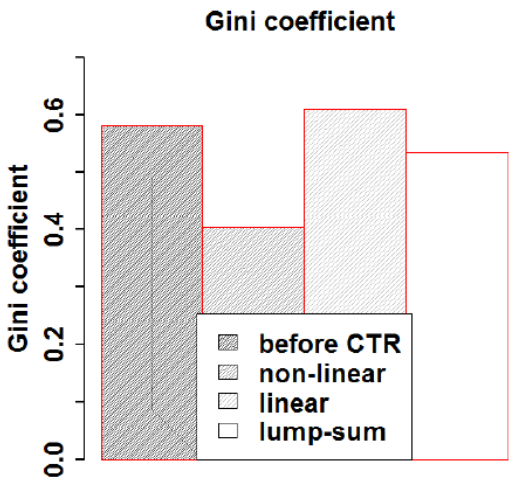
- Non-linear tax cuts simultaneously enhance output.

$\Rightarrow$ **Double Dividend of Redistribution**



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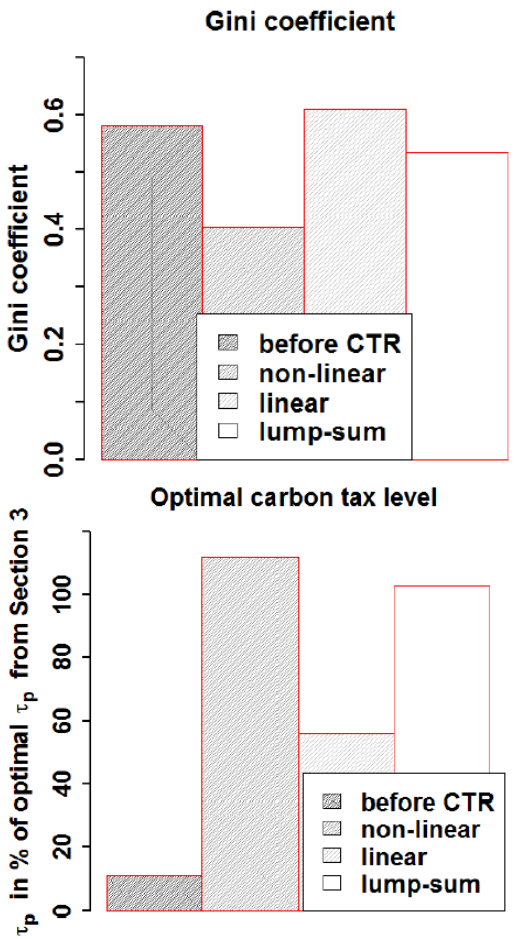
- More progressive recycling yields higher optimal carbon taxes.



II. Infrastructure and inequality

Based on:

Mattauch, L., Edenhofer, O., **Klenert, D.** and S. Bénard (2016). Distributional Effects of Public Investment when Wealth and Classes are Back: Distributional Effects of Public Investment. *Metroeconomica*, 67(3), 603-629. [Ch. 5]

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Klenert, D., Mattauch, L., Edenhofer, O. and K. Lessmann (2016). Infrastructure and Inequality: Insights from Incorporating Key Economic Facts about Household Heterogeneity. *Macroeconomic Dynamics*, first view. doi:10.1017/S1365100516000432. [Ch. 6]

Meta-studies on infrastructure provision

Infrastructure is underprovided

- Estimated returns to public investment in infrastructure are higher than estimated costs.

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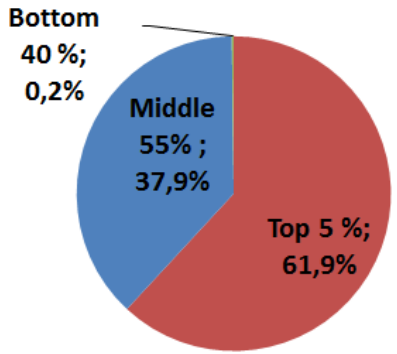
- World Economic Forum estimated the infrastructure funding gap in 2013 to be around 1 trillion US$ per year.

Wealth inequality and household heterogeneity

U.S. wealth is very unequally distributed



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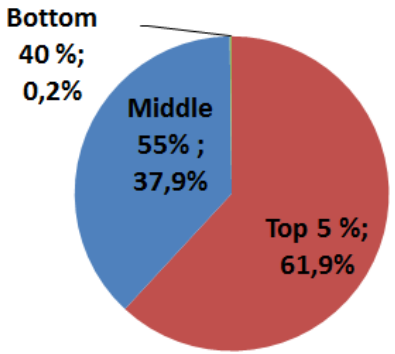

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- **Saving motive**: wealthy households $\Rightarrow$ dynastic, poorer households $\Rightarrow$ life-cycle (Attanasio, 1994; Dynan et al., 2004; Browning and Lusardi, 1996).

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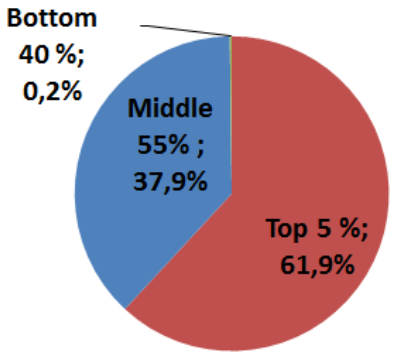

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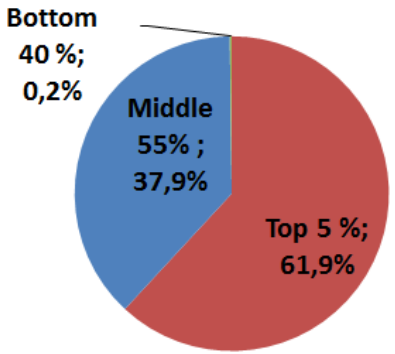

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- **Patience**: time preference rate decreases with wealth (Lawrance, 1991; Green et al., 1996; Saez & Zucman, 2016).

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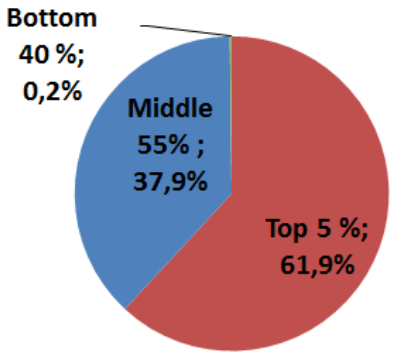

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$\Rightarrow$ Develop a two-class model with heterogeneous saving motives, income sources and time preference rates

Research questions and previous work

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Previous studies

(Alesina and Rodrik, 1994; Chatterjee and Turnovsky, 2012; Glomm and Ravikumar, 1994)

- . . . use mainly models with heterogeneity in initial endowments.
- This ignores important distributional channels of public investment,
- and leads to the finding that public investment is almost always distribution-neutral or regressive.

Analytical model [Ch. 5]

Capitalist (dynastic)

$$\max_{C_{c,t},K_{c,t}} \sum_{t=0}^{t_{\text{final}}} \frac{1}{(1+\rho_c)^t} U(C_{c,t})$$

subject to

$$K_{c,t+1} - K_{c,t} = (1-\tau_k) r_t K_{c,t} - (1+\tau_c) C_{c,t}.$$

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subject to

$$K_{c,t+1} - K_{c,t} = (1-\tau_k) r_t K_{c,t} - (1+\tau_c) C_{c,t}.$$

Worker (life-cycle saver)

$$\max_{C_y,C_o,S} U(C_{y,t}) + \frac{1}{(1+\rho_m)} U(C_{o,t+1}).$$

subject to

$$(1-\tau_w) w_t L = (1+\tau_c) C_{y,t} + S_t \quad \text{and}$$

$$(1+(1-\tau_k) r_{t+1}) S_t = (1+\tau_c) C_{o,t+1}.$$

...with Capitalist: $K_{c,t}$ capital stock, $C_{c,t}$: consumption, ρ_c: time preference rate. Worker: S_t: capital stock, $C_{y,t}, C_{o,t}$: consumption when young and old, L: labor (fixed), ρ_w: time preference rate. r_t: interest rate, τ_k, τ_w, τ_c: capital income, labor income and consumption tax rates, w_t: wage rate.

Analytical model: firm, government and steady state

Firm

$$F(K_t, L) = K_{G,t}^{\beta} \left(K_t^{\alpha} L^{1-\alpha} \right),$$

$$\text{with } K_t = K_{c,t} + S_{t-1}.$$

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Steady state

- The steady-state interest is given by: $\tilde{r} = \rho_c/(1 - \tau_k)$.
- **Pasinetti (1962) Paradox:** capitalists determine the size of the *total* stock of private capital; workers determine each group's *share* of capital.

...with δ_G: depreciation of public capital, $K_{G,t}$: public capital stock, α: private capital share, β: efficiency factor of public capital.

Analytical insights [Ch. 5]

Assumptions:

- logarithmic utility
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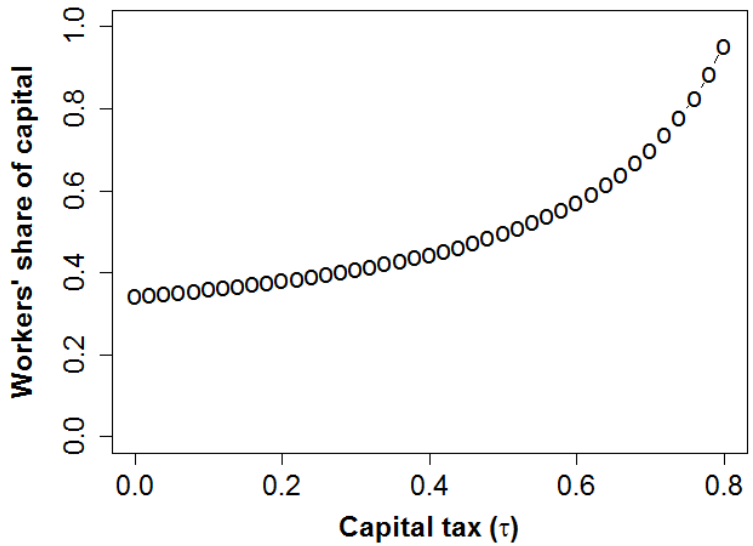

Propositions

1. Capital tax-financed public investment reduces wealth inequality.

Analytical insights [Ch. 5]

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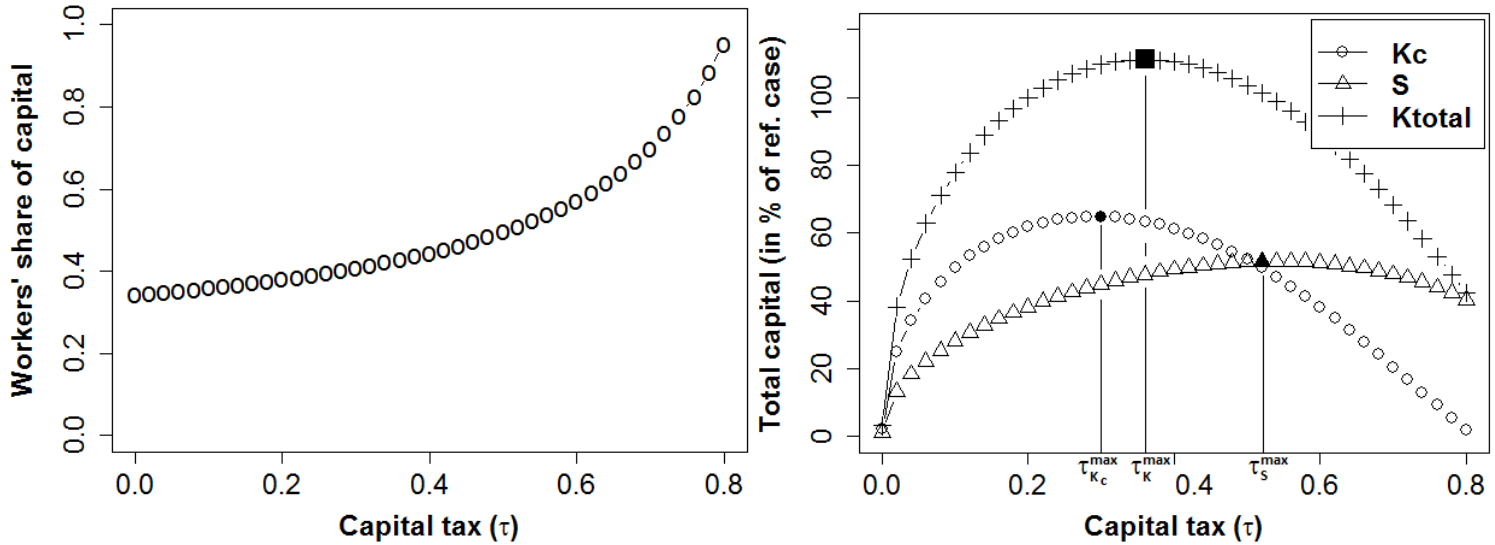

Propositions

1. Capital tax-financed public investment reduces wealth inequality.
2. Workers prefer a higher capital tax rate than capitalists.
3. There exists a Pareto-improving range of capital tax rates.

Numerical results I [Ch. 6]

Numerical solution

- more complex functional forms,
- more sophisticated measures of inequality in wealth, welfare and income,
- endogenous labor $\rightarrow$ labor and consumption tax financing,
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Efficiency

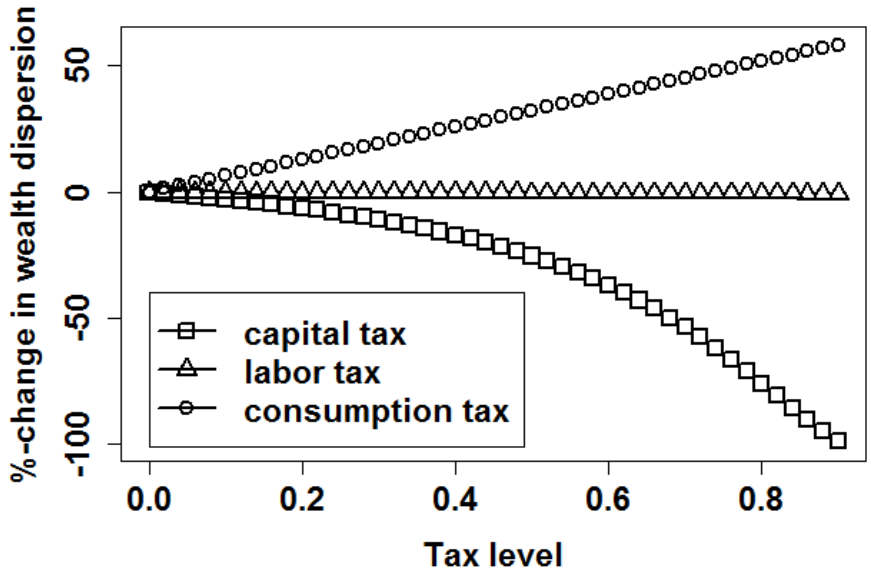
- Labor- and consumption tax financing is more efficient than capital tax financing.

$\Rightarrow$ capital taxation disincentivizes capital accumulation

Numerical results II [Ch. 6]

Distribution

- Labor tax-financing increases inequality.
- Consumption tax-financing is distribution-neutral.



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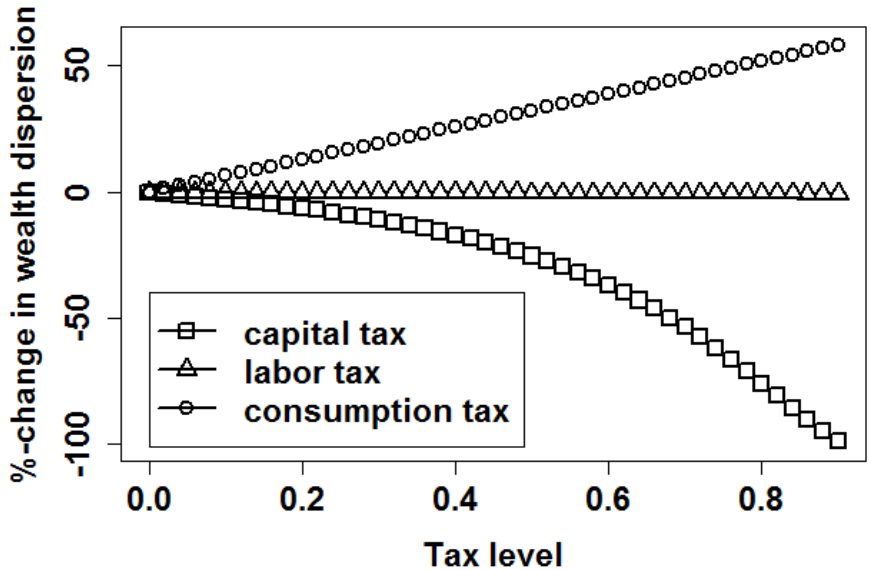

Robustness

Results hold

- for both steady state convergence/endogenous growth
- for different/identical time preference rates.
- independent of the role public capital plays.

Conclusions

Based on:

Chapter 1 and Chapter 8.

Summary

I. Environmental policy

- The regressive effect of carbon taxes can be offset completely by the recycling of its revenue.
- Such a policy can greatly reduce inequality and enhance output if the tax system before the reform was sub-optimal.

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- Such a policy can greatly reduce inequality and enhance output if the tax system before the reform was sub-optimal.

II. Infrastructure policy

- Small increases in public investment enhance output for all financing mechanisms.
- The distributional effects of this policy, however, depend crucially on the financing mechanisms: a capital tax is progressive, a consumption tax is neutral and a labor tax is regressive.

Equity and Efficiency in the presence of common goods

- Unregulated common goods tend to be undersupplied or overused.
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This thesis demonstrates that

- political regulation of common goods can be designed such that inequality is reduced or remains constant,
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$\Rightarrow$ additional rationale for stricter environmental regulations and increased public investment.

Policy implications

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I. We live in a second-best world in which most standard results do not apply.

II. Accounting for micro-founded types of household heterogeneity yields fresh insights on second-best problems.

Thank you for your attention.

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