Green Capital Requirements

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Capital Requirements and Climate Change: Motivation

Climate change has become a major topic for financial regulators

- ECB, Bank of England have conducted climate stress tests
- Federal Reserve announced "pilot climate scenario analysis exercise"

The topic remains **controversial** (in regulatory sphere and more broadly)

Objective: Analyze capital requirements as a tool to address

- Climate-related financial risks
- Emissions (causing externalities)

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- Ineffective if bank capital is ample (or firms can access public markets)
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- Capital requirements may help facilitate carbon taxes if environmental regulation subject to commitment problem

Model Ingredients

A single-period model, universal risk-neutrality

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Continuum of cashless, **bank-dependent firms**

- finite mass π_q of type $q \in \{\textbf{C}\text{lean}, \textbf{D}\text{irty}\}$
- invest I at $t = 0$, lognormal cash flow X_q at $t = 1$
- D have higher expected CF $\overline{X}_D > \overline{X}_C$ but higher emissions $\phi_D > \phi_C$

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A **regulator** who sets **capital requirements** $\underline{\mathbf{e}} = \{\underline{e}_C, \underline{e}_D\}$

- lower deposit insurance put and affect mass of funded firms ω_q

Roadmap

Preliminary analysis:

Banking sector equilibrium with heterogeneous borrowers

Policy analysis:

Ad-hoc green tilts to capital requirements:

- Brown penalizing factor (higher capital requirements for dirty loans)
- Green supporting factor (lower capital requirements for green loans)

Optimal capital requirements:

- Prudential mandate (cares only about financial risks)
- Impact mandate (also cares about externalities)

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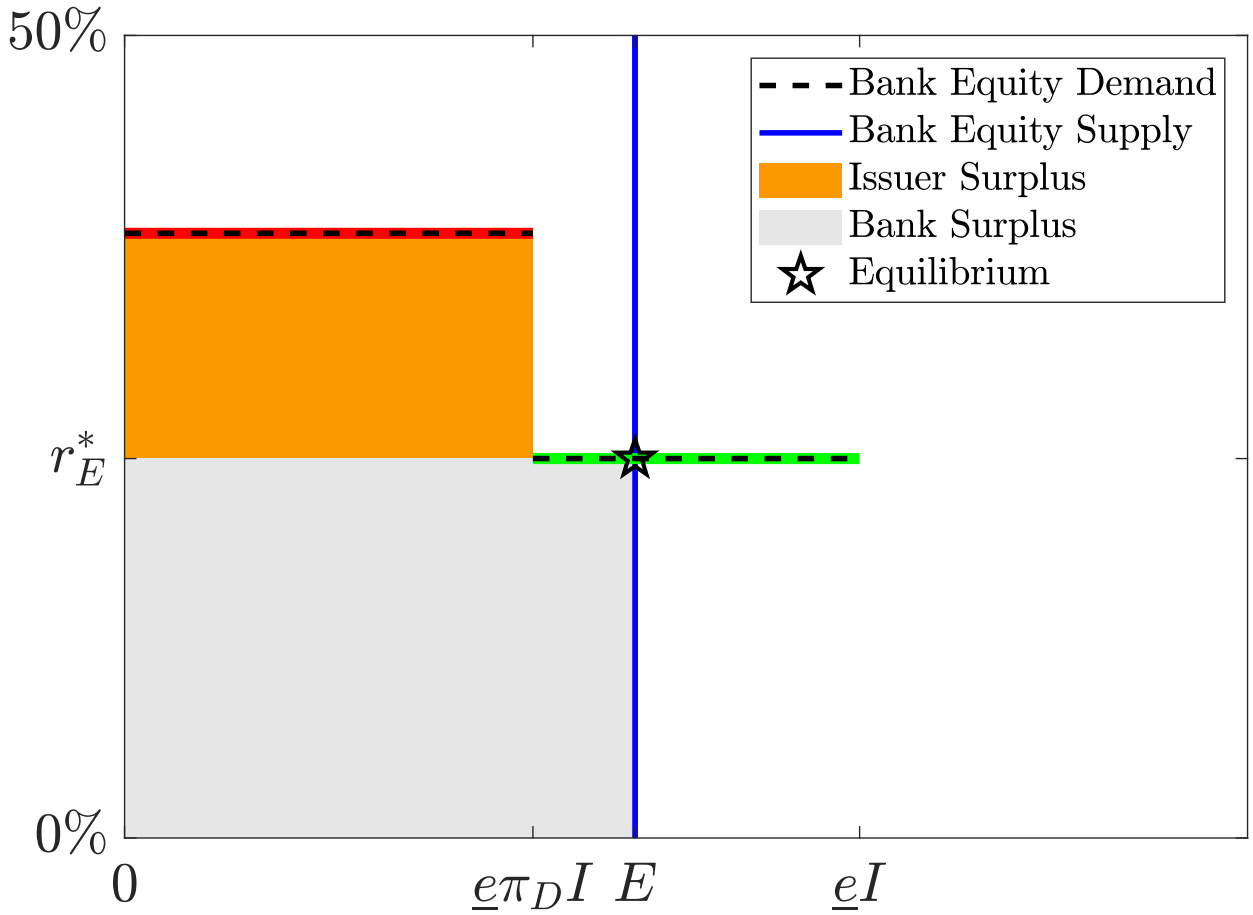
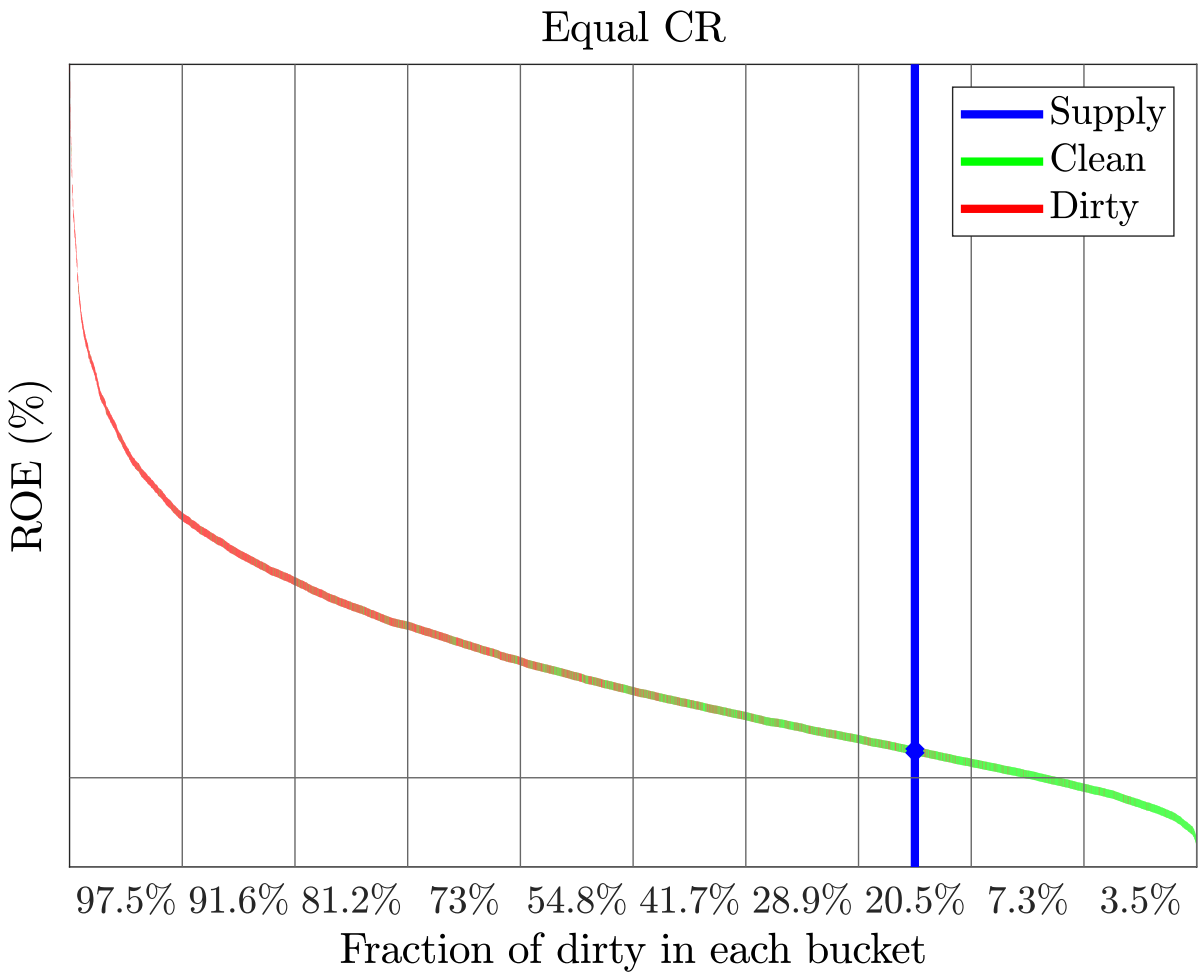
$$r_q^{max}(\underline{e}_q) = \frac{\text{NPV}_q + \text{PUT}_q}{I\underline{e}_q}$$

- **Numerator:** bilateral surplus (cash flow and deposit insurance put)
- **Denominator:** amount of bank equity taken up by the loan

Equilibrium for Equal Capital Requirements



A Smoother Version (Heterogeneous Types)



Positive Analysis: Green Tilts

Take **equal capital requirements** as **point of departure**

- focus on intermediate bank equity case (most interesting)
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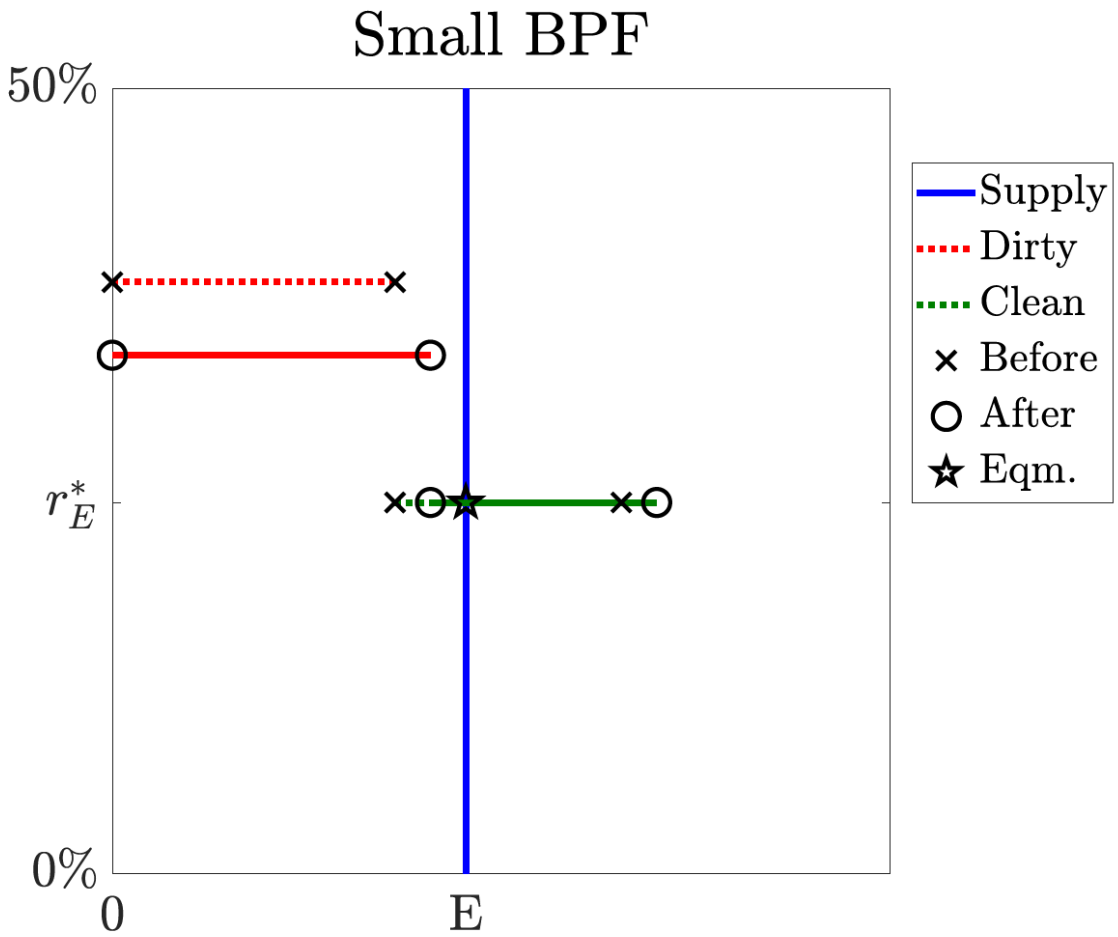
For now, ad-hoc interventions (but insights relevant for optimal regulation)

Brown Penalizing Factor



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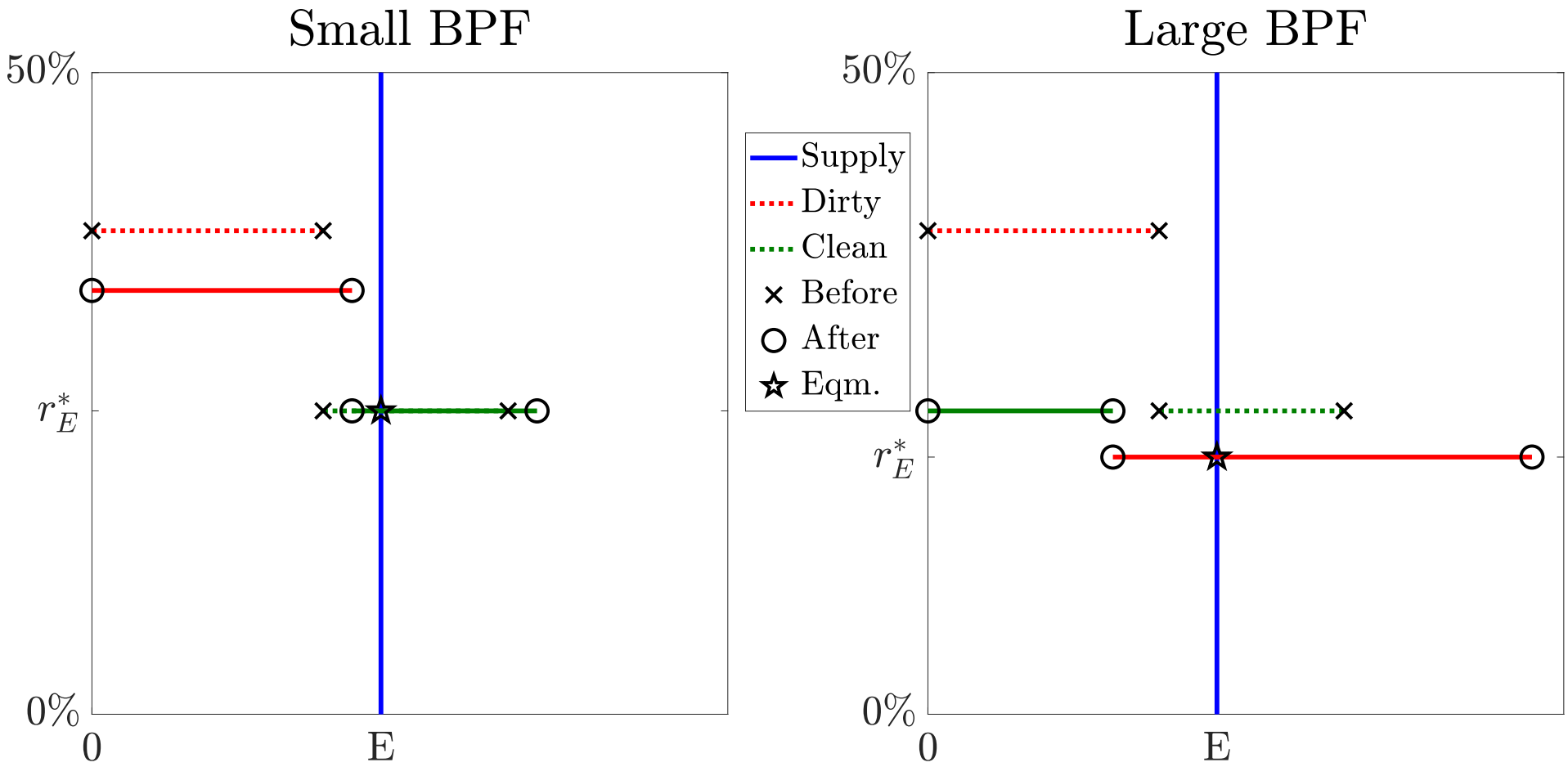

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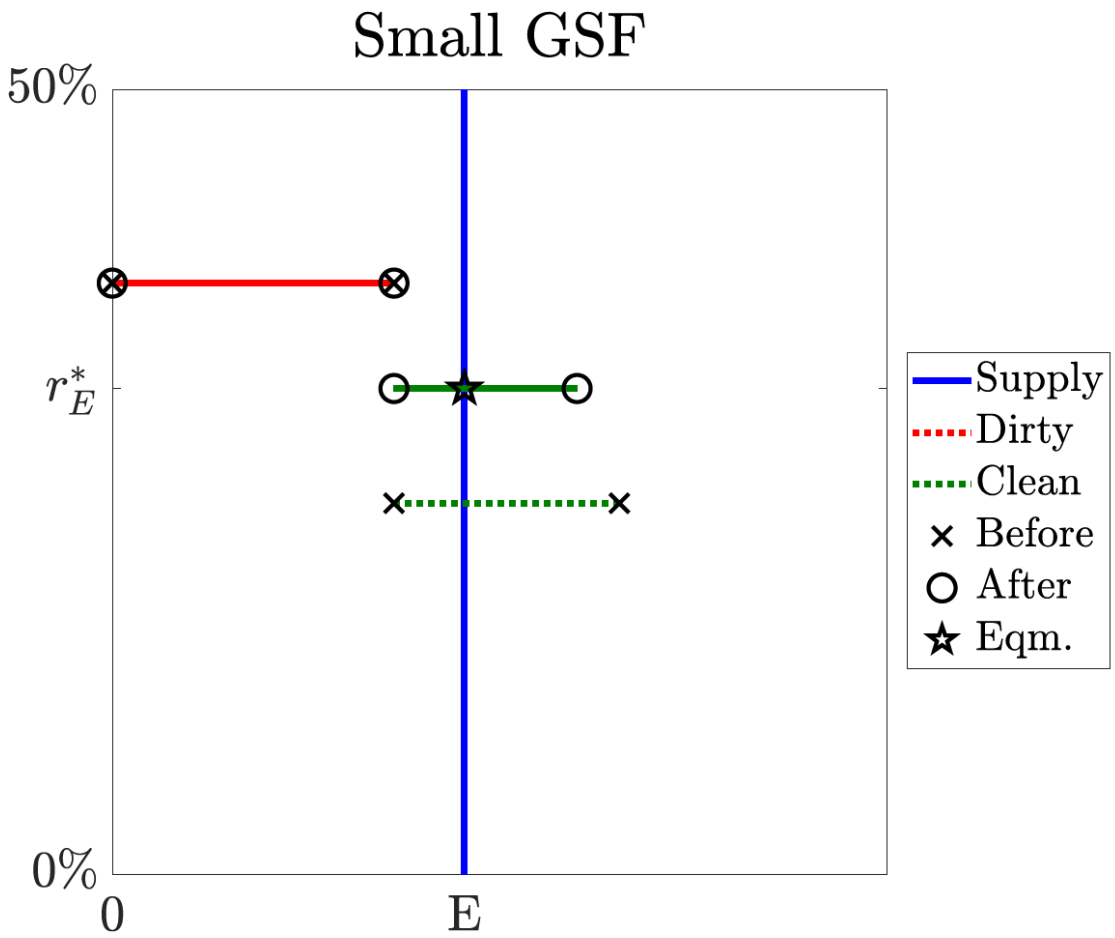

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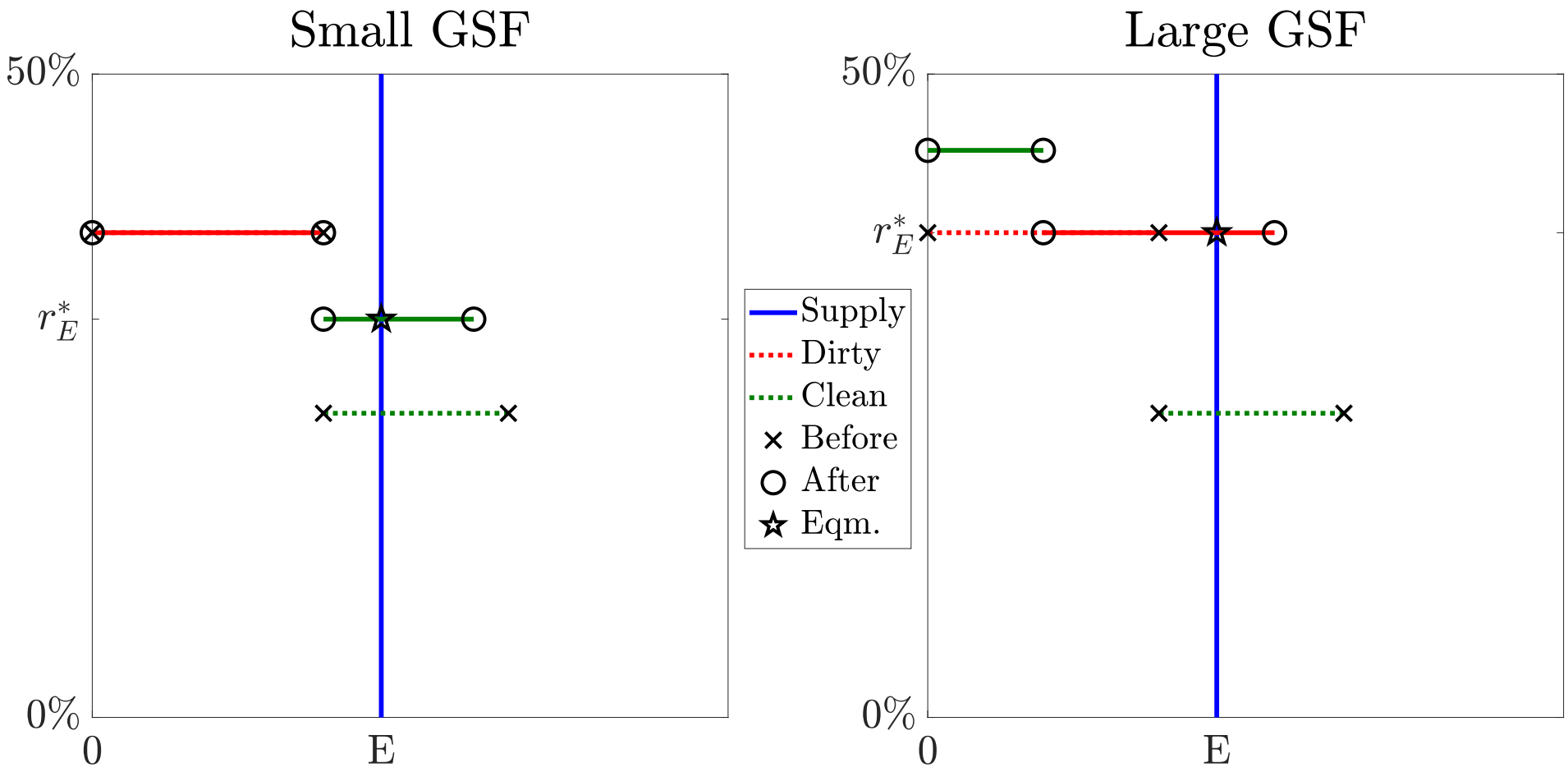

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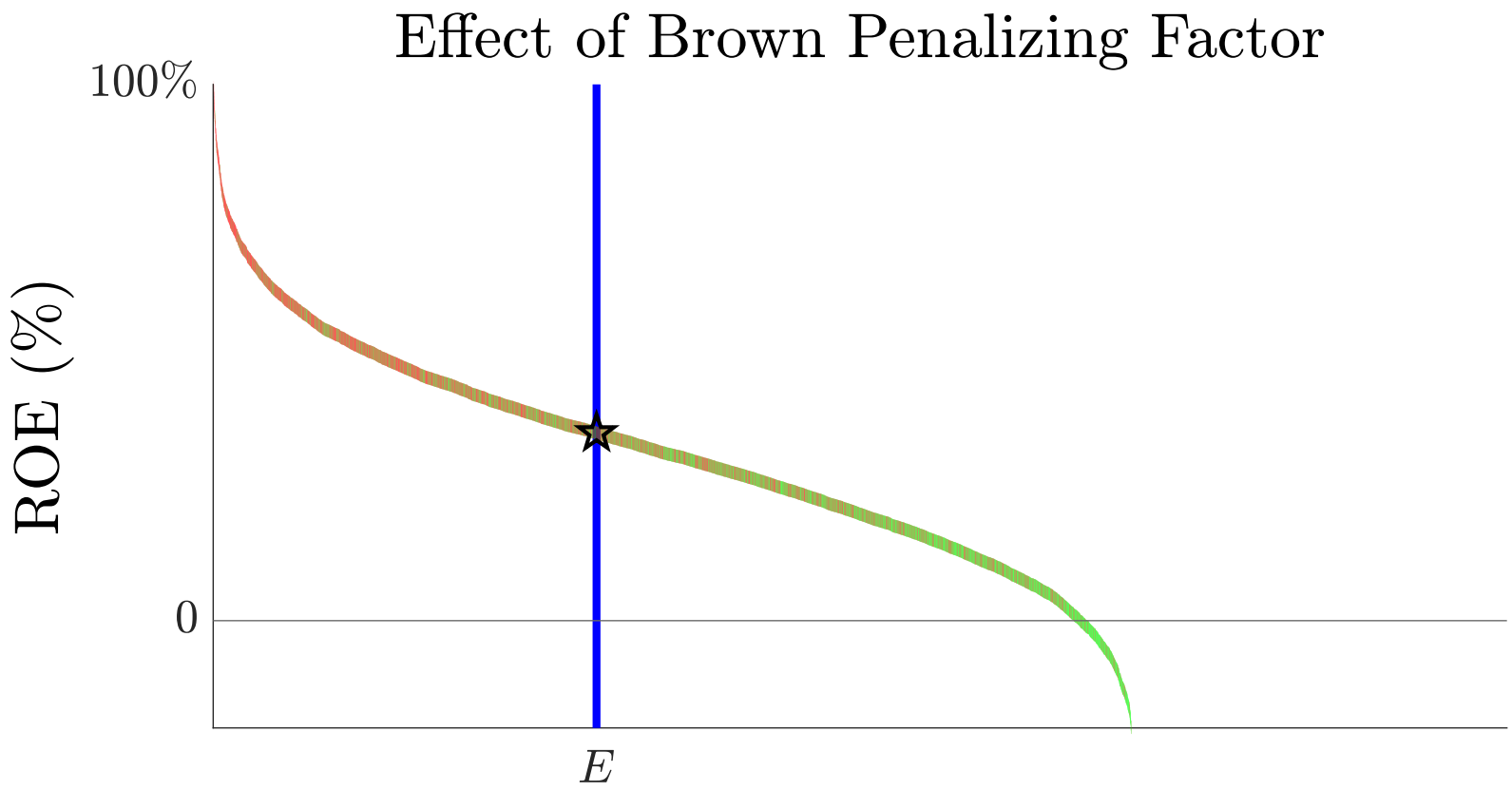
Positive Analysis: Broader Takeaway

Green tilts to capital requirements have **substitution** and **income** effects:

- **Substitution effect:** relatively cheaper to fund clean loans
- **Income effect:** Banks can afford to fund more/less of both types
  GSF and BPF have different income effect sign!

General insights also apply in heterogeneous-type setting

Effect of BPF with Heterogeneous Types



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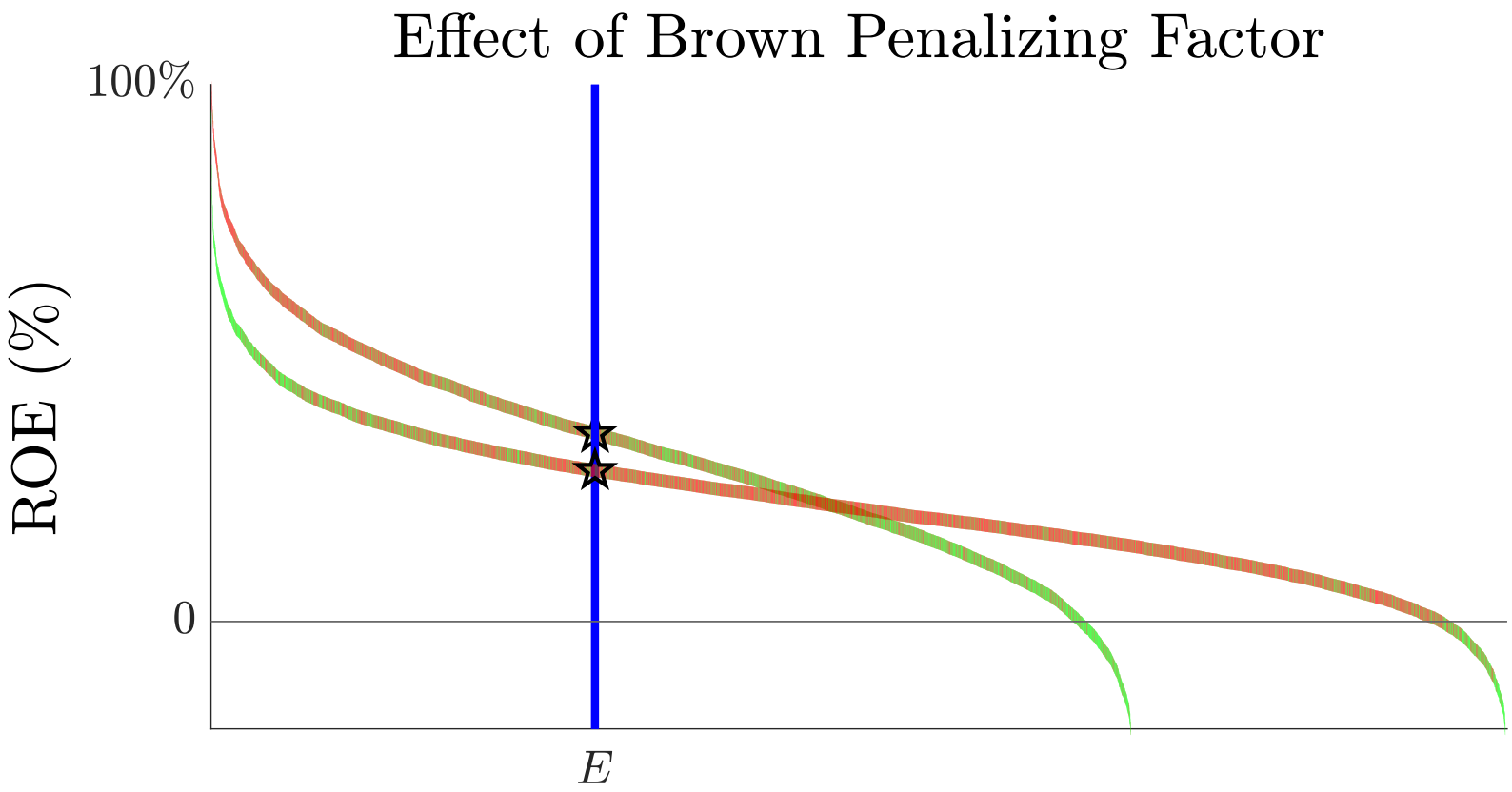

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Rewrite objective as:

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where $\tilde{\omega}_q$ is fraction of equity allocated to type q and

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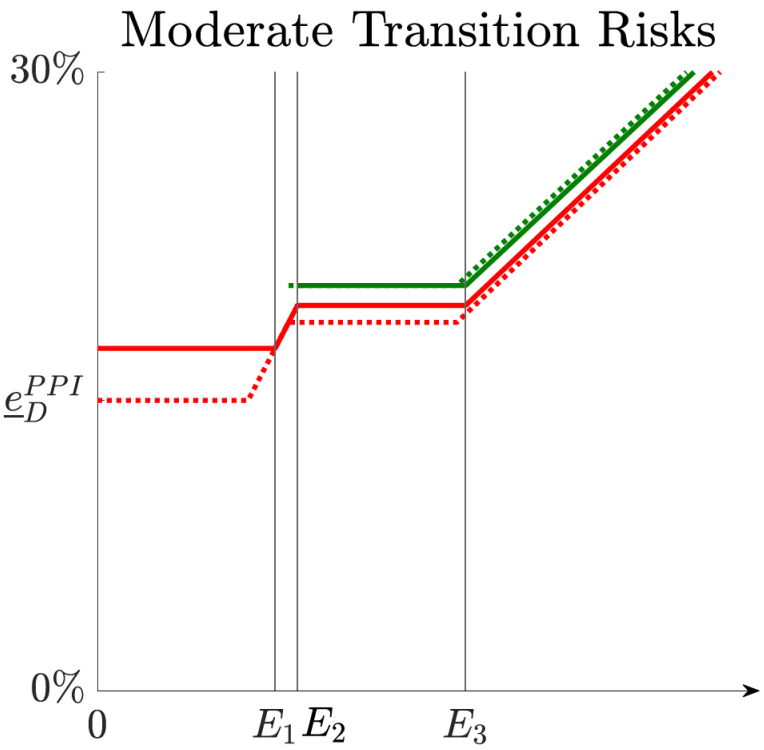
Climate-related financial risk enters via NPV & deposit insurance put

Effect of Increased Financial Risks for Dirty Firms



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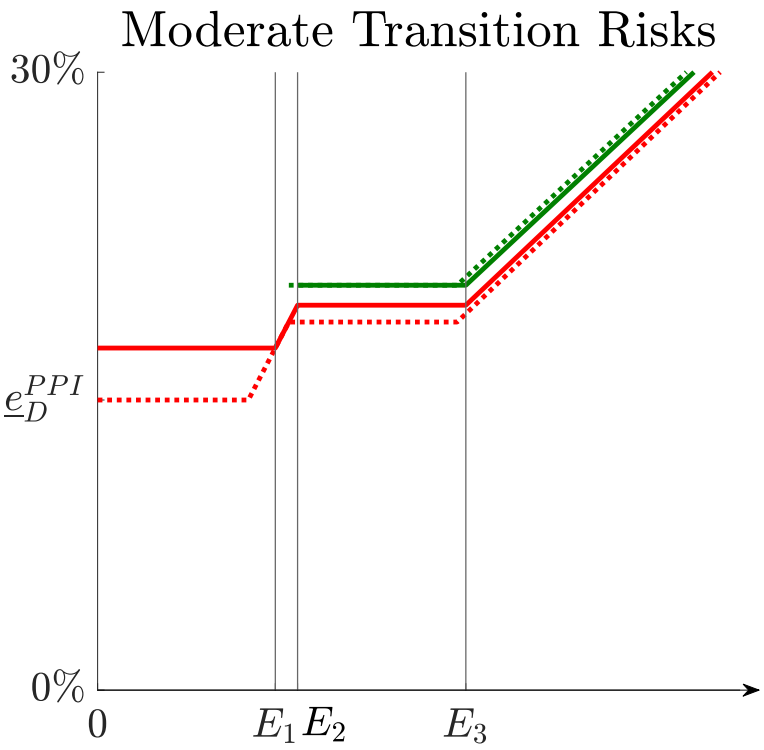

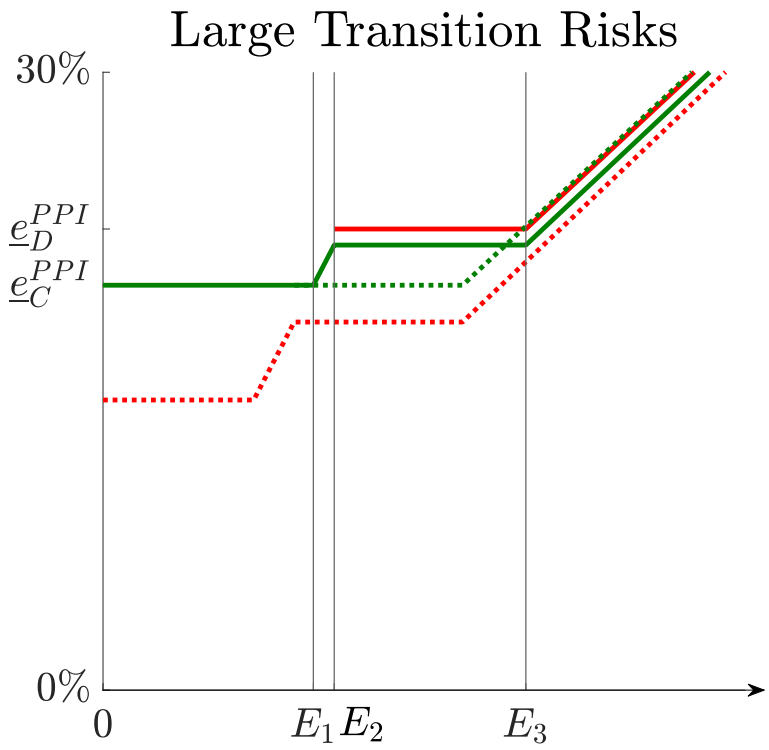

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  - moderate risks: prudentially optimal to crowd out clean loans
  - large risks: set large BPF to induce ranking change

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Consider now regulator with (hypothetical) impact mandate: **maximizes**

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Implications

1) **Non-bank financing**: Substitution to bond market removes financial risks from banking sector, but does not lower pollution

2) **Bank capital scarcity and the cost of raising equity**: Lower frictions to raising bank equity make it easier for capital requirements to address financial risks, harder to address externalities

3) **Dirty firms' abatement incentives**: Additional maximization problem to choose optimal technology τ maximizing $r_q^{max} = \max_\tau r_{q\tau}^{max}$

Carbon Taxes versus Capital Requirements

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- stricter capital requirements provide cushion against such losses
- make credible that environmental regulator will increase carbon taxes

NB: specific conditions needed, no blank cheque for intervention

Conclusion

Flexible framework to study **green capital requirements** under varying assumptions about the severity of climate risks and objective functions.

Positive analysis: brown penalizing factor may crowd out clean loans

Normative analysis distinguishes between addressing financial risks and lowering emissions (externalities)

- **prudential regulation** can deal with climate-related financial risks
- **reducing pollution** via capital requirements not always possible and may require sacrificing financial stability
- potential **indirect role**: reduce stranded asset risk to **facilitate carbon tax**