Green Capital Requirements

Martin Oehmke and Marcus Opp

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Green Capital Requirements: Motivation

Climate change has become a major topic for financial regulators

- ECB strategy review dedicates whole work stream to climate risk
- Entire chapter in BoE Future of Finance report

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

Objectives of this paper:

Positive: What are effects of green capital requirements?

Normative: Optimal policy under different regulatory objectives

- classic **prudential mandate**
- broader **"green" mandate**

High-Level Takeaways

Can green capital requirements reduce climate-related financial risks?
Yes, but this is not the same as lowering emissions (higher capital requirements for dirty firms may actually reduce clean lending)

Can capital requirements help reduce emissions in absence of carbon tax?
Sometimes, but firepower limited. May require sacrificing financial stability.

Punchline: Capital requirements better at addressing consequences of climate change rather than its causes

Baseline Model Ingredients

A single-period model, universal risk-neutrality

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 $\phi_D > \phi_C$

A continuum of **competitive banks**

- maximize value of (fixed) equity E, raise insured deposits
- deposit insurance not perfectly priced ($\Rightarrow$ transfer to bank)

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:

Equilibrium for given capital requirements

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 climate-related cash flow risks)
- Broader "green" mandate (additionally cares about externalities on agents outside of the banking sector)

Banking Sector Equilibrium

Demand for bank equity (from funded loans) = **Supply** of bank equity

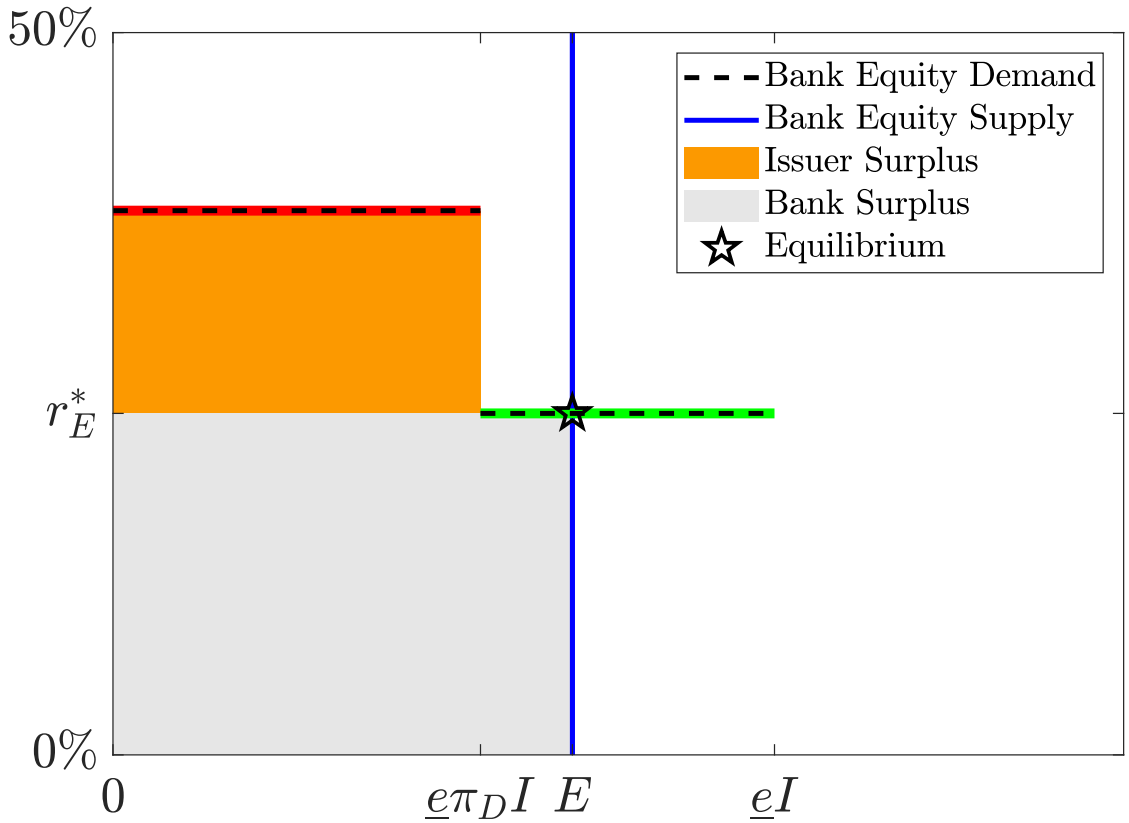
Supply curve: Determined by (fixed) bank equity E

Demand curve: Maximum RoE type q can offer on a unit of bank equity:

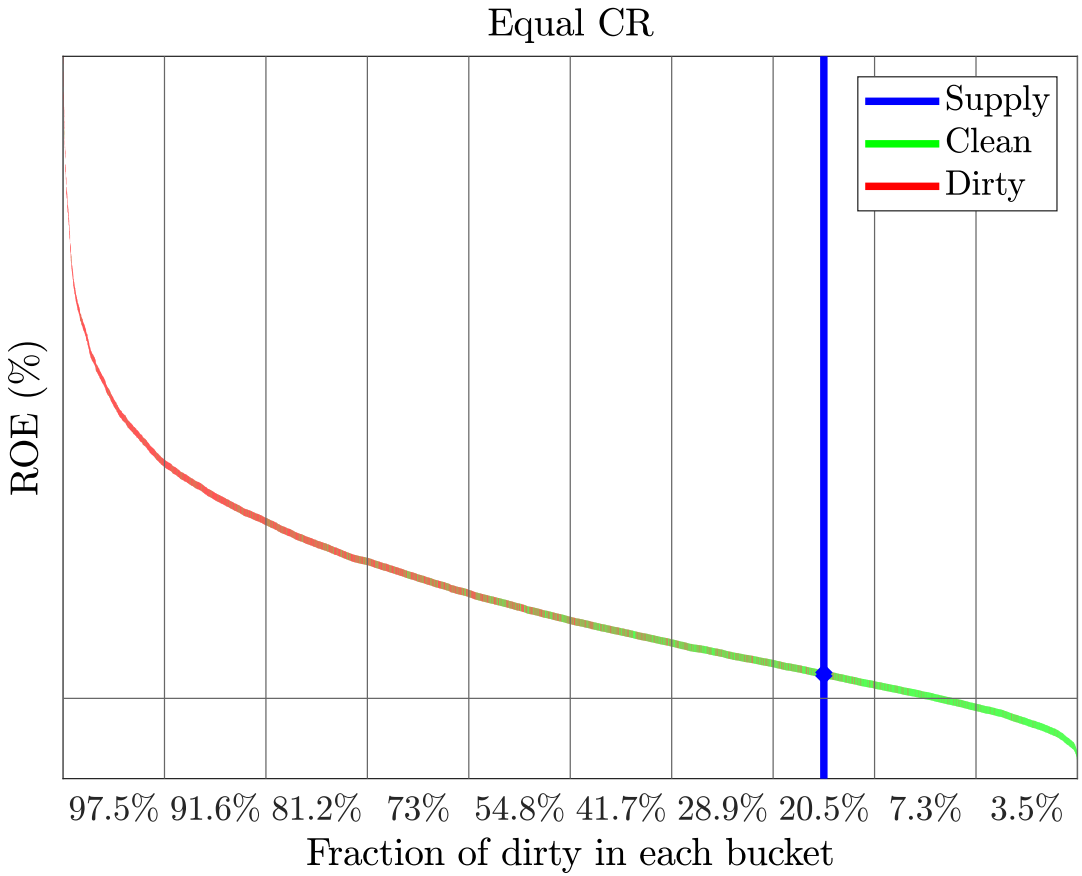
$$r_q^{max}(\underline{e}_q) = \frac{\text{NPV}_q + \text{PUT}_q}{I\underline{e}_q}$$

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

Equilibrium for Equal Capital Requirements



Many Types


Equal CR
Supply
Clean
Dirty
ROE (%)
97.5% 91.6% 81.2% 73% 54.8% 41.7% 28.9% 20.5% 7.3% 3.5%
Fraction of dirty in each bucket

Positive Analysis: Green Tilts

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

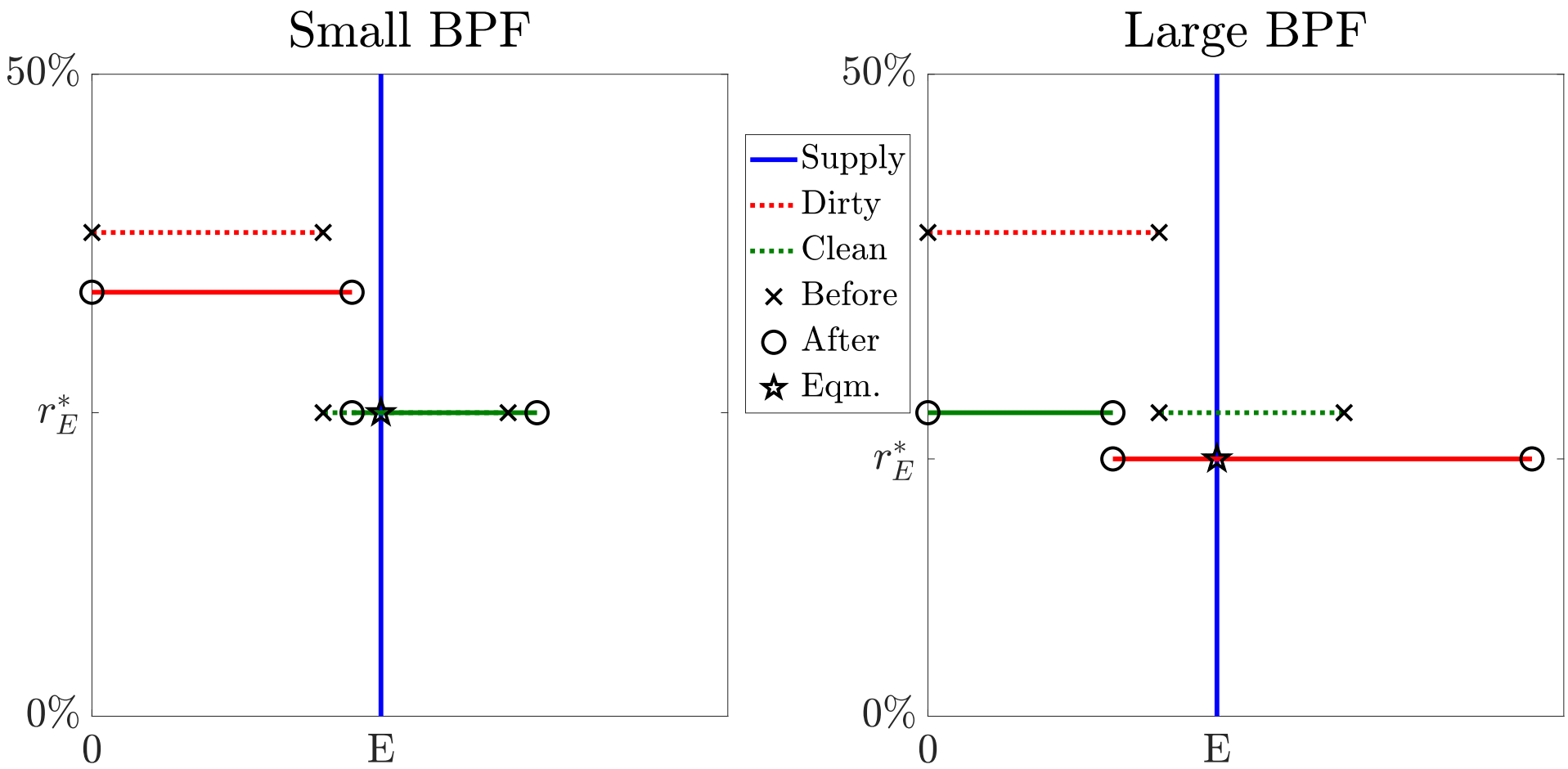
- focus on intermediate bank equity case (most interesting)
- given equal capital requirements, dirty loans rank above clean

Study **positive effects** of most commonly proposed interventions

- **Brown penalizing factor** (BPF)
- **Green supporting factor** (GSF)

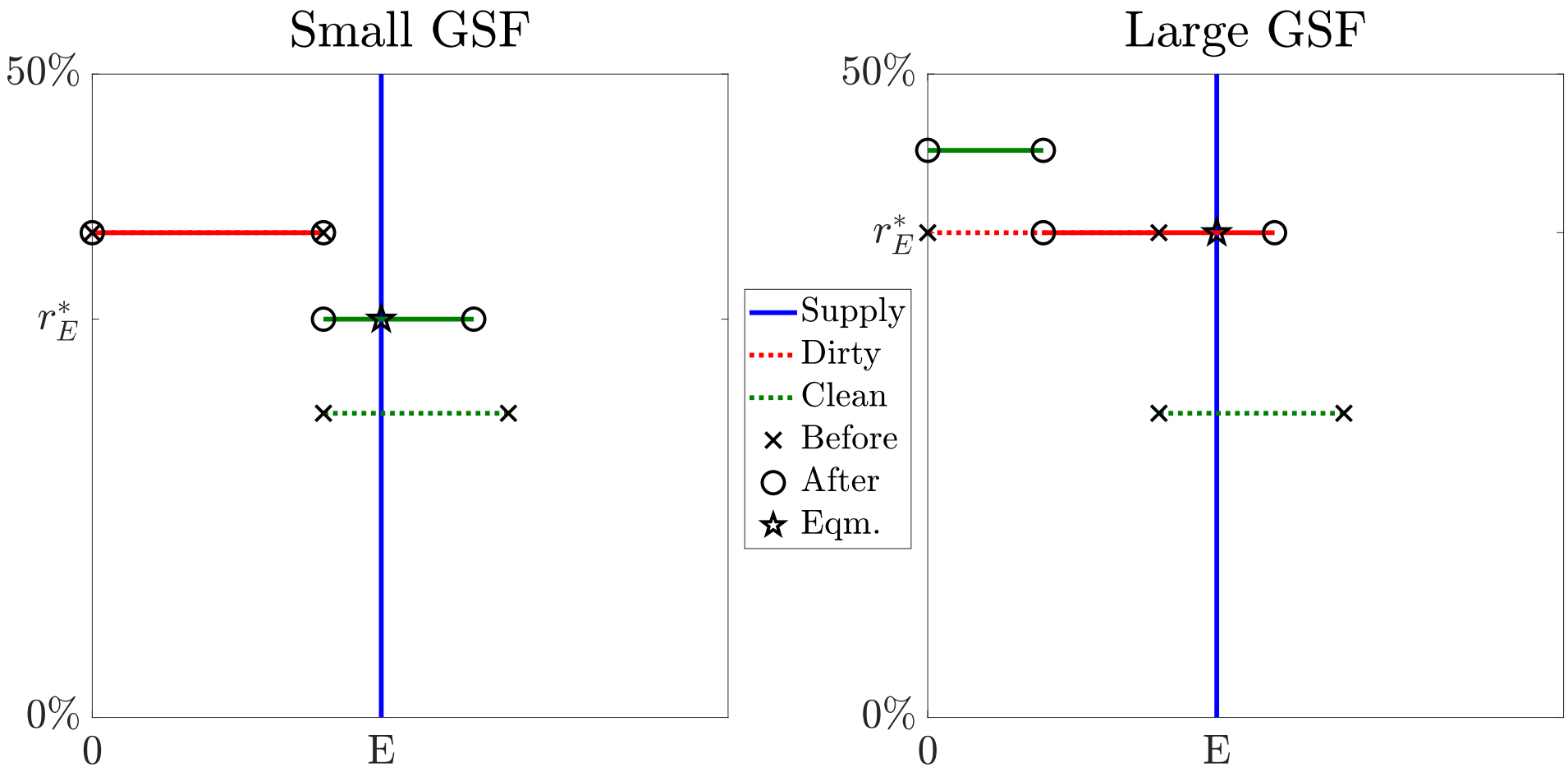
For now, simply exogenous interventions (i.e., no objective function)

Brown Penalizing Factor



Small BPF may crowd out clean loans!

Green Supporting Factor



Small GSF crowds in clean loans!

Positive Analysis: Broader Takeaway

"Greening" has **income** and **substitution** effects:

- Substitution effect: relatively cheaper to fund clean/dirty loans
- Income effect: Banks can afford to fund more/less of both types

Small interventions driven by **income effect** (because ranking of borrowers unaffected) $\Rightarrow$ marginal borrower gets crowded in/out

- BPF crowds out marginal loan (clean loan in example)
- GSF crowds in marginal loan (clean loan in example)

Large interventions Substitution effect implies change in borrower ranking $\Rightarrow$ qualitatively similar effects of BPF and GSF

Optimal Prudential Capital Requirements

Prudential regulator **maximizes**

$$\text{NPV from bank loans} - \lambda\,[\text{deposit insurance put}]$$

Climate risk enters via NPV and/or deposit insurance put

Example: Transition risk lowers profitability or raises risk of dirty firms

- optimal to **increase dirty capital requirement** (BPF)
- **size of climate risks** important
  - small risks: prudentially optimal to crowd out clean loans
  - large risks: set large BPF to induce ranking change

Can also analyze **physical risks** (symmetric effect on clean and dirty firms) or **endogenous risks** (i.e., caused by emissions)

Capital Requirements as a Tool to Lower Emissions?

"Green" regulator **maximizes**

$$\text{NPV from bank loans} - \lambda\,[\text{deposit insurance put}] - \text{carbon externality}$$

Example: Large externalities $\Rightarrow$ regulator does not want dirty firm funded

Capital requirements not the most **effective tool** for this:

- **dirty loans** may be **profitable**, even **at high capital requirements**
- regulator may have to **distort clean capital requirements** and **sacrifice financial stability**

(Contrasts with carbon tax)

Conclusion

Flexible framework to study **green capital requirements**

Positive analysis of brown penalizing and green supporting factors

Normative analysis under different regulatory objective functions

- **prudential regulation** can be adapted to deal with climate risks
- **"green" regulator** limited by banking sector IC constraint
  $\Rightarrow$ Carbon tax is a more direct tool to address externalities