



# GREEN FIRMS ARE LESS RISKY: RESULTS FROM A PREFERENTIAL CAPITAL REQUIREMENT PROGRAM IN EMERGING EUROPE



# BACKGROUND AND MOTIVATION



One potential tool supervisors: green supporting factors (**GSF**) and dirty penalizing factors (DPF) in **capital requirements** framework

Main goal of capital requirements: **stable** financial institutions -> **risk based**

*Promote transition to a low-carbon economy and enhance stability of institutions with higher transition risks*

- **European Banking Authority (2022)**: discussion on how environmental and climate risks could be incorporated into the prudential framework
- **Bank of England (2021)**: “whether changes in the design, use or calibration of the regulatory capital framework are needed” to tackle climate related financial risks
- **World Bank (2021)**: „Explore the *differentiation in Basel Pillar 1 risk weightings*, and consider introduction of *potential adjustments based on evidence-based outcomes* and international consensus and standards”

Our results: Loans in a green capital program have empirically **lower default rates**, even after **controlling** for relevant credit risk factors. A substantial **preferential** capital requirement is **justified**.

# BACKGROUND AND MOTIVATION



MNB 2020: launching a **Green Preferential Capital Requirement Program (GPCR)** for sustainable corporate and municipal financing

- Eligibility criteria: based on the EU Taxonomy
- GSF: banks can deduct **5 - 7 percent** of each eligible gross exposure from their **Pillar II capital requirements** (capped at 1.5 percent of RWAs)

Underlying **hypothesis**: green loans are **less risky**

- Lower level of transition risks for sustainable loans
- Environmentally conscious management attitude
- Capability to obtain such complex products
- Favourable policy measures, steady revenue, little variation in cash flows

We *test* this hypothesis in our study.

## *Green capital requirement:*

- Environmental risks in the ICAAP regulation of large banks in Brazil in 2017 (Miguel et al. (2024))
- Impacted large banks **reallocate their lending** away from exposed sectors; Only **moderate impacts to the real economy** and to greenhouse gas emissions.
- Implementing green capital requirement **slows climate change**; It may increase bank leverage, **posing risks** to financial stability (Dafermos & Nikolaidi (2021))
- Optimal regulation may involve **complementing** capital requirements with **further green finance policies** like guarantees, carbon taxation, and carbon risk adjustment (Lamperti et al., 2021; Dunz et al., 2021)
- Green capital requirements are **optimal for a prudential mandate**, but **inefficient for green mandates**; Differentiation in capital requirements is proposed to enhance substitution between green and dirty lending (Oehmke & Opp (2022))

## ***Credit risk of green loans:***

- Romania 2010 -2020 credit risk of green loans using *micro data*: **less credit risk overall**, but do not observe a significant risk reduction if relevant factors are controlled for (Neagu et al. (2024))
- Carbon-neutral lending to corporates **improves asset quality** of banks due to the lower volatility of the borrowers' earnings (Umar et al., 2021)
- Higher proportion of green loans **reduces banks' NPL ratios** (Cui et al., 2018).
- Energy efficient collateral **lowers default risk** of residential mortgages (Kaza et al., 2014; Guin & Korhonen, 2020; Billio et al., 2022).

# DATA AND METHODOLOGY

Time frame: **2020Q1 – 2023Q2, quarterly data**

- **Credit Register** of the Central Bank of Hungary: loan level data on debtor, collateral
- **Financial statements** of firms: previous year's **balance sheet data**

-> **2.3 million loan, 569,000 firm obs.**

## 1) *Logistic regression*

RE: renewable energy; EM: Electromobility

$$Prob(Y_i = 1|X_i) = \text{logit}^{-1}(\alpha + \beta_{RE} \cdot RE_i + \beta_{EM} \cdot EM_i + \sum_k \beta_k \cdot X_{i,k})$$

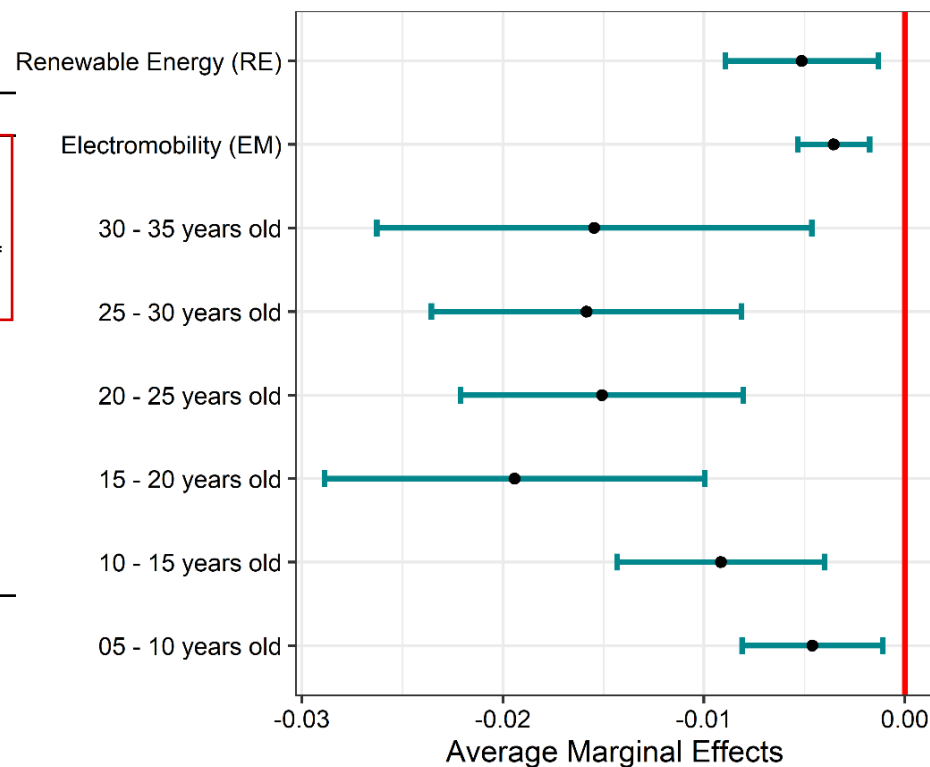
## 2) *Survival analysis: extended Cox proportional hazard model*

$$h(t) = \lim_{\Delta t \rightarrow 0} \frac{Prob(t \leq T < t + \Delta t \mid t \leq T)}{\Delta t}$$

$$h(t, \mathbf{x}_i(t)) = \exp(\beta' \mathbf{x}_i(t)) \cdot h_0(t)$$

# RESULTS: LOGISTIC REGRESSION

	(1)	(2)	(3)	(4)	(5)
GPCR RE	-1.826*** (0.498)	-2.152*** (0.501)	-1.393** (0.566)	-1.504*** (0.562)	-1.569** (0.652)
GPCR EM	-1.027*** (0.209)	-1.104*** (0.210)	-1.087*** (0.210)	-0.953*** (0.211)	-0.790*** (0.239)
Financial controls	No	No	No	No	Yes
Credit controls	No	No	No	Yes	Yes
Sector control	No	No	Yes	Yes	Yes
Firm rel. controls	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes
County FE	No	Yes	Yes	Yes	Yes
Observations	568,999	568,999	568,999	568,999	395,573



ESTIMATED AVERAGE MARGINAL EFFECTS OF GREEN AND AGE GROUPS IN MODEL (5)

The reference group is 0-5 years firms and not SME corporations. Confidence intervals are based on the 95th percentiles.

LOGISTIC REGRESSION ESTIMATES ON CORPORATES' PROBABILITY OF DEFAULT.

**Financial controls:** Sales growth rate, Liquidity, Leverage, ROA (after tax), EBITDA to Equity ratio, Sales to Assets. **Credit related controls:** longest elapsed loan term, remaining maturity, floating rate flag, logarithmized collateral value, logarithmized loan amount, FX flag, HUF flag, subsidized loan flags (NHP and Szechenyi). **Firm related controls:** age (categories with 5-year buckets), size (micro, small, medium or not SME), legal entity type, foreign entity flag.



# RESULTS: SURVIVAL ANALYSIS

	(1)	(2)	(3)	(4)	(5)
GPCR RE	-1.637*** (0.500)	-1.929*** (0.501)	-0.985* (0.576)	-1.153** (0.574)	-1.319** (0.665)
GPCR EM	-0.871*** (0.214)	-0.904*** (0.214)	-0.895*** (0.214)	-0.854*** (0.215)	-0.709*** (0.226)
Financial controls	No	No	No	No	Yes
Credit related controls	No	No	No	Yes	Yes
Economic sector control	No	No	Yes	Yes	Yes
Firm related controls	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes
Observations	562,371	473,885	473,885	473,885	350,368

## SURVIVAL ANALYSIS RESULTS

**Financial controls:** Sales growth rate, Liquidity, Leverage, ROA (after tax), EBITDA to Equity ratio, Sales to Assets.

**Credit related controls:** longest elapsed loan term, remaining maturity, floating rate flag, logarithmized collateral value, logarithmized loan amount, FX flag, HUF flag, subsidized loan flags (NHP and Szechenyi)

**Firm related controls:** age (categories with 5-year buckets), size (micro, small, medium or not SME), legal entity type, foreign entity flag, county

	(Filt 5)	(Unfilt 5)	(GPCR and other RE 5)
GPCR and other RE			-0.900*** (0.336)
GPCR RE	-1.569** (0.652)	-1.588** (0.628)	
GPCR EM	-0.790*** (0.239)	-0.491** (0.207)	-0.792*** (0.239)
Financial controls	Yes	Yes	Yes
Credit related controls	Yes	Yes	Yes
Economic sector control	Yes	Yes	Yes
Firm related controls	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
Observations	568,999	568,999	395,573

## ROBUSTNESS RESULTS

### Unfiltered:

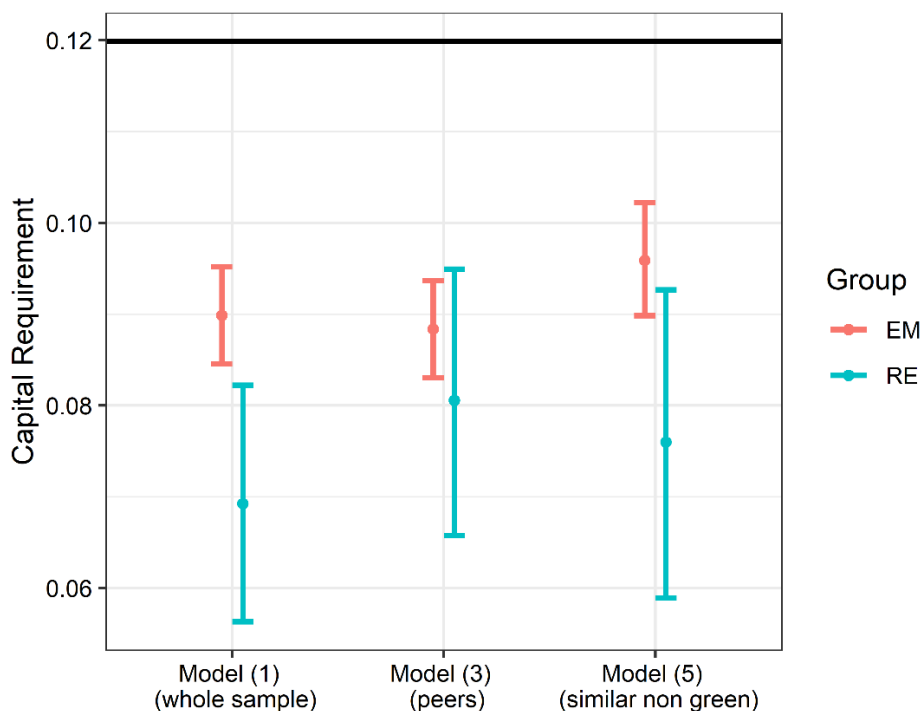
if any loan of the firm in the observed period defaults (no at least 10 percent limit)

### Other RE:

winners of renewable energy auctions supported by the government (not included in the GPCR)



# RESULTS: CAPITAL REQUIREMENTS



**FIGURE 6: FAIR CAPITAL REQUIREMENTS FOR THE CORPORATE SEGMENT FOR MODEL (1), (3) AND (5)**

Results based on the range of logit Model (1), (3) and (5)'s odds ratios for RE and EM, and their respective confidence intervals.

**Model (1):** the PD difference of green firms to the whole sample

**Model (3):** peers in the given sector and similar basic firm characteristics.

**Model (5):** green and similar but non-green firm

- a 5 percent capital deduction in the GPCR might be **justifiable**
- **Half** of this discount is **validated** even for lower bound impacts
- the different risk profiles could explain around **half of the discounts for EM loans**

# CONCLUSION



1. Loans in a green capital program have empirically **lower default rates**
2. **After controlling** for other relevant factors, firms with renewable energy and electromobility loans exhibit **lower probability of default** values
3. Capital discount for green loans in the framework is generous, at least half of this **discount is validated** by our results. Some of our estimates for renewable energy justify the entire discount.

Investigating other periods and gathering evidence from other economies is essential to assess the lower risk levels of sustainable activities in a robust manner.

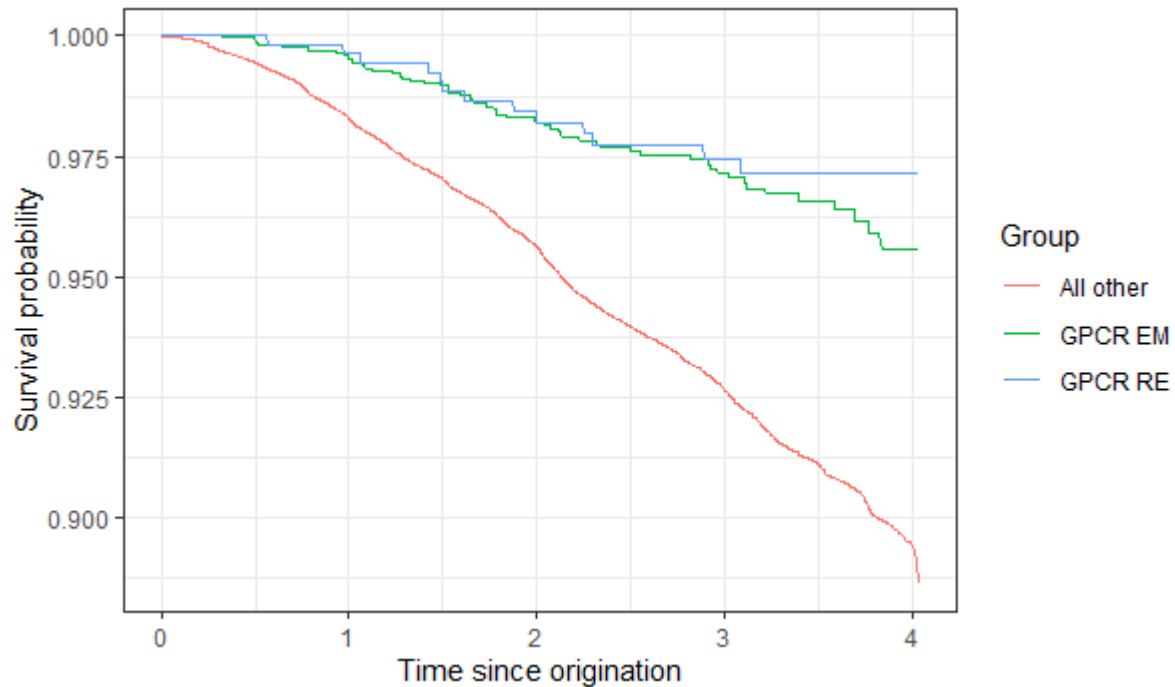


THANK YOU FOR YOUR  
ATTENTION!

# UPDATED RESULTS (2024Q2)



## Kaplan-Meier survival probabilities for RE, EM and other firms



# UPDATE: STRONGLY SIGNIFICANT, BUT LOWER RISK DIFFERENCE



	(1)	(2)	(3)	(4)	(5)
GPCR RE	-1.174*** (0.259)	-1.437*** (0.260)	-0.670** (0.281)	-0.800*** (0.283)	-0.694** (0.291)
GPCR EM	-1.062*** (0.124)	-1.132*** (0.124)	-1.126*** (0.124)	-0.931*** (0.125)	-0.829*** (0.149)
Financial controls	No	No	No	No	Yes
Credit controls	No	No	No	Yes	Yes
Sector control	No	No	Yes	Yes	Yes
Firm rel. controls	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes
County FE	No	Yes	Yes	Yes	Yes
Observations	890,872	890,872	890,872	890,872	618,916

*LOGISTIC REGRESSION ESTIMATES ON CORPORATES' PROBABILITY OF DEFAULT.*

**Financial controls:** Sales growth rate, Liquidity, Leverage, ROA (after tax), EBITDA to Equity ratio, Sales to Assets. **Credit related controls:** longest elapsed loan term, remaining maturity, floating rate flag, logarithmized collateral value, logarithmized loan amount, FX flag, HUF flag, subsidized loan flags (NHP and Szechenyi). **Firm related controls:** age (categories with 5-year buckets), size (micro, small, medium or not SME), legal entity type, foreign entity flag.