Банк России

GREEN LANDING AND THE RISE OF GOVERNMENT BANKING IN RUSSIA

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Bank of Russia and New Economic School Workshop
"Transition to a low-carbon economy: costs and risks for the financial sector"

5 July 2022

Motivation and research

- **Research question(s)**:

  1. Do banks already—before the regulation—put markups on lending to "brown" firms / industries?

  2. If so, does it depend on whether the industries / firms export their production abroad?

  3. Given the rising share of the state and growing ESG hype, do the Big-4 state-owned banks facilitate an in-advance transition to green finance?

  4. Any real effects of markups to "brown" firms / industries so far?

Relation to the literature: green finance

- Following the 2015 Paris climate agreement, the literature has already established (internationally):

  ▶ Firms' "brown" projects: from banks cheaper, from bond and equity markets expensive, De Haas & Popov (2021), Beyene et al. (2021)

  ▶ Regulatory arbitrage: foreign banks from advanced countries extract profits, not facilitating green Benincasa et al. (2021), Ben-David et al. (2021 EP)

  ▶ "Green meets green" vs. banks financing brown firms' investment in CO_2 reduction, Degryse et al, (2021), Kacperczyk & Peydro (2021)

  ▶ Under large pollution storage and low permitting prices, credit spreads for polluting firms fell by 25% from 2013, an unintended consequence of the EU green policy design, Antoniou et al. (2020)

Relation to the literature: government banking

- Government ownership of banks is largely inefficient,
  La Porta et al. (2002 JoF)

- But state-banks smooth the credit cycles internationally,
  Bertay et al. (2015 JBF)

Granular emissions data

- Federal Law №296 On limiting greenhouse gas emissions: companies with an annual GHGs emission volume more than 150 thousand tons CO2e (scope 1) start reporting in 2023; in 2025 – reporting threshold decreases to 50 thousand tons CO2e.

- Meanwhile: Ministry of Natural Resources and Environment issued guidelines on assessment of GHGs emission volume on firm level (order №300, June 30th, 2015). CO2e emissions are calculated based on energy consumption.

- Industry-level energy consumption data in physical terms (tce): Rosstat 4ter database (Information on the use of fuel and energy resources)

- Industry-level data on cost fuels as a part of production costs:
Rosstat 1p database (Key performance indicators of enterprises and organizations)

Scope of industry emissions data: 2018

- Total emissions (without LULUCF) 2 133 582 kt CO2e – National inventory report (NIR)
- Industry emissions based on fuel consumption 1 214 867 kt CO2e (Rosstat 4ter) (98% of categories 1-3 of Fuel consumption in NIR)

1. Energy	A. Fuel combustion	1. Energy industries	825 088,89
		2. Manufacturing, construction	166 836,30
		3. Transport	254 077,22
		4. Other sectors (Residential)	207 834,50
		5. Other	19 597,71
	B. Fugitive emissions from fuels		205 798,81
2. Industrial processes and product use			243 282,58
3. Agriculture			112 824,98
5. Waste			98 240,62

1 246 002,40 kt CO2e

Volume of emissions and emission coefficient
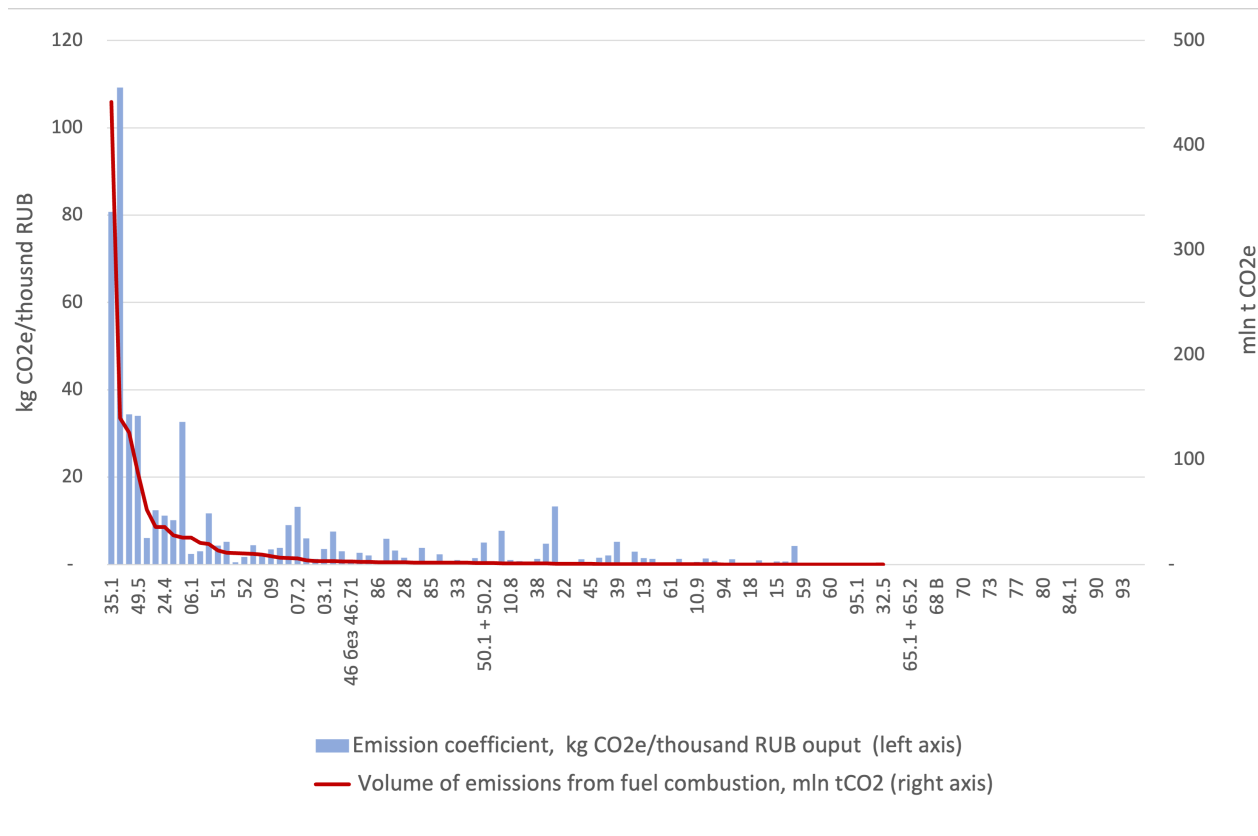
Emission coefficient and export share
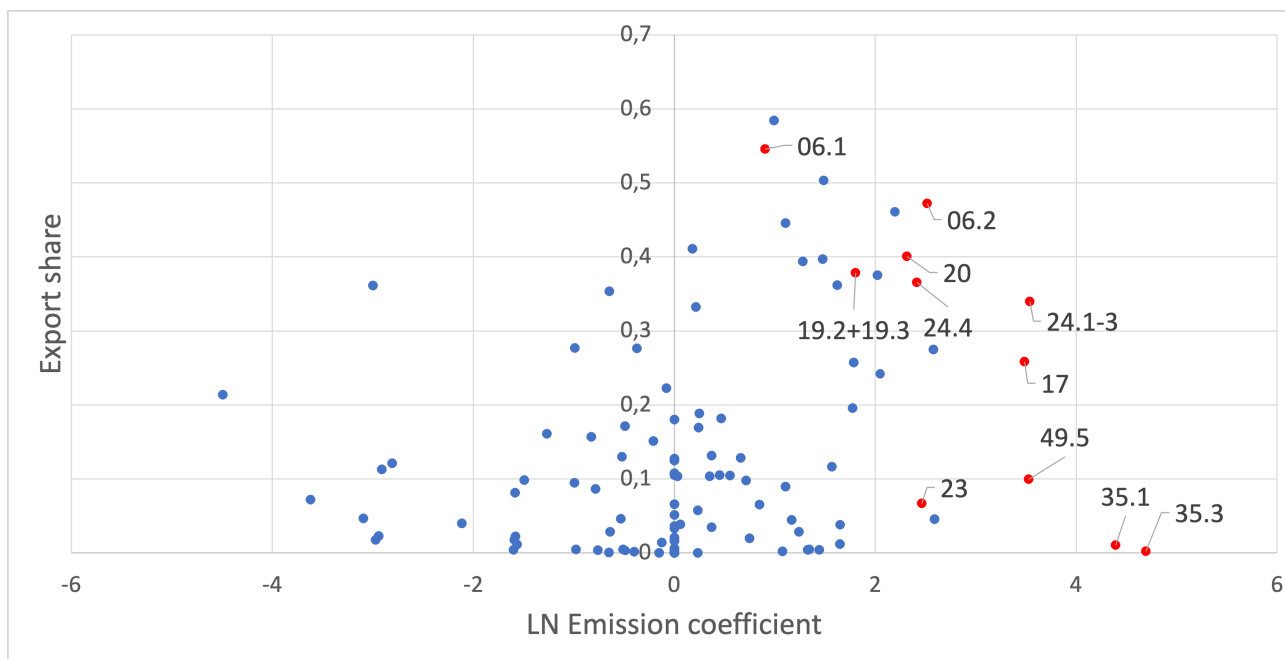
- Cumulative emissions of 11 marked industries equals 85% of total CO_2 emissions in 2019.

"Brown" industries and banks

- Average share of new loans by type of a bank (state, foreign, other) in 2018-2021 for "brown" industries.
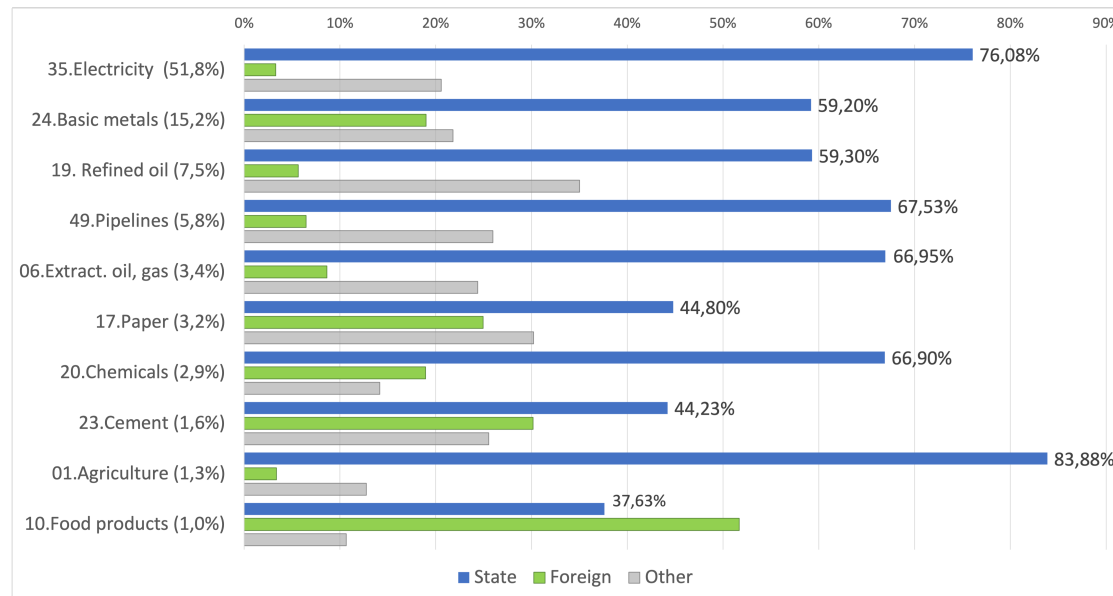
- Total CO_2 emissions of 10 industries on the graph above equals 94% (share in total emissions in 2019 in parentheses)

Concentration of ownership across bank ownership types
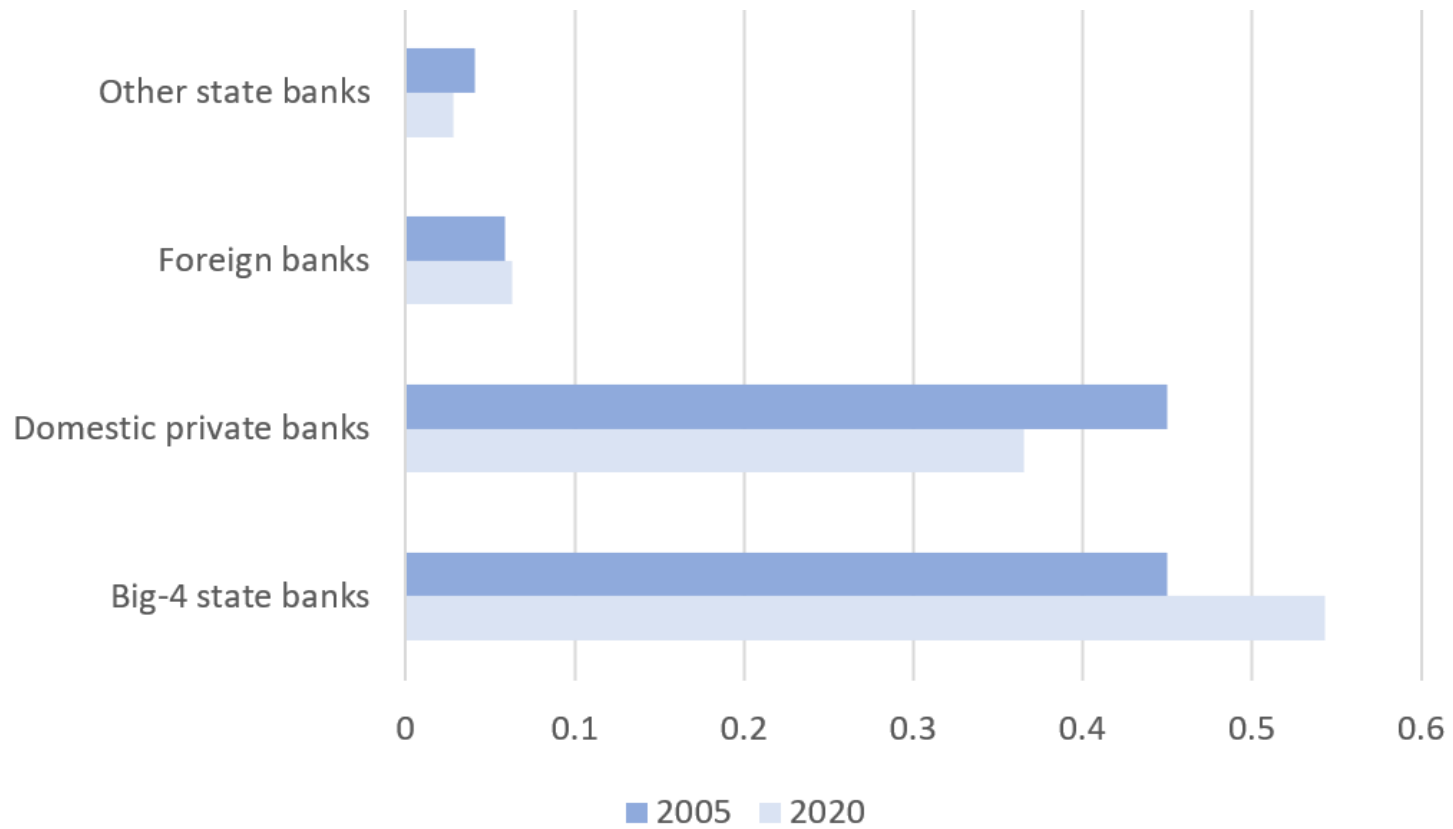
Data for research

- **Matched "bank-firm" data**

  - ▶ The bank-firm credit register, 2017–2021 (The Bank of Russia's confidential data)

  - ▶ Banks' balance sheets and P&L accounts, 2008–2018 (The Bank of Russia publicly available data

  - ▶ Non-financial firms' balance sheets and P&L accounts, 2008–2020 (SPARK-Interfax database)

- **Detailed industry-level data on CO2 emissions and exporting status:**

  - ▶ Emissions are based on industry energy use (Rosstat dataset 4ter Ïnformation on the use of fuel and energy resources", 2018-2019)

  - ▶ Shares of exports in industries' output are computed with detailed input-output tables from Rosstat (years 2016 – 2019)

  - ▶ 117 industries, 2016-2019

Descriptive statistics 2017-2020

	Mean	Median	SD	Min	Max
Loan level					
Interest rate	11.95	12.50	4.86	0.00	24.90
log of loan volume	14.54	14.62	2.32	6.81	20.18
Industry level					
log of CO_2 emission / Added value	−1.17	−1.27	1.87	−5.00	4.69
Export / Output	0.10	0.09	0.09	0.00	0.58
Bank ownership types					
Big-4 state banks (*Big.STATE*)	0.44	0.00	0.50	0.00	1.00
Other state banks (*Other.STATE*)	0.01	0.00	0.09	0.00	1.00
Big foreign banks (*Big.FOREIGN*)	0.05	0.00	0.22	0.00	1.00
Other foreign banks (*Other.FOREIGN*)	0.01	0.00	0.09	0.00	1.00
Other private banks (*Other.PRIVATE*)	0.22	0.00	0.42	0.00	1.00
Bank level					
log of total assets (Bank.Size)	7.63	8.17	2.61	0.90	10.44
Liquidity	0.07	0.05	0.05	0.01	0.37
Capital Buffer	0.05	0.05	0.03	−0.04	0.23
Deposit Strength	0.79	0.81	0.14	0.10	1.08
Credit Maturity Ratio	0.57	0.63	0.18	0.02	1.22
Firm level					
log of total assets (*Firm.Size*)	19.89	19.75	1.95	14.92	25.86
Leverage	0.71	0.76	0.24	0.08	1.34
ROA	0.05	0.03	0.08	−0.30	0.45

Interest rate regressions, 2018

$$r_{b,f,i,t}^L = \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)} + \left(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Gamma$$

$$+ \text{Bank.OWNERSHIP}'_{b,t}\Omega + \text{Bank.Control}'_{b,t}\Psi + \text{Firm.Control}'_{f,t}\Phi + \text{Loan.Control}'_{b,f,t}\Xi + \varepsilon_{b,f,i,t}$$

CO_2 and export

	Baseline (1)	+ Export (2)
log of CO_2.Emission / Value added (*industry-level*)	0.060*** (0.007)	0.032*** (0.007)
Export / Output (*industry-level*)		1.387*** (0.055)
Obs	350,248	350,248
R^2 (adj.)	0.5	0.5

All regressions include bank-, firm-, and loan-level controls, and month fixed effects
Clustered standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

We find a positive price markup for CO_2 emission
But *on average* the markup is incredibly small, economically

Interest rate regressions, 2019

$$r^L_{b,f,i,t} = \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)} + \left(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Gamma$$

$$+ \textbf{Bank.OWNERSHIP}'_{\textbf{b,t}}\Omega + \textbf{Bank.Control}'_{\textbf{b,t}}\Psi + \textbf{Firm.Control}'_{\textbf{f,t}}\Phi + \textbf{Loan.Control}'_{\textbf{b,f,t}}\Xi + \varepsilon_{b,f,i,t}$$

	Baseline (1)	+ Export (2)
log of CO_2.Emission / Value added (*industry-level*)	0.060*** (0.007)	0.032*** (0.007)
Export / Output (*industry-level*)		1.387*** (0.055)
Big.STATE	−0.882*** (0.018)	−0.874*** (0.018)
Other.STATE	−1.309*** (0.064)	−1.303*** (0.064)
Big.FOREIGN	−0.979*** (0.021)	−0.984*** (0.021)
Other.FOREIGN	−0.817*** (0.050)	−0.827*** (0.050)
Other.PRIVATE	−0.572*** (0.026)	−0.575*** (0.026)
Obs	350,248	350,248
R^2 (adj.)	0.5	0.5

All regressions include bank-, firm-, and loan-level controls, and month fixed effects
Clustered standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Interest rate regressions, 2019

$$r^L_{b,f,i,t} = \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)} + \left(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Gamma$$

$$+ \mathbf{Bank.OWNERSHIP}'_{\mathbf{b,t}} \Omega + \mathbf{Bank.Control}'_{\mathbf{b,t}} \Psi + \mathbf{Firm.Control}'_{\mathbf{f,t}} \Phi + \mathbf{Loan.Control}'_{\mathbf{b,f,t}} \Xi + \varepsilon_{b,f,i,t}$$

	Baseline (1)	+ Export (2)
log of CO_2.Emission / Value added (*industry-level*)	0.060*** (0.007)	0.032*** (0.007)
Export / Output (*industry-level*)		1.387*** (0.055)
Big.STATE $\times$ CO_2.Emission	−0.096*** (0.006)	−0.095*** (0.006)
Other.STATE $\times$ CO_2.Emission	−0.119*** (0.028)	−0.117*** (0.028)
Big.FOREIGN $\times$ CO_2.Emission	−0.109*** (0.010)	−0.112*** (0.010)
Other.FOREIGN $\times$ CO_2.Emission	0.136*** (0.022)	0.129*** (0.022)
Other.PRIVATE $\times$ CO_2.Emission	0.005 (0.007)	0.008 (0.007)
Obs	350,248	350,248
R^2 (adj.)	0.5	0.5

All regressions include bank-, firm-, and loan-level controls, and month fixed effects
Clustered standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Interest rate regressions, 2019

$$r_{b,f,i,t}^{L} = \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)} + \left(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Gamma$$

$$+ \left(CO_2.Emission_{f(i)} \times Export_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Theta$$

$$+ \mathbf{Bank.OWNERSHIP}_{b,t}' \Omega + \mathbf{Bank.Control}_{b,t}' \Psi + \mathbf{Firm.Control}_{f,t}' \Phi + \mathbf{Loan.Control}_{b,f,t}' \Xi + \varepsilon_{b,f,i,t}$$

	Baseline	+ Export	+ Export × Bank.OWN
	(1)	(2)	(3)
log of CO_2.Emission / Value added (*industry-level*)	0.060*** (0.007)	0.032*** (0.007)	0.123*** (0.009)
Export / Output (*industry-level*)		1.387*** (0.055)	1.838*** (0.114)
Big.STATE × CO_2.Emission × Export			1.183*** (0.059)
Other.STATE × CO_2.Emission × Export			1.920*** (0.303)
Big.FOREIGN × CO_2.Emission × Export			0.515*** (0.085)
Other.FOREIGN × CO_2.Emission × Export			1.324*** (0.207)
Other.PRIVATE × CO_2.Emission × Export			0.964*** (0.070)
Obs	350,248	350,248	350,248
R^2 (adj.)	0.5	0.5	0.5

Interest rate regressions, 2017-2020

- An alternative approach: panel regression, binary variable of most "brown" industries in terms of total CO_2 emissions (OKVED detailed codes)

	"Brown" × Export × Bank.OWN
	(1)
"Brown" Industry = 1	0.033
Export / Output (*industry-level*)	−0.752***
Big.STATE × "Brown" Industry = 1	−0.969***
Other.STATE × "Brown" Industry = 1	−0.565***
Big.FOREIGN × "Brown" Industry = 1	−0.522***
Other.FOREIGN × "Brown" Industry = 1	0.691***
Other.PRIVATE × "Brown" Industry = 1	0.144***
Big.STATE × "Brown" Industry = 1 × Export	6.448***
Other.STATE × "Brown" Industry = 1 × Export	7.729***
Big.FOREIGN × "Brown" Industry = 1 × Export	1.323***
Other.FOREIGN × "Brown" Industry = 1 × Export	1.686***
Other.PRIVATE × "Brown" Industry = 1 × Export	3.131***
Obs	1,001,315
R^2 (adj.)	0.5

All regressions include bank-, firm-, and loan-level controls, and month fixed effects
Clustered standard errors not reported. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Regression results: further steps

- *Selection issues*: who is more willing to extract rents from / facilitate an in-advance transition of "green" finance in Russia?

  - ▶ The Big-4 state-owned banks

  - ▶ Foreign banks

  - ▶ Private banks

- We suggest a two-stage approach to manage the selection concerns:

  1. the first-stage regression: who buys which types of loans from other banks issued to more vs. less "brown" industries / firms? How it depends on the export shares?

  2. the second-stage regression: what are the interest rates on loans to more vs. less "brown" industries / firms, their amounts of loans outstanding, credit types, and credit quality *across* the bank ownership types?

Regression results: further steps

- The first-stage regression (Linear probability model, LPM):

$$\mathbf{Pr}\Big(bank\ b_2\ buys\ the\ loan\ of\ firm\ f\ from\ bank\ b_1 = 1 \,|\, \mathbf{X}_{f,b,r,t} \Big) =$$

$$+ \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)}$$

$$+ \Big(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b_1,t} \Big)' \Gamma_1 + \Big(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b_2,t} \Big)' \Gamma_2$$

$$+ \mathbf{Bank.OWNERSHIP}'_{b_1,t}\Omega_1 + \mathbf{Bank.Control}'_{b_1,t}\Psi_1$$

$$+ \mathbf{Bank.OWNERSHIP}'_{b_2,t}\Omega_2 + \mathbf{Bank.Control}'_{b_2,t}\Psi_2$$

$$+ \mathbf{Firm.Control}'_{f,t}\Phi + \mathbf{Loan.Control}'_{b_1,f,t}\Xi + \tau Bank.SELECT_{b_2,t} + \varepsilon_{b_2,f,i,t}$$

- $Bank.SELECT_{b_2,t} = ?$ Foreign branches? Participation at some climate / ESG forums in Russia / abroad? Else?

- Extract an analog to the Inverse Mills Ratio (IMR) and use it at the second stage to adjust for selection bias, if any

Regression results: further steps

- The second-stage regression: interest rate on loan

$$r^L_{b,f,i,t} = \alpha_t + \beta_1 CO_2.Emission_{f(i)} + \beta_2 Export_{f(i)} + \left(CO_2.Emission_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Gamma$$
$$+ \left(CO_2.Emission_{f(i)} \times Export_{f(i)} \times Bank.OWNERSHIP_{b,t} \right)' \Theta$$
$$+ \mathbf{Bank.OWNERSHIP}'_{b,t}\Omega + \mathbf{Bank.Control}'_{b,t}\Psi + \mathbf{Firm.Control}'_{f,t}\Phi + \mathbf{Loan.Control}'_{b,f,t}\Xi$$
$$+ \rho IMR_{b,f,i,t} + \varepsilon_{b,f,i,t}$$

- Hypothesis:

  1. Selection issues: $\rho \neq 0$ statistically

Conclusion

- Banks already put a markup in interest rate on loans for "brown" industries

- The average size of the markup is very small

- However, the markup is highly heterogeneous:

  ▶ non-exporters pay nearly nothing

  ▶ exporters pay up to 1.0 p.p. in state banks and only 0.3 p.p in foreign banks