EUROPEAN CENTRAL BANK

The poor, the rich, and the credit channel of monetary policy

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This paper

1. Are the poor affected differently by monetary policy compared to the wealthy?

2. And if so, what role does **credit** play in this configuration?

Motivation

- Theoretically,
  - Wealth could influence lending decision if banks perceive it as collateral (Holmstrom and Tirole, 1997 QJE)
    - Explicit for full liability firms
    - Implicit for limited liability firms, if banks believe they will be able to persuade the owner during times of corporate stress
  - Collateral/Wealth might matter less during expansionary monetary policy: risk-taking channel (Ioannidou et al., 2014 RF; Jimenez et al., 2014 ECMA)

Findings

1. Monetary policy transmits to business loan approval rates, but transmission diminishes with wealth of business owner
   - Owners at 25^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 4.4 pp $\downarrow$ loan approval
   - Owners at 75^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 0 pp $\downarrow$ loan approval

2. Loan approval significantly affects owners' ability to generate future income & wealth

Findings

1. Monetary policy transmits to business loan approval rates, but transmission diminishes with wealth of business owner
   - Owners at 25^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 4.4 pp $\downarrow$ loan approval
   - Owners at 75^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 0 pp $\downarrow$ loan approval
2. Loan approval significantly affects owners' ability to generate future income & wealth
3. 1 + 2 imply that monetary policy may have redistributive effects
4. The effect transmits especially via banks with low liquidity and low capital

Related literature

1. Monetary policy and economic inequality
   - Amberg et al., 2021; Andersen et al., 2021; Auclert, 2019; Coibion et al., 2017; Holm et al., 2021; Jasova et al., 2023; Kaplan et al., 2018; Moser et al., 2024; Mumtaz and Theophilopoulou, 2017
2. Credit channel of monetary policy
   - Bernanke and Blinder, 1992; Ciccarelli et al., 2015; Heider et al., 2019; Hulsewig et al., 2006; Ioannidou et al., 2014; Jimenez et al., 2014; Kashyap and Stein, 2000; Kishan and Opiela, 2000; Maddaloni and Peydro, 2011
3. Real effects of loan approval
   - Banerjee and Duflo, 2014; Berg, 2018; Delis et al., 2023

Data

Two datasets with distinct (dis)advantages:

1. Confidential and detailed data from a large North European bank (2002-2018)
   - \+ Loan applications (disentangle loan demand from supply)
   - \+ Private wealth observed by bank
   - \+ Credit Score observed (disentangle effect of business quality from private wealth)
   - – Only one bank

2. Matched Survey on the access to finance of enterprises (SAFE) with ORBIS data (2009-2020)
   - \+ Loan applications (disentangle loan demand from supply)
   - \+ Multiple banks and countries (external validity + study bank heterogeneity)
   - – Private wealth approximated through past dividends
   - – Credit score not observed

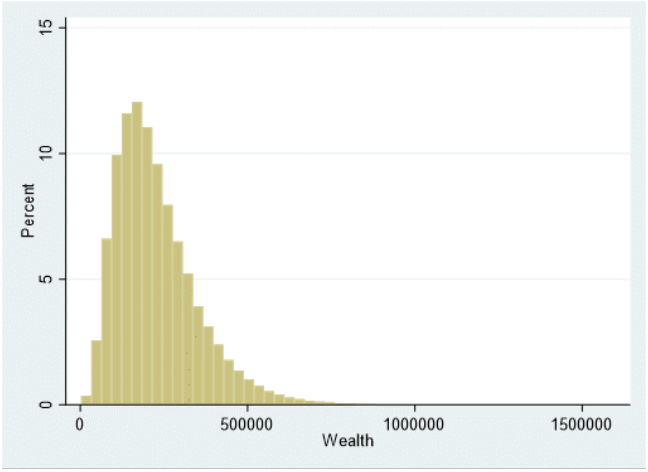
Data set 1

137.000 loan applications from 16.000 SMEs to a large North European bank (2002-2018).

- **Loan (application) info**: e.g. granted or not, amount, spread, collateral, default status
- **Private wealth** of the majority owner
  - All money in savings and deposit accounts, stocks, bonds, etc. (= Holm et al. 2021 JPE)
  - Excluding: house value and mortgage debt, the (net present) value of their business
- **Credit score** of the business
  - Assessment of the firm's quality and repayment capacity, as given by the bank
  - Includes both soft and hard information
  - Known cutoff determines loan approval
- **Other info** about majority owners (e.g. education, children, age, gender) as well as the business (income statements and balance sheets)

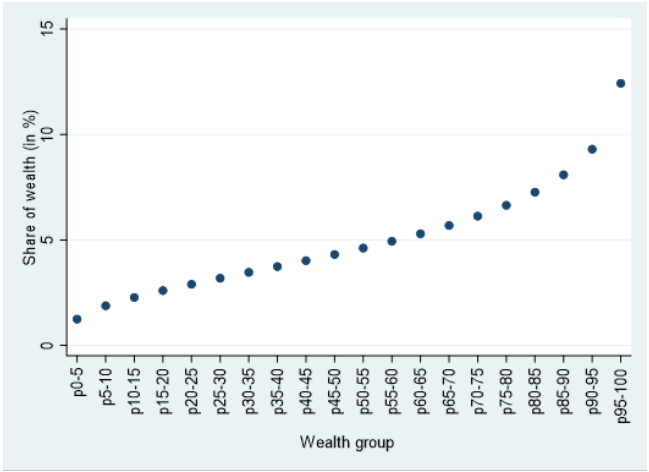
Summary statistics: wealth

Figure: Histogram of business owners' wealth (from our large euro area bank sample)



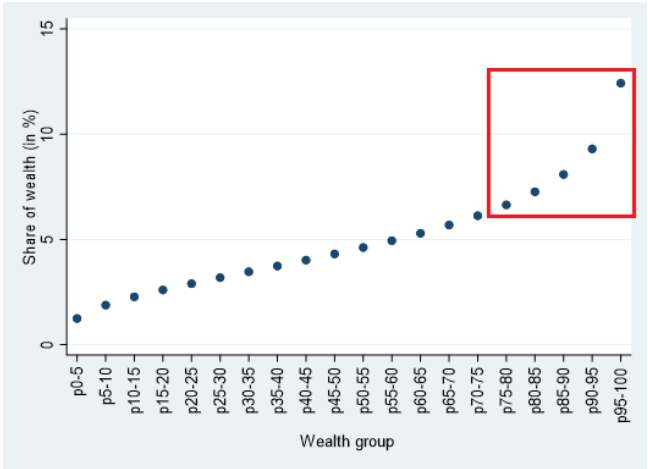
Summary statistics: wealth

Figure: Wealth inequality among business owners: Share of total wealth owned by each vigintile



Summary statistics: wealth

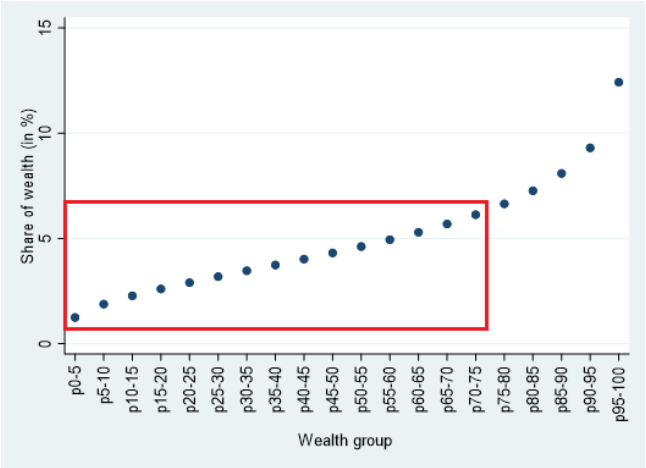
Figure: Wealth inequality among business owners: Share of total wealth owned by each vigintile



- top quartile owns 44%

Summary statistics: wealth

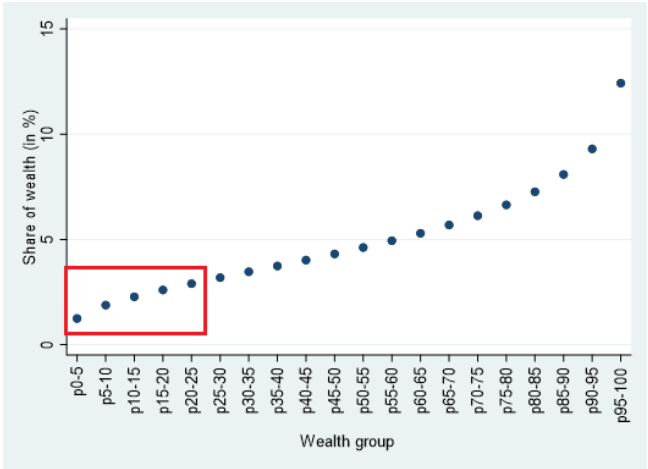
Figure: Wealth inequality among business owners: Share of total wealth owned by each vigintile



- top quartile owns 44%
- bottom 3 quartiles own 56%

Summary statistics: wealth

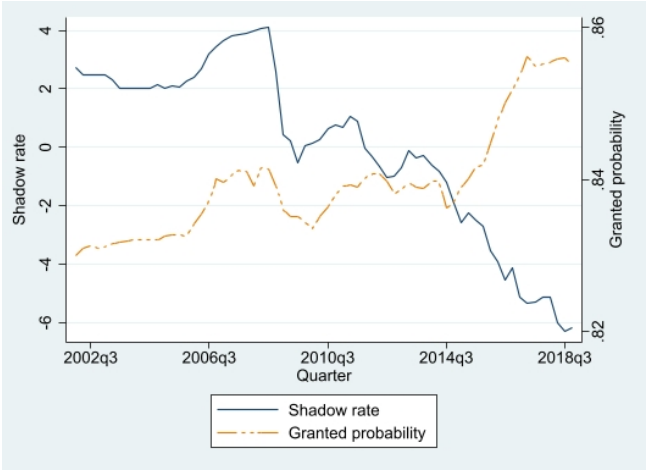
Figure: Wealth inequality among business owners: Share of total wealth owned by each vigintile



- top quartile owns 44%
- bottom 3 quartiles own 56%
- bottom quartile owns 11.5%

Summary statistics: monetary policy and loan approval

Figure: Evolution of the shadow rate and average loan approval rate during sample period



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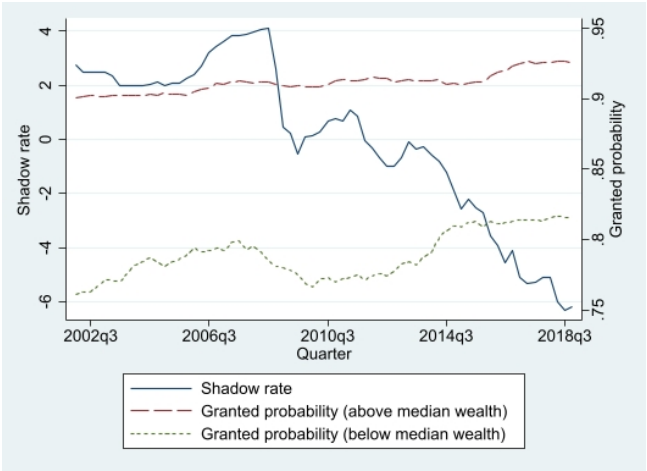

Methodology

Regression model:

$$\begin{aligned} Granted_{ift} \quad = \quad & \beta_1 \; Wealth_{it} + \beta_2 \; Monetary \; Policy_t + \beta_3 \; Monetary \; Policy_t \times Wealth_{it} + \\ & \beta_4 \; X'_{ift-1} \; (+\delta_f + \rho_t) + \epsilon_{iot} \end{aligned} \tag{1}$$

- $Monetary\ Policy_t$ is either the shadow rate (Wu and Xia, 2016) or monetary policy shocks (Altavilla et al., 2019).
- X_{ift-1} :i) credit score; income, education, age, firm size, ROA, cash holding, n of applications; ii) ROE, equity ratio, cash flow, size; bank liquidity and capital ratios
- Expectation: $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$
- We can limit the analysis to a narrow bandwidth around the known Credit Score cutoff to ensure firms are observationally equal. Manipulation test

Summary statistics: narrow bandwidth around cutoff

	Mean	St. dev.	Min.	Max.	Mean diff.	Std. error
Granted	0.66	0.47	0	1	1	0
Credit score	0.06	0.16	-0.30	0.30	0.277	0.073
Shadow rate	-0.19	3.28	-6.40	4.28	0.017	0.016
Wealth	11.50	0.60	7.21	13.97	0.020	0.026
Income	10.69	0.30	9.73	11.49	0.027	0.026
Education	2.13	0.99	0	5	0.033	0.021
Age	44.80	15.86	20	76	0.238	0.252
Children	1.86	1.47	0	6	0.004	0.036
Gender	0.81	0.39	0	1	0.009	0.006
Fim size	12.72	0.40	9.96	14.09	0.011	0.007
Firm leverage	0.20	0.03	0.15	0.74	0.002	0.002
Firm ROA	0.06	0.09	-0.40	0.49	0.005	0.002
Firm cash holdings	0.07	0.03	0.01	0.16	0.000	0.001

Wealth, loan approval, and monetary policy

	Granted				
Wealth					
Shadow rate					
Shadow rate × Wealth					
Lambda					
Credit score bandwidth	[-∞,+∞]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.1,0.1]
Observations	137,321	32,310	32,310	32,310	18,028
Observations (first stage)				414,730	
Adj. R-squared	0.723	0.706	0.720		0.819
Controls and Firm FE	Yes	Yes	Yes	Yes	Yes
Year:quarter FE			Yes		

Wealth, loan approval, and monetary policy

	Granted				
Wealth	0.016***	0.013***	0.013***	0.014***	0.012***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Shadow rate	-0.239***	-0.212***		-0.206***	-0.202***
	(0.063)	(0.074)		(0.056)	(0.066)
Shadow rate × Wealth	0.022***	0.017***	0.018***	0.020***	0.018***
	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)
Lambda				-0.172	
				(0.164)	
Credit score bandwidth	[-∞,+∞]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.1,0.1]
Observations	137,321	32,310	32,310	32,310	18,028
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Controls and Firm FE	Yes	Yes	Yes	Yes	Yes
Year:quarter FE			Yes		

Wealth, loan approval, and monetary policy

Economic effect of a 1 standard deviation increase in the Shadow rate (3.3pp)

- Wealth at 25th percentile of the distribution is EUR 120,000 (ln=11.68).
- 3.3 x (-0.212 + 0.017×11.68) = -4.4pp lower approval likelihood

- Wealth at 75th percentile of the distribution is EUR 270,000 (ln=12.50).
- 3.3 x (-0.212 + 0.017×12.5) = 0.1pp no effect on approval likelihood

Role of wealth as collateral: stronger for fully liable entrepreneurs?

	Granted		
Wealth	0.013***	0.013***	0.012***
	(0.003)	(0.004)	(0.002)
Shadow rate	-0.212***	-0.196***	-0.223***
	(0.074)	(0.113)	(0.066)
Shadow rate × Wealth	0.017***	0.014**	0.019***
	(0.006)	(0.007)	(0.005)
Credit score bandwidth	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]
Firm type	all	limited liability	full liability
Observations	32,310	27,140	5,170
Adj. R-squared	0.706	0.709	0.698
Controls and Firm FE	Yes	Yes	Yes

Role of wealth as collateral: does it reduce loan default?

	Default 3 years after origination		
Wealth	-0.032***	-0.030***	-0.047***
	(0.009)	(0.007)	(0.010)
Credit score	-0.051***	-0.052***	-0.051***
	(0.020)	(0.020)	(0.017)
Firm type	all	limited liability	full liability
Observations	77,510	61,935	15,875
Adj. R-squared	0.703	0.716	0.695
Controls & Firm FE	Yes	Yes	Yes

Role of wealth as collateral: is it used to (re)capitalize the firm?

	(1)	(2)	(3)	(4)	(5)	(6)
	Capital increase			**Capital increase**		
	all firm-years			firm-years with deteriorating default probability		
Wealth decrease	0.687***	0.489***	0.709***	0.511***	0.347***	0.655***
	(0.103)	(0.091)	(0.106)	(0.152)	(0.094)	(0.110)
Firm type	all	limited liability	full liability	all	limited liability	full liability
Observations	32,310	27,140	5,170	16,014	13,420	2,594
Adj. R-squared	0.81	0.70	0.83	0.55	0.50	0.57
Controls	No	No	No	No	No	No
Firm FE	No	No	No	No	No	No
Year FE	No	No	No	No	No	No

Role of loan approval for future income and wealth generation

- We want to identify the effect of the loan decision on the loan applicant's future income and wealth.
- We follow Berg (2018) and use an RDD regression model:

$$y_{it+3} = \alpha_0 + \alpha_1 \; Granted_{it} + \alpha_2 \; (x_{it} - \overline{x}) + \alpha_3 \; Granted_{it} \times (x_{it} - \overline{x}) + \alpha_4 \; y_{it} + \alpha_5 \; x'_{it-1} + \nu_{it} \tag{2}$$

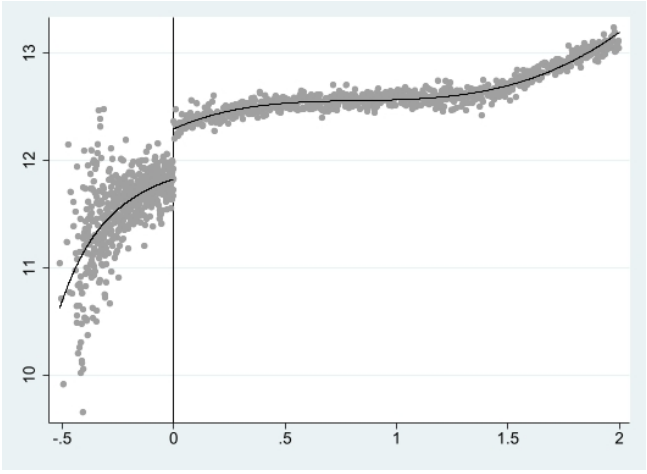
- where y is ln(annual income) or ln(private wealth)
- x_{it} is the Credit Score and $\overline{x}$ is the known cutoff Manipulation test

Does loan approval matter for future income and wealth generation?

	Income 3 years after loan origination	**Wealth** 3 years after loan origination
Granted	0.072***	0.053***
	(0.015)	(0.010)
Shadow rate	-0.012**	-0.011**
	(0.006)	(0.005)
Credit score	0.006	0.005
	(0.004)	(0.004)
Credit score × Granted	-0.009	-0.006
	(0.006)	(0.005)
Income	0.036***	
	(0.007)	
Wealth		0.025***
		(0.005)
Observations	77,510	77,510
Adj. R-squared	0.629	0.703
Controls & Firm FE	Yes	Yes

Graphical representation of RDD

Figure: Graphical result of the RDD model: Effect on future wealth



Robustness

- We use **monetary policy shocks** as in Altavilla et al. (2019 JME) instead of shadow rates Table
- We look at **loan amounts** and **loan spreads** instead of the propensity to grant a loan Table

External validity using the SAFE survey data

- We use the matched **SAFE-ORBIS data** from the ECB:
  - 10.000 (private, profit-oriented and family-owned) SMEs
  - 19 Euro Area countries
  - 2009-2020
  - 16.000 loan applications (at different banks)

→ With this data, we:

- confirm the effect in a less sophisticated, but significantly broader setting
- can look into bank heterogeneity

Wealth, loan approval and monetary policy using the SAFE survey data

	Granted			
Wealth	0.07***	0.05**	0.05**	0.08
	(0.02)	(0.02)	(0.02)	(0.07)
Shadow rate	-1.51***	-1.54***		
	(0.33)	(0.36)		
Shadow rate × Wealth	2.21***	2.20***	2.24***	2.90***
	(0.52)	(0.53)	(0.53)	(0.87)
Observations	15,627	15,627	15,627	9,556
No. firms	9,158	9,158	9,158	3,087
R-squared	0.12	0.15	0.16	0.65
Control variables:	Yes	Yes	Yes	Yes
Country FE		Yes	Yes	Yes
Wave FE			Yes	Yes
Firm FE				Yes

Wealth, loan approval and monetary policy using the SAFE survey data

Economic effect of a 1 standard deviation increase in the Shadow rate (2.4pp)

- At 25th percentile of distribution, the effect is 2.4 x (-0.0154 + 0.022×0) = -3.7pp lower approval likelihood
- At 75th percentile of distribution, the effect is 2.4 x (-0.0154 + 0.022×0.11) = -3.1pp lower approval likelihood
- At 95th percentile of distribution, the effect is 2.4 x (-0.0154 + 0.022×0.59) = -0.6pp lower approval likelihood

Bank heterogeneity using the SAFE survey data

Banks with:	**High Liquidity**			**Low Liquidity**		
	Granted			**Granted**		
Wealth	0.19***	0.07***	-0.10	0.08	0.15**	0.19
	(0.04)	(0.04)	(0.16)	(0.07)	(0.06)	(0.16)
Shadow rate	-1.69***	-0.72		-3.28***	-2.46***	
	(0.50)	(0.51)		(0.40)	(0.43)	
Shadow rate × Wealth	3.61**	2.21**	1.13	4.02**	5.39***	6.17***
	(1.39)	(1.01)	(1.70)	(1.65)	(1.43)	(2.11)
Observations	2,443	2,329	1,719	2,519	2,328	1,565
No. firms	1,215	1,311	521	1,372	1,263	500
R-squared	0.01	0.11	0.62	0.02	0.11	0.65
Control variables		Yes	Yes		Yes	Yes
Country FE, wave FE, firm FE			Yes			Yes

Bank heterogeneity using the SAFE survey data

Banks with:	**High Capital**			**Low Capital**		
	Granted			**Granted**		
Wealth	-0.11	-0.11	0.18	0.21**	0.23***	-0.03
	(0.10)	(0.09)	(0.29)	(0.09)	(0.08)	(0.15)
Shadow rate	-3.78***	-2.30***		-3.99***	-3.05***	
	(0.65)	(0.60)		(0.60)	(0.60)	
Shadow rate × Wealth	2.11	1.36	-0.11	4.39**	5.37***	2.91
	(3.19)	(3.27)	(7.07)	(1.86)	(1.59)	(2.00)
Observations	1,536	1,422	872	2,174	2,042	1,378
No. firms	923	858	308	1,205	1,108	444
R-squared	0.04	0.12	0.72	0.04	0.13	0.67
Control variables		Yes	Yes		Yes	Yes
Country FE, wave FE, firm FE			Yes			Yes

Conclusion

- Monetary policy is passed through to borrowers via loan approval rates.
- The strength of this transmission depends on the wealth of the business owner.
  - Owners at 25^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 4.4 pp $\downarrow$ loan approval
  - Owners at 75^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 0 pp $\downarrow$ loan approval

Conclusion

- Monetary policy is passed through to borrowers via loan approval rates.
- The strength of this transmission depends on the wealth of the business owner.
  - Owners at 25^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 4.4 pp $\downarrow$ loan approval
  - Owners at 75^{th} pctile in wealth distribution: 1 sd. $\uparrow$ shadow rate $\rightarrow$ 0 pp $\downarrow$ loan approval
- This transmission happens primarily through banks with below average liquidity ratios and capital ratios.
- There are redistributive effects as loan approval matters for income & wealth generation.

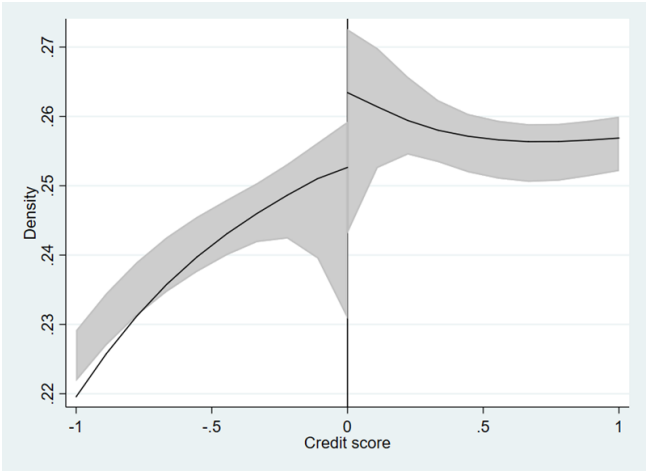
Thank you for your attention!

Appendix

Graphical test credit score manipulation

Back Methodology Back RDD

Figure: Manipulation test RDD



Summary statistics

	Mean	St. dev.	Min.	Max.	Mean diff.	Std. error
Granted	0.66	0.47	0	1	1	0
Shadow rate	-0.19	3.28	-6.40	4.28	0.017	0.016
Monetary policy shock	0.02	2.31	-7.10	4.74	0.004	0.008
Wealth	11.50	0.60	7.21	13.97	0.020	0.026
Income	10.69	0.30	9.73	11.49	0.027	0.026
Education	2.13	0.99	0	5	0.033	0.021
Age	44.80	15.86	20	76	0.238	0.252
Dependents	1.86	1.47	0	6	0.004	0.036
Gender	0.81	0.39	0	1	0.009	0.006
Fim size	12.72	0.40	9.96	14.09	0.011	0.007
Firm leverage	0.20	0.03	0.15	0.74	0.002	0.002
Firm ROA	0.06	0.09	-0.40	0.49	0.005	0.002
Firm cash holdings	0.07	0.03	0.01	0.16	0.000	0.001
Number of applications	7.22	1.48	1	9	0.091	0.070
Credit score	0.06	0.16	-0.30	0.30	0.277	0.073
Default	0.04	0.11	0	1	0.000	0.003
Loan amount	1.98	0.54	0.71	7.01	0.099	0.008
Maturity	44.13	35.94	4	233	0.841	0.570
Loan provisions	0.46	0.50	0	1	0.023	0.036
Collateral	0.69	0.45	0	1	0.011	0.027

Wealth, loan approval, and monetary policy shocks

Back

	(1) Granted	(2) Granted	(3) Granted	(4) Granted	(5) Granted	(6) Granted	(7) Granted	(8) Granted	(9) Granted
Wealth	0.012***	0.011***	0.010***	0.010***	0.012***	0.019***	0.013***	0.015***	0.010***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.005)	(0.002)
Mon. pol. shock	-0.296***	-0.257***	-0.229***	-0.266***	-0.233**		-0.257***	-0.269***	-0.237***
	(0.112)	(0.091)	(0.094)	(0.086)	(0.087)		(0.067)	(0.074)	(0.083)
Mon. pol. shock × Wealth	0.022**	0.020**	0.016**	0.023***	0.017**	0.022***	0.021***	0.024***	0.017***
	(0.009)	(0.008)	(0.080)	(0.007)	(0.007)	(0.006)	(0.007)	(0.008)	(0.006)
Mon. pol. shock × Credit score					0.064***				
					(0.010)				
Lambda							-0.171	-0.194	
							(0.163)	(0.179)	
Credit score bandwidth	[-∞,+∞]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.1,0.1]
Firm type	all	all	limited liability	unlimited liability	all	all	all	all	all
Observations	121,540	28,750	24,150	4,600	28,750	28,750	28,750	28,750	16,101
Observations (first stage)							367,988	599,214	
Adj. R-squared	0.718	0.707	0.708	0.696	0.776	0.720			0.803
Controls and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year:quarter FE	No	No	No	No	No	Yes	No	No	No

Wealth, loan approval, and shadow rates

	(1) Granted	(2) Granted	(3) Granted	(4) Granted	(5) Granted	(6) Granted	(7) Granted	(8) Granted	(9) Granted
Wealth	0.016***	0.013***	0.013***	0.012***	0.005***	0.013***	0.014***	0.014***	0.012***
	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Shadow rate	-0.239***	-0.212***	-0.196***	-0.223***	-0.116*		-0.206***	-0.226***	-0.202***
	(0.063)	(0.074)	(0.113)	(0.066)	(0.061)		(0.056)	(0.049)	(0.066)
Shadow rate × Wealth	0.022***	0.017***	0.014**	0.019***	0.020***	0.018***	0.020***	0.020***	0.018***
	(0.005)	(0.006)	(0.007)	(0.005)	(0.007)	(0.004)	(0.005)	(0.004)	(0.005)
Shadow rate × Credit score					0.044***				
					(0.009)				
Lambda							-0.172	-0.162	
							(0.164)	(0.135)	
Credit score bandwidth	[-∞,+∞]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.3,0.3]	[-0.1,0.1]
Firm type	all	all	limited liability	unlimited liability	all	all	all	all	all
Observations	137,321	32,310	27,140	5,170	32,310	32,310	32,310	32,310	18,028
Observations (first stage)							414,730	675,327	
Adj. R-squared	0.723	0.706	0.709	0.698	0.935	0.720			0.819
Controls and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year:quarter FE	No	No	No	No	No	Yes	No	No	No

Wealth, loan outcomes, and monetary policy

Back

	(1) Loan amount	(2) Loan amount	(3) Spread	(4) Spread
Wealth	0.014**	0.012**	-0.055***	-0.048***
	(0.006)	(0.006)	(0.012)	(0.010)
Shadow rate	-0.319***		-0.131**	
	(0.095)		(0.063)	
Shadow rate × Wealth	0.030***		-0.099***	
	(0.009)		(0.017)	
Monetary policy shock		-0.428***		0.120
		(0.162)		(0.102)
Monetary policy shock × Wealth		0.032***		-0.120***
		(0.012)		(0.021)
Observations	26,972	24,004	26,972	24,004
Adj. R-squared	0.840	0.831	0.732	0.726
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year:quarter FE	Yes	Yes	Yes	Yes