The effect of market structure and relationship lending on the likelihood of credit tightening

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Outline

- Motivation & research question
- Theoretical underpinnings: a sketch
- Testable hypotheses
- Major results
- Data and methodology
- Variables description
- Regression results and robustness checks
- Conclusions, limits and future work

Why another paper on market structure and relationship lending?

- **Concerns for credit tightening become widespread during economic downturns, as the likelihood of a decline in borrowing firms' creditworthiness may be higher**
  - but: *are all riskier borrowers equally affected by credit tightening?*
- **Add new evidence on the role of relationship lending *jointly* with banking market competition to explain the availability of credit**
  - not unambiguous theoretical predictions
  - mixed empirical findings from previous studies
  - test of hypotheses in a different institutional environment

Theoretical underpinnings: a sketch

Market structure and institutions/market devices affect credit availability and borrowing conditions

1. At firm level, relationship lending (RL) benefits the borrowing firm through:

   - a greater availability of credit and/or lower costs (interest rate and collateral requirements)
   - inter-temporal smoothing of contractual terms
   - improvements in borrower reputation

   *But: **hold-up** and **soft-budget constraint costs** may reduce or overcome the benefits of inside financing*

Theoretical underpinnings: a sketch (cont.)

2. Bank market power may influence the supply of credit through:

   - non-competitive behaviour (so-called *"traditional effect of credit market power"*)

   - incentives to compete more aggressively in order to protect the informational rents (co-called *"informational effect of credit market power"*)

   If the informational effect outweighs the traditional one, the availability of credit should be higher for firms in concentrated markets than in competitive markets

3. The amount of relationship financing provided by banks and the value of lending relationship for the borrower are strictly related to competition, both at industry and firm level

Testable hypotheses

1. Establishing strong LR translates into a lower probability of being credit tightened

   H1: *Strong lending relationships reduce the probability of a firm being credit constrained (by the banking system as a whole)*

2. The market structure does directly affect the probability of tightening

   H2*: The probability of a firm being credit constrained (by the banking system as a whole) is decreasing in local banking market power*

3. The value of RL for the borrower is affected by the local credit market structure

   H3*: Strong lending relationships lower the probability of a firm being constrained (by the banking system as a whole) in concentrated banking markets more than in competitive ones*

Major results

- Tightening actions do reflect the borrower creditworthiness and the changes in its risk profile

- Having *more concentrated* (i.e., stronger) *LRs* – either by borrowing from few banks and/or by borrowing a relevant share of debt from just one bank – is *beneficial to the firm*, as it faces a lower probability of credit tightening

- After controlling for observable measures of firm creditworthiness and LR strength, the probability of tightening is *decreasing in banking market concentration*

- Strong LRs reduce the probability of tightening *more* in highly concentrated than in competitive markets

Data and methodology

- The hypotheses are distinct, but strictly related
- All predictions are tested through logistic regression estimations of the following econometric specification:

$$\text{Prob}(DV\_TIGHT_{it}=1)=\alpha_0+\alpha_1(FIRM\ CONTROLS_{it})+\alpha_2(RELATION_{it})+\alpha_3(MKTPOWER_{it})+\alpha_4(OTHER\ CONTROLS_i)+\varepsilon_{it}$$

- The analysis is performed on a unique panel data set including more than 9,000 Italian firms, which borrow from at least one bank over the years 1996-2002. Data comes from:
  - Italian Company Account Register (Centrale dei Bilanci)
  - Central Credit Register (Centrale dei Rischi)
  - Bank of Italy

Data and methodology (cont.)

- Data on individual firm's exposure towards the banking system comes from the Central Credit Register and are on a monthly basis
- The reporting threshold is euro 75,000
- Data refers to individual credit lines, overdrafts, mortgages, subordinated loans, repos, leasing and factoring; for each type of loan, maturity, risk-mitigating guarantees and collateral are reported
- Data on individual loans is aggregated to obtain total outstanding credit, drawn amount, and degree of collateralisation by loan type and firm

Variables description

VARIABLE	PROXY	CONSTRUCTION
LENDING STANDARDS	CREDIT LINES USAGE	CREDIT DRAWN / CREDIT GRANTED
	COLLATERALISATION RATIO	CREDIT SECURED BY REAL COLLATERAL/TOTAL CREDIT GRANTED
	GUARANTEE COVERAGE RATIO	PERSONAL GUARANTEE / TOTAL CREDIT GRANTED
	NUMBER OF FIRST INFORMATION REQUESTS	
LENDING RELATIONSHIP	NUMBER OF LENDING BANKS	TRUNCATED CONTINUOUS VARIABLE (REPORTED IF THE NUMBER OF BANKS IS GREATER THAN THREE)
	SKEWNESS OF BANK DEBT	$\left\lvert \frac{Credit\ by\ bank_i}{Total\ bank\ credit} - \frac{1}{number\ of\ lending\ banks} \right\rvert$
	BORROWING CONCENTRATION	FRACTION OF BANK DEBT BORROWED FROM ONE CURRENT LENDER
FIRM-SPECIFIC CHARACTERISTICS	SIZE	BOOK VALUE OF TOTAL ASSETS
	RISKINESS	CREDIT RISK SCORE
	BANK DEBT EXPOSURE	BANK DEBT / TOTAL FINANCIAL DEBT
	ASSET LIQUIDITY	CURRENT ASSETS / TOTAL ASSETS
	AGE	NUMBER OF YEARS SINCE THE FIRM WAS FOUNDED
	INDUSTRIAL DISTRICT	DUMMY VARIABLE EQUAL 1 IF THE FIRM IS LOCATED IN AN INDUSTRIAL DISTRICT AREA
MARKET CONCENTRATION	HERFINDAHL INDEX	CONCENTRATION INDEX OF BANK BRANCH NETWORK, COMPUTED AT PROVINCE LEVEL

More on the dependent variable

We assume a firm is credit tightened ($DV\_TIGHT_{it}=1$) if:

- there is an *increase* in the (average) bank credit line usage and
- an *increase* in the (average) ratio of collateralization or guarantee coverage, and
- the Central Credit register signals *at least 1 information request* for the firm over the reporting period (month)

Regression results

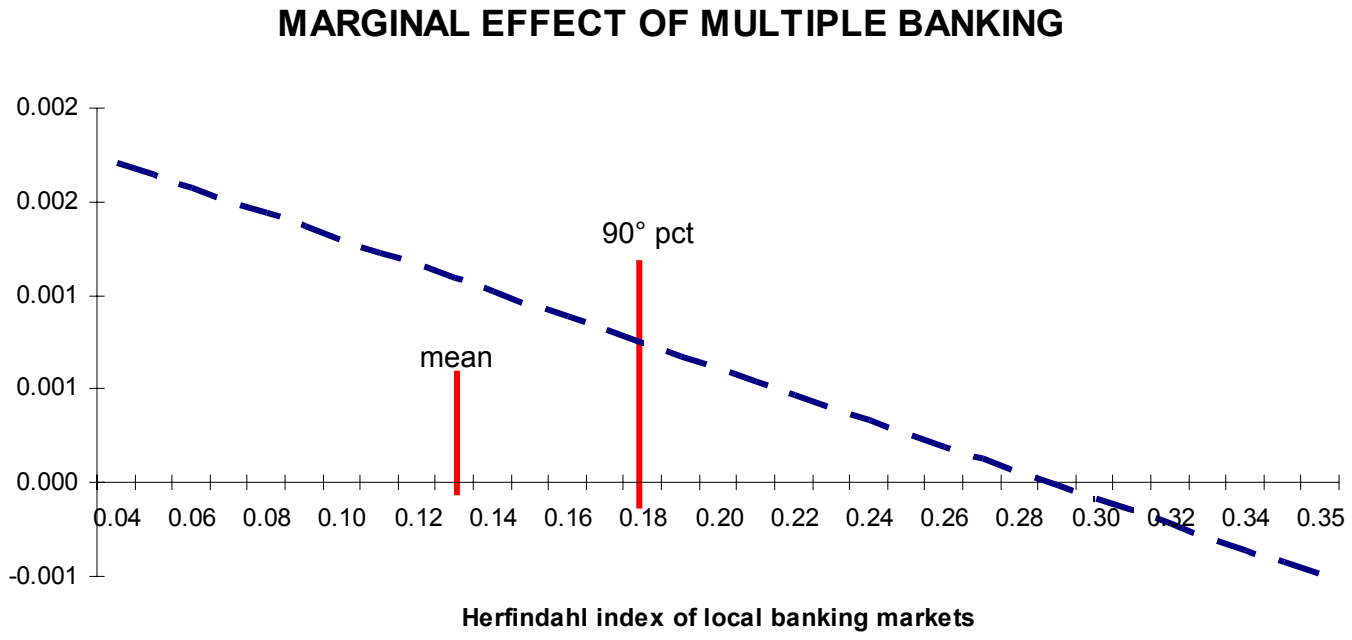
Dependent variable **Prob. (Tightening = 1)**												
	I				**II**				**III**			
Independent variables	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*
Constant	-15.69	-14.41	0.000	-	-15.24	-13.82	0.000	-	-15.92	-14.52	0.000	-
Firm-specific characteristics												
Log (Total assets)	2.28	10.98	0.000	0.127	2.18	10.42	0.000	0.122	2.35	11.25	0.000	0.133
Log (Total assets)^2	-0.10	-9.76	0.000	-0.005	-0.09	-8.87	0.000	-0.005	-0.10	-10.06	0.000	-0.006
Log (AGE)	0.13	1.44	0.150	0.007	0.13	1.42	0.155	0.007	0.13	1.41	0.158	0.007
Log (AGE)^2	-0.03	-1.57	0.117	-0.002	-0.03	-1.55	0.120	-0.002	-0.03	-1.57	0.117	-0.002
Bank debt /Total financial debt	0.80	7.54	0.000	0.045	0.80	7.45	0.000	0.045	0.72	6.66	0.000	0.041
Asset liquidity	-1.20	-9.84	0.000	-0.067	-1.16	-9.38	0.000	-0.065	-1.20	-9.77	0.000	-0.068
Credit score	0.00	3.07	0.002	0.000	0.00	3.43	0.001	0.000	0.00	3.16	0.002	0.000
Delta score	0.32	7.15	0.000	0.018	0.32	7.07	0.000	0.018	0.32	7.10	0.000	0.019
Lending relationship												
Number of banks	0.02	6.39	0.000	0.001					0.02	3.84	0.000	0.001
Debt skewness (drawn debt)					-0.78	-3.43	0.001	0.044				
Borrowing concentration									-0.01	-2.50	0.012	0.000
Number of banks * Borrowing concentration									0.00	4.67	0.000	0.000
Credit market concentration												
Herfindahl index	-0.84	-1.86	0.062	-0.047	-0.94	-2.06	0.040	-0.053	-0.85	-1.88	0.060	-0.048
Obs	36638				36072				36072			
Wald chi2(15)	707.33				657.74				712.46			
Prob > chi2	0.000				0.000				0.00			
rho	0.08				0.09				0.08			
Likelihood-ratio test of rho=0	30.79				33.76				28.52			
Prob > chibar2	0.000				0.000				0.000			

Regression results (cont.)

Dependent variable **Prob. (Tightening = 1)**

	I				III				IV			
Independent variables	*Coeff.*	*z-score*	*dy/dx*	*p-value*	*Coeff.*	*z-score*	*dy/dx*	*p-value*	*Coeff.*	*z-score*	*dy/dx*	*p-value*
Constant	-16.11	-14.58	-	0.000	-15.88	-14.57	-	0.000	-15.30	-13.90	-	0.000
Firm-specific characteristics												
Log (Total assets)	2.32	11.16	0.129	0.000	2.30	11.09	12.760	0.000	2.17	10.39	0.122	0.000
Log (Total assets)^2	-0.10	-9.95	-0.006	0.000	-0.10	-9.87	-0.005	0.000	-0.09	-8.83	-0.005	0.000
Log (AGE)	0.13	1.44	0.007	0.149	0.12	1.39	0.006	0.166	0.12	1.37	0.007	0.169
Log (AGE)^2	-0.03	-1.56	-0.002	0.118	-0.03	-1.54	-0.002	0.124	-0.03	-1.52	-0.002	0.127
Bank debt /Total financial debt	0.80	7.56	0.044	0.000	0.81	7.60	0.044	0.000	0.80	7.48	0.045	0.000
Asset liquidity	-1.20	-9.76	-0.066	0.000	-1.21	-9.82	-0.066	0.000	-1.16	-9.37	-0.065	0.000
Credit score	0.00	3.08	0.000	0.002	0.00	2.92	0.000	0.004	0.002	3.25	0.000	0.001
Delta score	0.32	7.14	0.018	0.000	0.31	6.93	0.017	0.000	0.31	6.86	0.018	0.000
Lending relationship												
Number of banks	0.04	4.62	0.002	0.000	0.02	5.93	0.001	0.000				
Debt skewness									-0.54	-2.23	-0.029	0.026
Credit market concentration												
Herfindahl index	0.84	0.95	0.047	0.344								
DV_concentrated mkt					-0.41	-2.74	-0.019	0.006	-0.06	-0.61	-0.003	0.543
DV_competitive mkt					0.00	0.00	0.000	0.998	-0.11	-1.09	-0.006	0.274
Herfindahl index*Number of banks	-0.15	-2.13	-0.008	0.033								
DV_concentrated mkt*Number of banks					0.01	1.44	0.001	0.150				
DV_competitive mkt*Number of bank					-0.02	-1.26	-0.001	0.209				
DV_concentrated mkt*Debt skewness									-2.04	-2.17	-0.114	0.030
DV_competitive mkt*Debt skewness									-1.12	-1.19	-0.063	0.233
Obs	36638				36638				36072			
Wald chi2(15)	712.22				717.79				667.42			
Prob > chi2	0.000				0.000				0.000			
rho	0.081				0.081				0.085			
Likelihood-ratio test of rho=0	30.07				30.66				33.85			
Prob > chibar2	0.000				0.000				0.000			

Regression results (cont.)



- Borrowing from multiple banks increases the probability of tightening, but it does so in a much more powerful way when the market is less concentrated; if the market is very highly concentrated, multiple banking induces a form of competition at firm level, which benefits the borrower

Robustness checks

- The estimation results are robust to different sample and variable specifications
  - More restrictive definition of TIGHTENING (increase in the credit line usage and increase in the (average) ratio of collateralization and guarantee coverage, and at least 1 information request)
  - Short-term, non-committed lines of credit only
  - One (randomly selected) line of credit by firm
  - One-year lagged independent variables (firm-specific characteristics)

Conclusions, limits, and future works

- Overall, the evidence is consistent with the hypotheses that RL benefits the borrowing firm through greater availability of credit, and the relation is more valuable in highly concentrated than in competitive markets

- We are aware of the following limits:
  - the proxy for credit tightening is based only on non-price tightening actions (no access to data on interest rate), and
  - it captures the tightening action by the banking system as a whole; we can't discard the hypothesis that individual bank's lending policy may be different
  - underlying assumption: year-end (December) data good proxy for annual data
  - sample selection *bias*: no firms that have been *denied* credit at all

- We will further check for robustness all results on a longer time series (1997-2004), and discuss the implications of differences in data frequency and different dependent variable specifications; more accurate estimation of the interaction terms' statistical significance and marginal effect (Ai and Norton, 2003)

... by drawing on the new data set (1997-2004)

Table V - CREDIT TIGHTENING, LENDING RELATIONSHIPS AND MARKET COMPETITION

This table reports the results of the random-effect logistic regression analysis. The dependent variable of regressions I and II is the probability of a sample firm being credit tightened: a firm is credit tightened if there is an increase in the credit lines usage and an increase in the collateralization ratio ***or*** in the guarantee coverage, and the Credit Register signals at least one information request for the firm. As robustness checks, the dependent variable of model III and IV has a more restrictive definition:a firm is credit tightened if there is an increase in the credit lines usage and an increase in the collateralization ratio ***and*** in the guarantee coverage, and the Credit Register signals at least one information request for the firm. The 'DELTA SCORE' is a dummy variable equal 1 if the firm credit risk score increases y/y (i.e., if the firms riskiness increases). Year and industry control dummy variables included, but not reported. For dummy variables, the marginal effect is for discrete change from 0 to 1.

Dependent variable **Prob. (Tightening = 1)**

	I				II				III				IV			
Independent variables	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*
Constant	-16.62	-19.21	0.000	-	-16.02	-18.05	0.000	-	-18.15	-14.50	0.000	-	-17.64	-13.70	0.000	-
Firm-specific characteristics																
Log (Total assets)	2.29	14.06	0.000	0.151	2.17	13.16	0.000	0.143	2.22	9.65	0.000	0.044	2.04	8.59	0.000	0.040
Log (Total assets)^2	-0.10	-12.43	0.000	-0.006	-0.09	-10.95	0.000	-0.006	-0.08	-8.21	0.000	-0.002	-0.07	-6.62	0.000	-0.001
Log (AGE)	0.30	2.88	0.004	0.020	0.31	2.88	0.004	0.020	0.36	2.16	0.031	0.007	0.38	2.24	0.025	0.007
Log (AGE)^2	-0.05	-2.54	0.011	-0.003	-0.05	-2.52	0.012	-0.003	-0.07	-2.37	0.018	-0.001	-0.07	-2.38	0.017	-0.001
Bank debt /Total financial debt	0.68	8.86	0.000	0.045	0.72	9.16	0.000	0.047	0.22	1.99	0.047	0.044	0.35	3.07	0.002	0.007
Asset liquidity	-1.20	-12.39	0.000	-0.079	-1.15	-11.91	0.000	-0.076	-0.39	-2.61	0.009	-0.008	-0.32	-2.10	0.035	-0.006
Credit score	0.00	5.59	0.000	0.000	0.00	5.70	0.000	0.000	0.00	2.97	0.003	0.000	0.00	3.29	0.001	0.000
Delta score	0.31	9.18	0.000	0.208	0.30	8.62	0.000	0.020	0.30	5.66	0.000	0.006	0.28	5.11	0.000	0..557
Lending relationship																
Number of banks	0.03	10.29	0.000	0.002					0.04	9.96	0.000	0.001				
Debt skewness (drawn debt)					-1.00	-5.62	0.000	0.066					-0.79	-2.90	0.004	-0.016
Credit market concentration																
Herfindahl index	-1.40	-3.60	0.000	-0.092	-1.41	-3.56	0.000	-0.930	-1.37	-2.15	0.032	-0.027	-1.31	-2.04	0.042	-0.026
Other control variables																
Industrial district	0.12	2.22	0.027	0.007	0.11	2.13	0.033	0.008	-0.04	-0.50	0.614	-0.001	-0.05	-0.62	0.536	-0.001
Nord	-0.17	-3.16	0.002	-0.011	-0.13	-2.36	0.018	-0.009	0.06	0.75	0.455	0.001	0.12	1.43	0.152	0.002
Centre	-0.07	-0.97	0.331	-0.004	0.02	-0.21	0.831	0.001	0.02	0.20	0.842	0.000	0.12	0.97	0.334	0.002
Obs	54170				53306				54170				53306			
Wald chi2(15)	1703.12				1583.57				867.03				758.31			
Prob > chi2	0.000				0.000				0.000				0.000			
rho	0.10				0.11				0.17				0.19			
Likelihood-ratio test of rho=0	148.05				173.68				97.74				118.36			
Prob > chibar2	0.000				0.000				0.000				0.000			

... by drawing on the new data set (1997-2004) (cont.)

Table VI - CREDIT TIGHTENING AND MARKET COMPETITION

his table reports the results of the random-effect logistic regression analysis. The dependent variable of regressions I and II is the probability of a sample firm being credit tightened: a firm is credit tightened if there is an increase in the credit lines usage and an increase in the collateralization ratio or in the guarantee coverage, and the Credit Register signals at least one information request for the firm. As robustness checks, the dependent variable of model III and IV has a more restrictive definition:a firm is credit tightened if there is an increase in the credit lines usage and an increase in the collateralization ratio and in the guarantee coverage, and the Credit Register signals at least one information request for the firm. The 'DELTA SCORE' is a dummy variable equal 1 if the firm credit risk score increases y/y (i.e., if the firms riskiness increases). Year and industry control dummy variables included, but not reported. For dummy variables, the marginal effect is for discrete change from 0 to 1.

Dependent variable **Prob. (Tightening = 1)**

	I				II				III				IV			
Independent variables	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*	*Coeff.*	*z-score*	*P-value*	*dy/dx*
Constant	-16.61	-18.97	0.000	-	-15.95	-17.96	0.000	-	-18.28	-14.50	0.000	-	-17.57	-13.64	0.000	-
Firm-specific characteristics																
Log (Total assets)	2.29	14.18	0.000	0.151	2.17	13.18	0.000	0.143	2.22	9.49	0.000	0.044	2.04	8.600	0.000	0.04
Log (Total assets)^2	-0.10	-12.51	0.000	-0.006	0.09	-10.96	0.000	-0.006	-0.09	-8.10	0.000	-0.002	-0.07	-6.62	0.000	-0.001
Log (AGE)	0.30	2.89	0.004	0.020	0.31	2.88	0.004	0.020	0.36	2.16	0.031	0.007	0.38	2.24	0.025	0.007
Log (AGE)^2	-0.05	-2.58	0.010	-0.004	-0.05	-2.51	0.012	-0.003	-0.07	-2.38	0.017	-0.001	-0.07	-2.38	0.017	-0.001
Bank debt /Total financial debt	0.68	8.91	0.000	0.045	0.72	9.11	0.000	0.047	0.22	1.98	0.048	0.004	0.35	3.04	0.002	0.007
Asset liquidity	-1.20	-12.48	0.000	-0.079	-1.16	-11.88	0.000	-0.076	-0.39	-2.58	0.010	-0.008	-0.32	-2.08	0.037	-0.006
Credit score	0.00	5.54	0.000	0.000	0.00	5.70	0.000	0.000	0.00	2.95	0.003	0.000	0.00	3.30	0.001	0.000
Delta score	0.31	8.97	0.000	0.021	0.30	8.62	0.000	0.020	0.30	5.46	0.000	0.006	0.28	5.11	0.000	0.006
Lending relationship																
Number of banks	0.04	5.23	0.000	0.002					0.05	5.01	0.000	0.001				
Debt skewness (drawn debt)					-2.01	-4.27	0.000	-0.132					-1.86	-2.56	0.010	-0.037
Credit market concentration																
Herfindahl index	-0.79	-1.06	0.287	-0.052	-2.19	-4.20	0.000	-0.145	-0.44	-0.37	0.710	-0.009	-2.18	-2.57	0.010	-0.043
Herfindahl index*Number of banks	-0.05	-0.95	0.341	-0.003					-0.07	-0.940	0.345	-0.001				
Herfindahl index*Debt skewness					8.56	2.35	0.019	0.565					9.37	1.63	0.104	0.184
Other control variables																
Industrial district	0.13	2.33	0.020	0.009	0.12	2.15	0.031	0.008	-0.04	-0.49	0.623	-0.001	-0.05	-0.60	0.547	-0.001
Nord	-0.16	-3.01	0.003	-0.011	-0.13	-2.28	0.023	-0.009	0.07	0.81	0.420	0.001	0.13	1.49	0.137	0.002
Centre	-0.06	-0.94	0.345	-0.004	-0.01	-0.09	0.926	0.000	0.03	0.24	0.808	0.001	0.13	1.04	0.299	0.003
Obs	54170				53306				54170				53306			
Wald chi2(15)	1703.48				1587.33				868.70				760.77			
Prob > chi2	0.000				0.000				0.000				0.000			
rho	0.10				0.11				0.17				0.19			
Likelihood-ratio test of rho=0	148.22				173.43				97.78				118.28			
Prob > chibar2	0.000				0.000				0.000				0.000			