

Information Asymmetry, External Certification, and the Cost of Bank Debt

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Research Motivation

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- Motivation for this study
 - ▣ Banks produce (proprietary) information during the lending relationship
 - Initial screening and subsequent monitoring
 - Most of the information remains private to the bank

 - ▣ External sources of (public) information about borrower quality
 - Borrowers often subject to external evaluation and screening
 - Government subsidies
 - Process and product certifications
 - Public-private partnerships

Research Objective

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- Explore the effect of a public signal about borrowers on cost of debt
 - Two interrelated questions
 - How do banks incorporate public signals in loan contract terms (interest rate)?
 - How does public and private information interact to shape the loan contract?
 - Substitutes, complements, independent
 - Rationale for using the context of SME lending
 - Cleaner test setting
 - Detection of incremental information
 - Limited sources of capital
 - Significant information frictions
 - Data availability (in our case)
 - Key challenges with the research objective
 - Internal validity – identification (of the effect of the public signal)
 - External validity – generalizability

Preview of Results and Contribution

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- Main insights from the paper
 - Positive (by construction) public signal does not affect interest rate on average
 - Important nuances
 - Significant reduction in interest rate when the bank does not have information
 - Public signal and stock of bank information can act as substitutes
 - Over the course of the lending relationship, the public signal loses importance
 - Bank starts to weigh its own information more heavily

- Contribution to three broad areas of research
 - Implications of changes in information environment for cost of capital
 - Analyst coverage, audits, litigations, regulatory changes
 - Interactions between public funding and access to private sources of capital
 - R&D subsidies and government funding programs and markets for equity, debt, and venture capital
 - Effects of bank information availability on loan contract terms
 - Relationship length, geographic proximity, hierarchical distance, credit scoring technology

Data and Background I

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□ Sources of data – part I

▣ Data on SME lending

- Dataset of credit lines granted to a sample of SMEs by a large regional Italian bank
 - Bank has a core competency in lending to SMEs
 - Credit lines as of September 2004 and 2006 in two Italian provinces within one region
 - More than 4,450 borrowers with wide variety of economic activity
- Information on contract terms and borrower characteristics
 - Focus on borrowers present at both points in time
 - Very short panel data structure
 - No information on applications or contract performance

Data and Background II

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□ Sources of data – part II

□ Data on public signal

- Public information release by the regional agency for innovation in the Marche region
 - Program 1.1.1.4.1 Promotion of Industrial Research and Experimental Development in SMEs (PIREDS)
 - Aim of PIREDS is to promote R&D and innovation by SMEs by providing financial support (subsidy)
 - Subsidy covers up to 35% of project expenses after evaluation by committee of experts
- Outcome of the 2005 call of PIREDS generates a favorable public signal
 - List of subsidy winners publicly announced
 - Information on non-winners not disclosed

Empirical Strategy I

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- Empirical strategy and estimation models
 - Difference-in-differences (DD) approach
 - Exploit the (favorable) public signal generated by the program
 - Subsidy award → positive public information about borrower

 - Baseline model for average effect

$$Interest\ Rate_{it} = \beta_0 Public\ Signal_i + \beta_1 Post_t + \beta_2 Public\ Signal_i \times Post_t + \delta Controls_{it} + \varepsilon_{it}$$

- Controls
 - Size (sales)
 - Distance
 - Organizational form
 - Market segment
 - Fixed effects – industry, branch, province
 - Credit rating (in robustness test due to data constraints)
- Standard errors
 - Clustered at industry (robust to alternative approaches)

Empirical Strategy II

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- Empirical strategy and estimation models
 - ▣ Main model – condition the effect of the public signal on bank information
 - Bank information reflected in length of lending relationship (other measures in robustness)
 - Triple-difference specification

$$\begin{aligned} Interest\ Rate_{it} = & \beta_0 Public\ Signal_i + \beta_1 Post_t + \beta_2 Relationship\ Length_{it} + \beta_3 Public\ Signal_i \times Post_t + \\ & \beta_4 Public\ Signal_i \times Relationship\ Length_{it} + \beta_5 Relationship\ Length_{it} \times Post_t + \\ & \beta_6 Public\ Signal_i \times Relationship\ Length_{it} \times Post_t + \delta Controls_{it} + \varepsilon_{it} \end{aligned}$$

- Main effect of the public signal
 - Without bank information, the signal does not adversely affect interest rate ($\widehat{\beta}_3 \leq 0$)
- Interaction between information sources (assuming “correct” main effect)
 - $\widehat{\beta}_6$ negative: Effect of public signal magnified by bank information → information types act as complements
 - $\widehat{\beta}_6$ positive: Effect of public signal attenuated by bank information → information types act as substitutes
 - $\widehat{\beta}_6$ statistically indistinguishable from 0: Effect of public signal independent of bank information

Summary Statistics – Table 2

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□ Key variables

□ Outcome variable and information measures

- *Interest Rate* – rate charged by the bank (in percentage terms)
- *Public Signal* – indicator (1) if the borrower is awarded a PIREDS subsidy
- *Relationship Length* – days since the firm first borrowed from the bank

	<i>Public Signal</i> = 1 (82)		<i>Public Signal</i> = 0 (4377)		Means equality
	<i>Mean</i>	<i>St. dev.</i>	<i>Mean</i>	<i>St. dev.</i>	p-values
Interest Rate (pre-subsidy)	6.69	2.55	6.47	2.36	0.399
Interest Rate (post-subsidy)	7.11	2.03	7.20	2.11	0.709
Interest Rate (average)	6.90	2.07	6.83	2.04	0.768
Relationship Length (days)	4559	2981	3380	2718	0.000
D(Sales 1)	0.02	0.02	0.51	0.01	0.000
D(Sales 2)	0.04	0.19	0.10	0.30	0.063
D(Sales 3)	0.11	0.31	0.16	0.37	0.224
D(Sales 4)	0.26	0.44	0.12	0.33	0.000
D(Sales 5)	0.41	0.50	0.09	0.29	0.000
D(Sales 6)	0.16	0.37	0.02	0.15	0.000
Corporate Cluster	0.91	0.28	0.35	0.48	0.000
Portfolio	0.79	0.41	0.60	0.49	0.000
Distance	0.57	0.50	0.10	0.30	0.000
Distance	8.22	1.25	7.67	1.37	0.000

Main Result – Table 3

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- Effect of public signal on interest rate – no effect on average
 - Rate reduction when there is limited bank information
 - *Relationship Length* (continuous) and *D(Short)* (discrete) specification
 - Split-sample analysis (based on terciles of *Relationship Length*)
 - Public signal and bank information can function as substitutes

	(1)	(2)	(3)	(4)	(5)
		Full Sample		Low Information	High Information
Public Signal × Post	-0.318 (0.208)	-3.031*** (0.877)	-0.364 (0.229)	-1.130** (0.409)	0.086 (0.388)
Public Signal × Relationship Length × Post		0.309** (0.110)			
Public Signal × D(Short) × Post			-0.779** (0.374)		
Controls	Yes	Yes	Yes	Yes	Yes
Province/Industry/Branch FE	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
Observations	8,918	8,918	8,918	2,947	3,019
R-squared	0.071	0.071	0.071	0.084	0.106

Validation Test – Table 4

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Assumptions underlying the DD analysis

Parallel trends

- Cross-sectional estimation
- As expected, no significant effect prior to subsidy receipt (Year 2004)

	(1)	(2)
	Cross-section	Cross-section
	2004	2006
Public Signal	-2.019 (1.689)	-4.584** (1.658)
Relationship Length	-0.048 (0.036)	-0.092 (0.069)
Public Signal × Relationship Length	0.305 (0.213)	0.584*** (0.195)
Controls	Yes	Yes
Province/Industry/Branch FE	Yes/Yes/Yes	Yes/Yes/Yes
Observations	4,459	4,459
R-squared	0.054	0.055

PS Matching

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- Propensity score (PS) matching analysis
 - Adjusts for differences in observable characteristics
 - Estimate the probability of subsidy receipt
 - Match based on the estimated propensity score
 - Estimations for the PS-matched sample
 - Matched sample of 82 “treated” firms and 295 “control” firms
 - Sensitivity analysis – Rosenbaum (2002)
 - Key assumption
 - Conditional independence – conditional on covariates, assignment is “as good as random”
 - Rosenbaum bounds
 - Quantify the influence of unmeasured variable needed to invalidate the estimated effect
 - No direct test of the conditional independence assumption

PS Estimation – Table 5

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□ Estimation of the probability of subsidy receipt

□ Nearest neighbor matching with replacement

	Coefficient	S.E.	p-value
Portfolio	0.338	0.182	0.063
Corporate	0.644	0.167	0.000
D(Sales 2)	0.491	0.323	0.129
D(Sales 3)	0.572	0.269	0.034
D(Sales 4)	0.862	0.263	0.001
D(Sales 5)	0.970	0.295	0.001
D(Sales 6)	1.111	0.339	0.001
Cluster	0.330	0.135	0.001
Constant	-3.668	0.266	0.000
Province FE	Yes		
Industry Sector FE	Yes		
Observations	4,459		
Pseudo R-squared	0.323		

PS Matched Sample Analysis – Table 6

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□ Main insights confirmed

- Rate reduction when there is no bank information
- Public signal and bank information can function as substitutes

	(1) Full Sample	(2) Cross-section 2004	(3) Cross-section 2006
Public Signal	-1.058 (2.488)	-0.903 (2.646)	-7.984** (3.785)
Public Signal × Post	-6.495*** (1.711)		
Public Signal × Relationship Length	0.196 (0.308)	0.171 (0.329)	1.002** (0.446)
Public Signal × Relationship Length × Post	0.751*** (0.204)		
Controls	Yes	Yes	Yes
Province/Industry/Branch FE	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
Observations	754	377	377
R-squared	0.201	0.251	0.220

Sensitivity Analysis – Table 7

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□ Rosenbaum bounds

□ The intuition behind the test

- An unmeasured variable exerts influence (γ) on both assignment into treatment and outcome
- Find bounds for the influence through the odds ratio of assignment
 - The odds ratio bounded between $1/\exp(\gamma)$ and $\exp(\gamma)$
 - When $\exp(\gamma)$ is 1, odds ratio is 1, no effect of the unmeasured variable
 - When $\exp(\gamma)$ is 1.5, for instance, borrowers differ in odds of assignment with a factor of up to .5 → “hidden bias”
- Compute p-values for the upper and lower bounds

Exp(γ)	p-critical	
	Upper bound	Lower bound
1.0	.002	.002
1.5	.000	.016
2.0	.000	.044
2.5	.000	.081
3.0	.000	.123

□ Estimated effect is robust

- Any unmeasured variable has to more than double the odds of assignment

Underlying Mechanisms

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- Two alternative (not mutually exclusive) mechanisms
 - Incremental information (for the lending bank)
 - Subsidy receipt is a favorable signal of borrower quality
 - The signal provides incremental information when bank information is limited
 - Incremental market contestability
 - Subsidy receipt is true public information observed by other banks too
 - Other banks increase competitive pressure and lending bank has to lower the rate

- Explore the structure of the local credit market
 - Competitive market – information rent of the lender is low
 - Weak incentive to lower the rate further in response to increased market contestability
 - Non-competitive market – information rent of the lender is high
 - Strong incentive to lower the rate in response to increased market contestability

Underlying Mechanisms – Table 8

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- Incremental information vs. market contestability
 - Number of Banks – banks present in the local credit market
 - In less competitive markets, lending bank lowers the rate due to signal
 - In more competitive markets, no incentive to react
 - Market contestability effect of the signal is present (column (1)) but...
 - ...does not eliminate the incremental information role (column (2))

	(1)	(2)
Public Signal × Post	-1.273** (0.487)	-4.939*** (1.376)
Number of Banks × Public Signal × Post	0.062*** (0.021)	0.063*** (0.022)
Public Signal × Relationship Length × Post		0.419** (0.156)
Controls	Yes	Yes
Province/Industry/Branch FE	Yes/Yes/Yes	Yes/Yes/Yes
Observations	8,918	8,918
R-squared	0.071	0.072

Alternative Explanations – Table 8

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□ Signal for (potential) credit demand

□ The subsidy partially covers project expenses (up to 35%)

- Subsidy receipt might signal future demand for credit
- Bank lowers the interest rate to keep the customer

□ Examine change in credit with the bank

- Indicator $D(\text{Credit Increase})$ if the firm increases the borrowed amount
- No data on applications or capital raised from other sources
- Signal not very informative about future demand

	(3)
Public Signal × Post	-0.378 (0.435)
D(Credit Increase) × Public Signal × Post	0.159 (0.759)
Controls	Yes
Province/Industry/Branch FE	Yes/Yes/Yes
Observations	8,918
R-squared	0.073

Robustness Tests – Table 8

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- Robustness tests of the main result
 - Cross-sectional estimation
 - Data constraints
 - Inclusion of internal credit rating
 - Modified zero-order regression
 - Alternative measure of information
 - Information from other services

	(4)	(5)
	Cross-section 2006	
Public Signal	-4.869** (1.743)	-2.328*** (0.205)
Public Signal × Relationship Length	0.617*** (0.206)	
D(Rated) × D(Rating 1 or 2)	-0.344 (0.346)	
D(Rated) × D(Rating 3)	-0.175 (0.160)	
D(Rated) × D(Rating 4)	-0.065 (0.141)	
D(Rated) × D(Rating 5)	-0.306*** (0.088)	
D(Rated) × D(Rating 6)	-0.220* (0.124)	
D(Rated) × D(Rating 7)	-0.228 (0.211)	
D(Rated) × D(Rating 8 or 9)	0.126 (0.204)	
Public Signal × Other Services		2.719*** (0.262)
Controls	Yes	Yes
Province/Industry/Branch FE	Yes/Yes/Yes	Yes/Yes/Yes
Observations	4,459	4,459
R-squared	0.056	0.056

External Validity

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□ Generalizability of the inferences

□ Lender and borrower characteristics

- Large regional bank with lending to SMEs as a core (but not the only) competency
- Borrowers from a wide array of industry sectors

□ Local credit markets conditions – Table 1

- Significant local presence and competitive markets
- Representative provinces and economic conditions

	<i>Mean</i>	<i>Min</i>	<i>Max</i>
Number of branches of the bank	1.6	1	6
Number of competitor banks	13.8	1	38
Number of branches of competitor banks	30.7	1	108

□ Comparability of estimates

- Bonfim et al. (2021) examine SME certification due to a government program in Portugal
 - Estimated average effect of certification between 1.8% and 2.1%
- In our setting, estimated effect of 3% for a (hypothetical) new borrower
 - Borrower with a lending relationship of 1 year pays 1.2% less

Conclusions

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- Empirical analysis of the effect of public signal on cost of bank debt
 - Strategy and setting
 - Trace the effect of a favorable (by construction) public signal about borrower quality
 - Market subject to significant information frictions (SME lending)
 - Key insights
 - Public signal leads to lower cost of debt when bank information is limited
 - Once the bank accumulates information, the public signal loses importance
 - Public and private information can function as substitutes