Why Are Commercial Loan Rates So Sticky? The Effect of Private Information on Loan Spreads

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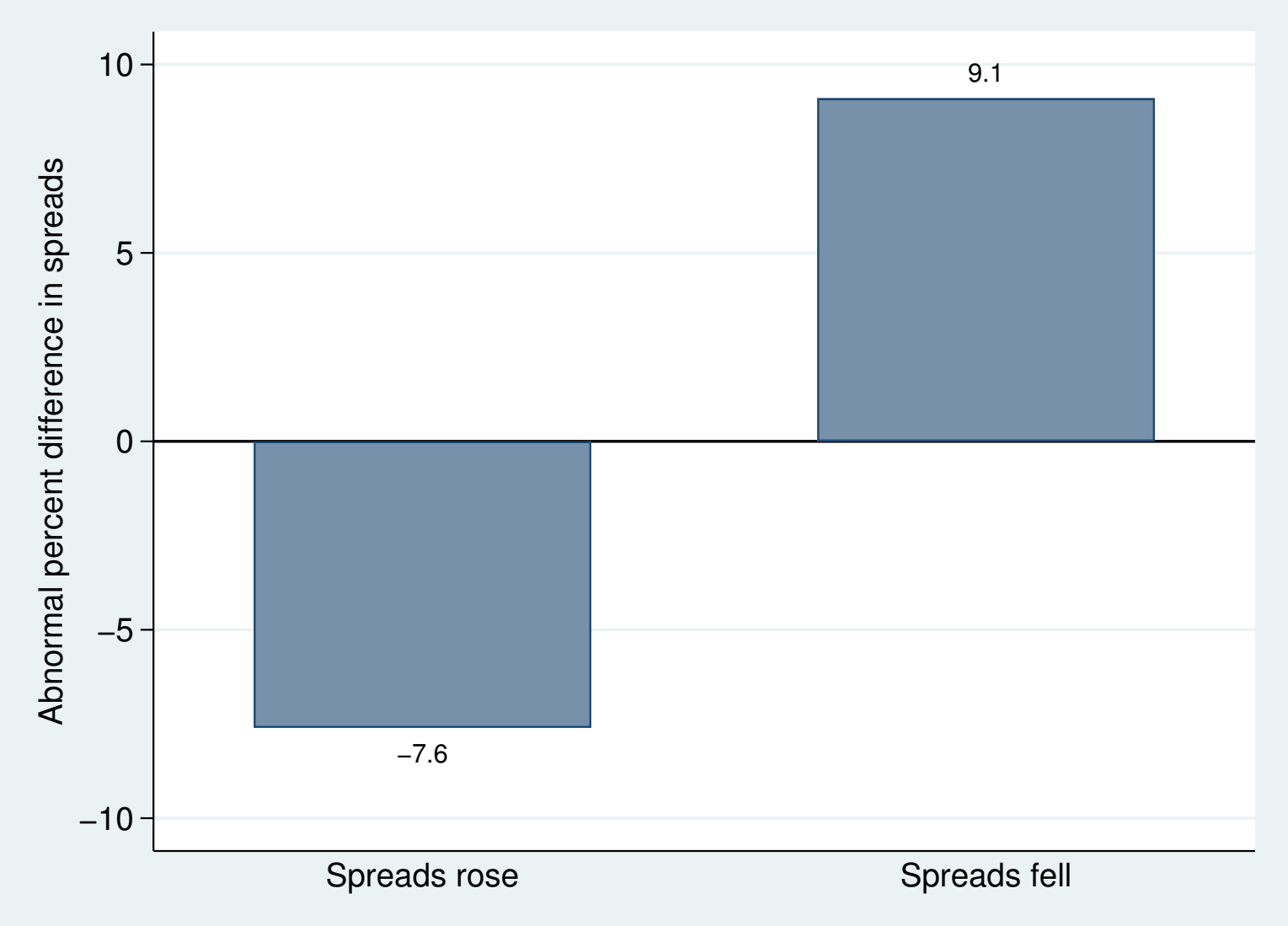
Motivation

Why are loan spreads so *sticky*?



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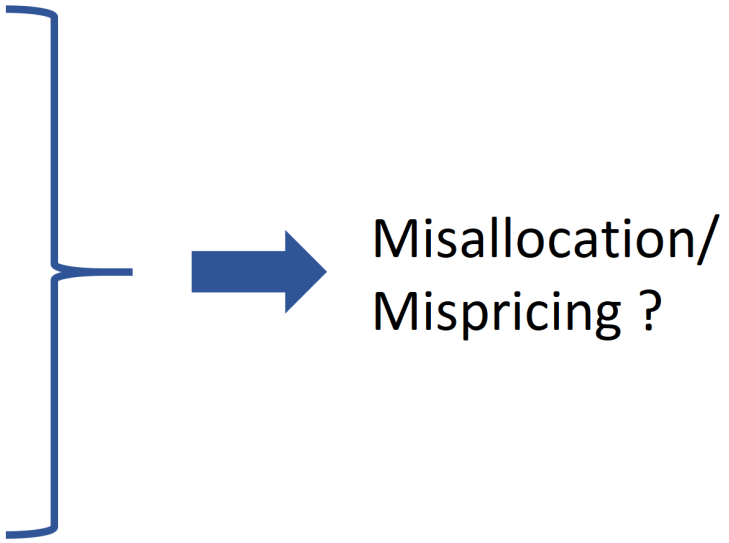

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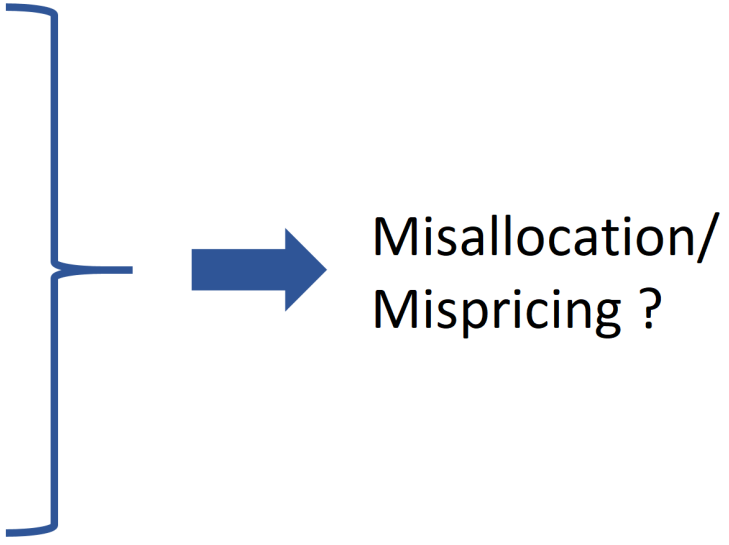

Private information

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Definition of Stickiness

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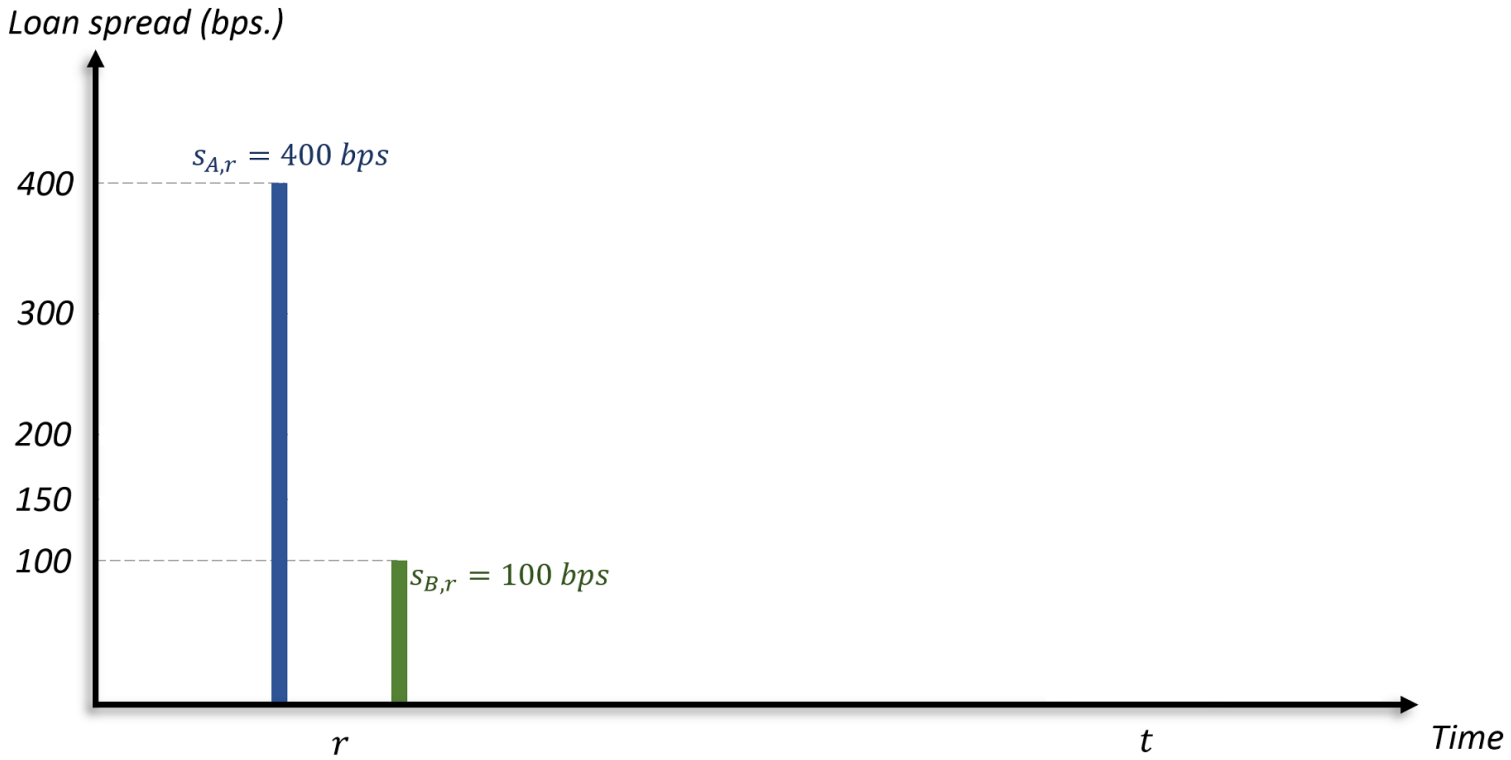

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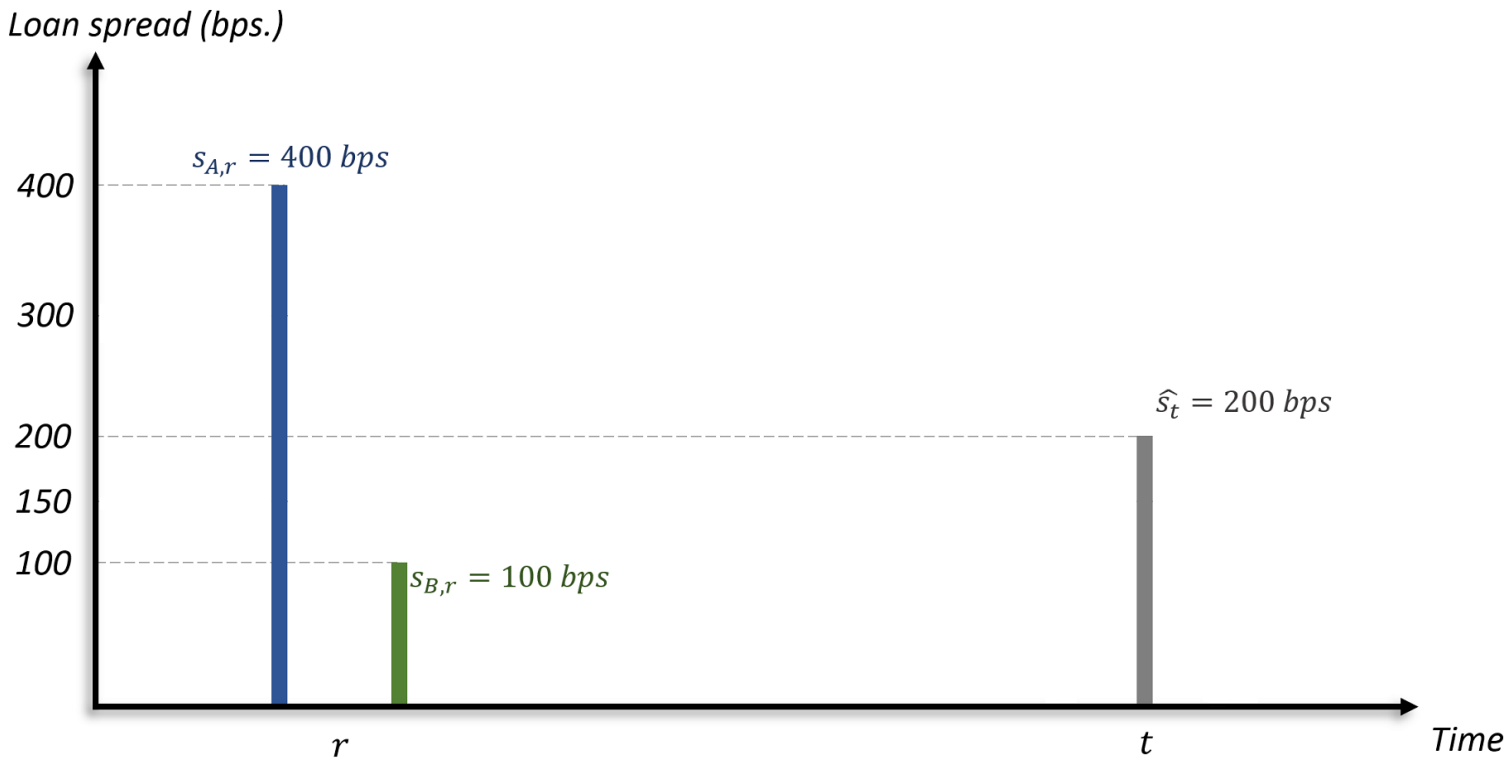

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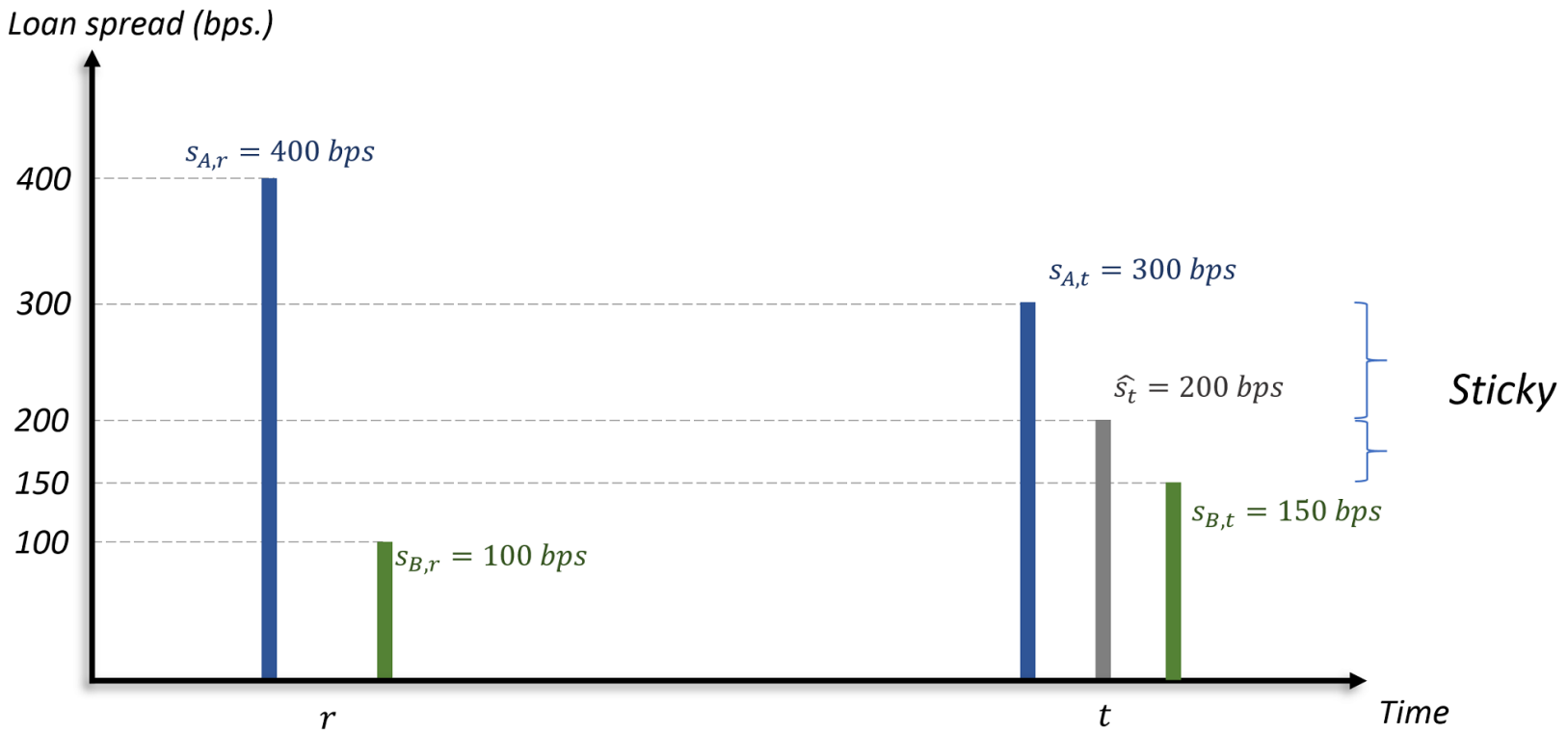

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- *Private information hypothesis*:
  - Loan spreads are affected by both "hard" credit information as well as soft information (unobservable to the econometrician)
  - Bank due diligence and monitoring efforts are positively correlated with credit spreads in the cross section and over time.
  - The positive correlations between the quality of or reliance on private information can lead to sticky loan rates.
- Note that the private information hypothesis does not preclude other explanations.

Main Results

1. CDS spreads are sticky, but only at loan dates.

2. Stickiness increases when private information is more important.
   - Bank-dependent firms.
   - Firm opaqueness.

3. Stickiness predicts future credit risk.
   - Firm's credit risk is positively related to spread evolution.
   - Predictive power of spread evolution varies with firm opaqueness.

4. Loan spread regression R^2 are much lower when credit standards are tight or when aggregate spreads are high.

Data

- Sample: USD denominated loans of non-financial, non-utility US firms from 1987 to 2016.
- Loan pricing and contract information from LPC Dealscan,
- Borrower financials from Compustat (public firms) and Capital IQ (private firms),
- Daily CDS spreads from Markit,
- Stock prices from CRSP,
- Loan ratings from S&P RatingsXpress,
- Bond issuance data from Mergent FISD.

Descriptive Statistics

Panel A: Firm and loan characteristics at issuance

	All firms			Firms with CDS		
	Mean	Median	*SD*	Mean	Median	*SD*
Firm						
Assets ($mm)	3793	862	11858	15963	7899	25565
Sales ($mm)	3703	871	11906	14760	6626	27072
Debt-to-assets	0.31	0.28	0.22	0.33	0.29	0.19
Return on assets	0.04	0.04	0.10	0.05	0.05	0.07
Current ratio	1.93	1.69	1.12	1.60	1.48	0.73
Volatility	0.03	0.02	0.02	0.02	0.02	0.01
Loan						
Maturity (months)	52	60	18	57	60	12
Amount ($mm)	387	175	706	1151	800	1319
Spread (bps.)	200	175	129	161	138	120
# of loans		12938			1366	
# of firms		3290			388	

Panel B: Loan and CDS spreads at issuance

	Loan spread (All-in-drawn spread)					CDS spread at the loan issuance date				
	N	Mean	10^{th}	Median	90^{th}	*N*	Mean	10^{th}	Median	90^{th}
By credit rating										
AAA/AA	113	30	15	18	63	35	26	9	17	63
A	730	58	20	37	100	253	66	20	69	100
BBB	1586	115	38	110	225	525	129	45	125	225
BB	2361	202	100	175	300	336	200	100	175	300
B	1530	282	150	250	425	177	299	150	275	450
<CCC	110	388	200	350	650	20	494	269	500	813
Not rated	6508	216	75	200	363	20	201	70	213	300
By loan type										
Revolver	10064	179	48	160	325	1133	141	30	125	275
Term loan	2874	273	125	250	450	233	258	100	225	450
All loans	12938	200	50	175	350	1366	161	35	138	300

Distribution of Spread Changes Loan Spreads

Borrowing Histories

- Timing of previous loan issuance affects current loan pricing.
- We find a similar timing effect in CDS spreads.
- Once the private information is controlled, historical information no longer explains loan prices.

	(1) Log(Loan spread)
Δ Agg. log(Loan spread)	-0.142***
	(0.014)
Δ Agg. log(CDS spread)	
Log(CDS spread)	
Constant	5.146***
	(0.004)
Year×loan type×rating FE	Yes
Observations	24533
R^2	0.431

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	(1) Log(Loan spread)	(2) Log(CDS spread)
Δ Agg. log(Loan spread)	-0.142*** (0.014)	
Δ Agg. log(CDS spread)		-0.142*** (0.030)
Log(CDS spread)		
Constant	5.146*** (0.004)	4.819*** (0.014)
Year×loan type×rating FE	Yes	Yes
Observations	24533	2179
R^2	0.431	0.680

Borrowing Histories

- Timing of previous loan issuance affects current loan pricing.
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- Once the private information is controlled, historical information no longer explains loan prices.

	(1) Log(Loan spread)	(2) Log(CDS spread)	(3) Log(Loan spread)
Δ Agg. log(Loan spread)	-0.142*** (0.014)		-0.014 (0.021)
Δ Agg. log(CDS spread)		-0.142*** (0.030)	
Log(CDS spread)			0.326*** (0.018)
Constant	5.146*** (0.004)	4.819*** (0.014)	3.243*** (0.086)
Year×loan type×rating FE	Yes	Yes	Yes
Observations	24533	2179	2179
R^2	0.431	0.680	0.781

Main Methodology

- First stage:

$$\hat{s}_{i,t} = X_{i,t}\beta_t$$

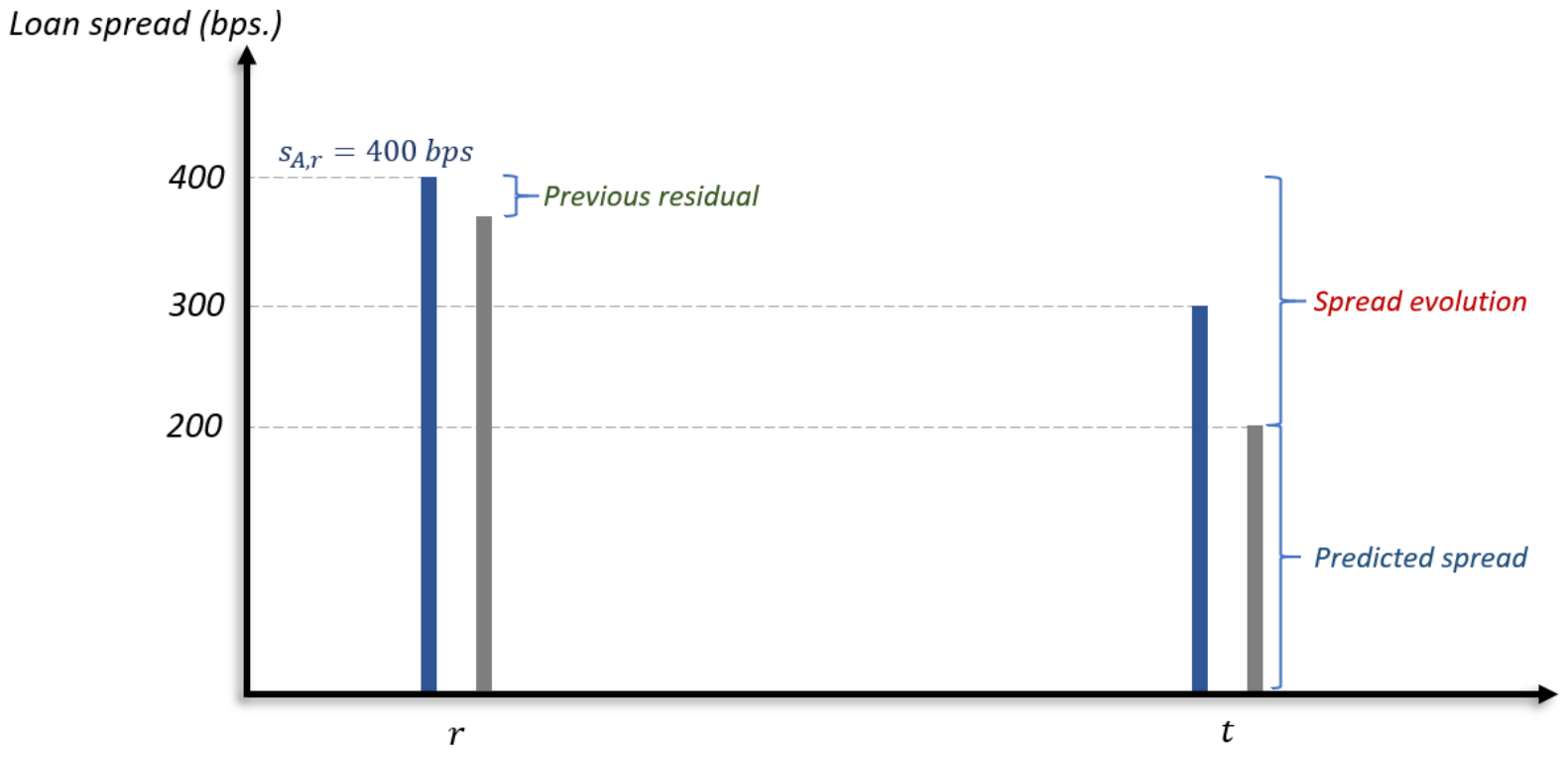
  - $X_{i,t}$: Firm- and loan-level characteristics.
    - Firm-level: Firm size, leverage, profitability, credit rating...
    - Loan-level: Loan size, maturity, loan type, contract terms...

First Stage Regressions LIBOR Regressions

Main Methodology

- Second stage:

$$s_{i,t} = \underbrace{\beta \hat{s}_{i,t}}_{\text{Predicted spread}} + \underbrace{\delta(s_{i,r} - \hat{s}_{i,t})}_{\text{Spread evolution}} + \underbrace{\gamma(s_{i,r} - \hat{s}_{i,r})}_{\text{Previous residual}} + \epsilon_{i,t}$$



Stickiness in Loan and CDS Spreads

- CDS spreads are also sticky at loan dates.
- Loan spreads are not sticky once information embedded in CDS spreads is controlled for.

	(1) Log(Loan spread)
Predicted spread	1.008***
	(0.005)
Spread evolution	0.049***
	(0.007)
Previous residual	0.155***
	(0.012)
Constant	-0.042*
	(0.024)
Log(CDS spread)	
Observations	12938
R^2	0.814

Stickiness in Loan and CDS Spreads

- CDS spreads are also sticky at loan dates.
- Loan spreads are not sticky once information embedded in CDS spreads is controlled for.

	(1) Log(Loan spread)	(2) Log(CDS spread)
Predicted spread	1.008*** (0.005)	1.006*** (0.008)
Spread evolution	0.049*** (0.007)	0.042*** (0.013)
Previous residual	0.155*** (0.012)	0.212*** (0.031)
Constant	-0.042* (0.024)	-0.039 (0.042)
Log(CDS spread)		
Observations	12938	1366
R^2	0.814	0.910

Stickiness in Loan and CDS Spreads

- CDS spreads are also sticky at loan dates.
- Loan spreads are not sticky once information embedded in CDS spreads is controlled for.

	(1) Log(Loan spread)	(2) Log(CDS spread)	(3) Log(Loan spread)
Predicted spread	1.008*** (0.005)	1.006*** (0.008)	0.903*** (0.020)
Spread evolution	0.049*** (0.007)	0.042*** (0.013)	0.009 (0.015)
Previous residual	0.155*** (0.012)	0.212*** (0.031)	0.183*** (0.031)
Constant	-0.042* (0.024)	-0.039 (0.042)	0.103* (0.058)
Log(CDS spread)			0.079*** (0.013)
Observations	12938	1366	1366
R^2	0.814	0.910	0.879

Placebo Test

- CDS spreads are not sticky at randomly chosen dates that are unrelated to loan issuance dates.

	(1) *Mean estimate* Log(CDS spread)
Predicted spread	1.011 (0.016)
Spread evolution	0.018 (0.020)
Previous residual	0.177 (0.037)
Constant	-0.049 (0.071)
Observations	1231
R^2	0.817

Importance of Private Information

Unrated Firms

- Loans of unrated firms are stickier.

	(1) Rated Log(Loan spread)		(2) Unrated Log(Loan spread)
Predicted spread	0.987*** (0.006)		1.062*** (0.010)
Spread evolution	0.022*** (0.008)		0.092*** (0.010)
Previous residual	0.136*** (0.015)		0.147*** (0.019)
Constant	0.061** (0.028)		-0.320*** (0.055)
Difference ((2) - (1))		0.070*** (0.013)	
Observations	6430		6508
R^2	0.863		0.721

Importance of Private Information

Firms without public bonds

- Loans of bank-dependent firms are stickier.

	(1) With bonds Log(Loan spread)		(2) Without bonds Log(Loan spread)
Predicted spread	1.000*** (0.006)		1.043*** (0.009)
Spread evolution	0.037*** (0.008)		0.079*** (0.011)
Previous residual	0.132*** (0.014)		0.164*** (0.021)
Constant	0.005 (0.028)		-0.229*** (0.050)
Difference ((2) - (1))		0.042*** (0.014)	
Observations	7544		5394
R^2	0.848		0.735

Importance of Private Information

Private Firms

- Loans of private firms are stickier.

	(1) Public Log(Loan spread)		(2) Private Log(Loan spread)
Predicted spread	1.018*** (0.005)		0.944*** (0.027)
Spread evolution	0.051*** (0.007)		0.149*** (0.031)
Previous residual	0.166*** (0.011)		0.206*** (0.041)
Constant	-0.090*** (0.026)		0.306** (0.153)
Difference ((2) - (1))		0.098*** (0.032)	
Observations	14274		938
R^2	0.799		0.700

Importance of Private Information

Institutional Loans

- Traditional (bank) term loans are stickier than institutional term loans.

	(1) Institutional term loan Log(Loan spread)		(2) Bank term loan Log(Loan spread)
Predicted spread	0.785***		1.001***
	(0.037)		(0.018)
Spread evolution	-0.047**		0.032*
	(0.023)		(0.019)
Previous residual	0.141***		0.113***
	(0.035)		(0.028)
Constant	1.278***		-0.056
	(0.209)		(0.097)
Difference ((2) - (1))		0.079***	
		(0.029)	
Observations	1034		1840
R^2	0.544		0.737

Shocks to Private Information

Introduction of Loan Ratings

- Introduction of loan ratings decreases stickiness.

	(1) Pre loan rating Log(Loan spread)	(2) Post loan rating Log(Loan spread)	(3) All eventually rated Log(Loan spread)	(4) All eventually rated Log(Loan spread)
Predicted spread	1.033***	0.968***	1.033***	1.021***
	(0.011)	(0.009)	(0.011)	(0.018)
Spread evolution	0.060***	0.022**	0.060***	0.050***
	(0.015)	(0.011)	(0.016)	(0.017)
Previous residual	0.162***	0.158***	0.162***	0.038
	(0.027)	(0.021)	(0.026)	(0.029)
Predicted spread × post l.r.			-0.065***	-0.119***
			(0.014)	(0.021)
Spread evolution × post l.r.			-0.038**	-0.063***
			(0.019)	(0.020)
Previous residual × post l.r.			-0.003	0.001
			(0.033)	(0.038)
Post loan rating			-0.003	0.001
			(0.033)	(0.038)
Constant	-0.166***	0.177***	-0.166***	-0.121
	(0.057)	(0.049)	(0.057)	(0.090)
Firm FE	N	N	N	Y
Observations	2304	3950	6254	6254
R^2	0.811	0.830	0.832	0.876

Shocks to Private Information

Public Listing

- Public listing of firm's equity decreases stickiness.

	(1) Pre public listing Log(Loan spread)	(2) Post public listing Log(Loan spread)	(3) All eventually listed Log(Loan spread)	(4) All eventually listed Log(Loan spread)
Predicted spread	0.954***	1.014***	0.954***	0.813***
	(0.061)	(0.005)	(0.061)	(0.096)
Spread evolution	0.231***	0.055***	0.231***	0.116
	(0.078)	(0.006)	(0.077)	(0.093)
Previous residual	0.146*	0.161***	0.146*	0.003
	(0.083)	(0.012)	(0.085)	(0.107)
Predicted spread × post p.l.			0.060	0.165*
			(0.061)	(0.096)
Spread evolution × post p.l.			-0.176**	-0.091
			(0.077)	(0.093)
Previous residual × post p.l.			0.015	-0.052
			(0.086)	(0.108)
Post public listing			-0.306	-0.914*
			(0.342)	(0.531)
Constant	0.233	-0.073***	0.233	1.020*
	(0.338)	(0.024)	(0.341)	(0.529)
Firm FE	N	N	N	Y
Observations	156	15003	15159	15159
R^2	0.681	0.802	0.802	0.870

Ex-post Changes in Credit Risk: Is Stickiness Informative?

- Spread evolution (stickiness) term contains information about future creditworthiness.

	(1) All loans	(2) Revolvers	(3) Term loans
	$\hat{s}_{i,t+1} - \hat{s}_{i,t}$	$\hat{s}_{i,t+1} - \hat{s}_{i,t}$	$\hat{s}_{i,t+1} - \hat{s}_{i,t}$
Predicted spread	-0.007**	-0.007***	-0.028***
	(0.003)	(0.003)	(0.009)
Spread evolution	0.006***	0.007***	-0.002
	(0.002)	(0.003)	(0.006)
Constant	0.058***	0.055***	0.177***
	(0.014)	(0.015)	(0.045)
Observations	11629	9127	2502
R^2	0.002	0.002	0.005

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	(1) All loans $\hat{s}_{i,t+1} - \hat{s}_{i,t}$	(2) Revolvers $\hat{s}_{i,t+1} - \hat{s}_{i,t}$	(3) Term loans $\hat{s}_{i,t+1} - \hat{s}_{i,t}$
Predicted spread	-0.007**	-0.007***	-0.028***
	(0.003)	(0.003)	(0.009)
Spread evolution	0.006***	0.007***	-0.002
	(0.002)	(0.003)	(0.006)
Constant	0.058***	0.055***	0.177***
	(0.014)	(0.015)	(0.045)
Observations	11629	9127	2502
R^2	0.002	0.002	0.005

Ratings

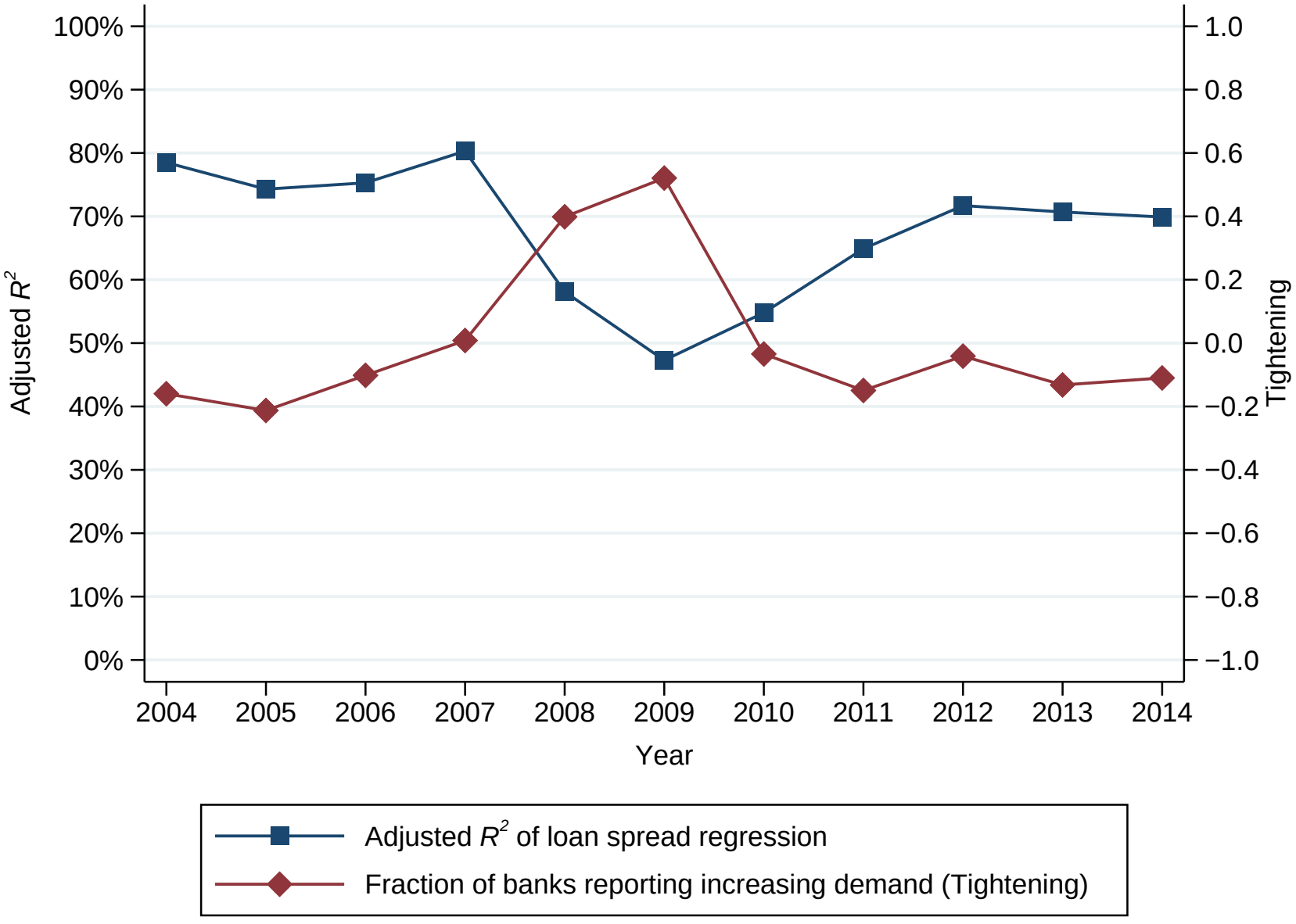
	(1) Rated $\hat{s}_{i,t+1} - \hat{s}_{i,t}$	(2) Unrated $\hat{s}_{i,t+1} - \hat{s}_{i,t}$
Predicted spread	-0.007*	-0.014***
	(0.004)	(0.005)
Spread evolution	-0.001	0.013***
	(0.003)	(0.004)
Constant	0.048***	0.098***
	(0.017)	(0.027)
Observations	5800	5829
R^2	0.001	0.005

Bonds

	(1) With bonds $\hat{s}_{i,t+1} - \hat{s}_{i,t}$	(2) Without bonds $\hat{s}_{i,t+1} - \hat{s}_{i,t}$
Predicted spread	-0.009**	-0.009*
	(0.003)	(0.006)
Spread evolution	0.003	0.010***
	(0.003)	(0.004)
Constant	0.058***	0.075***
	(0.016)	(0.027)
Observations	6782	4847
R^2	0.001	0.003

Model

Incentives to Conduct Due Diligence



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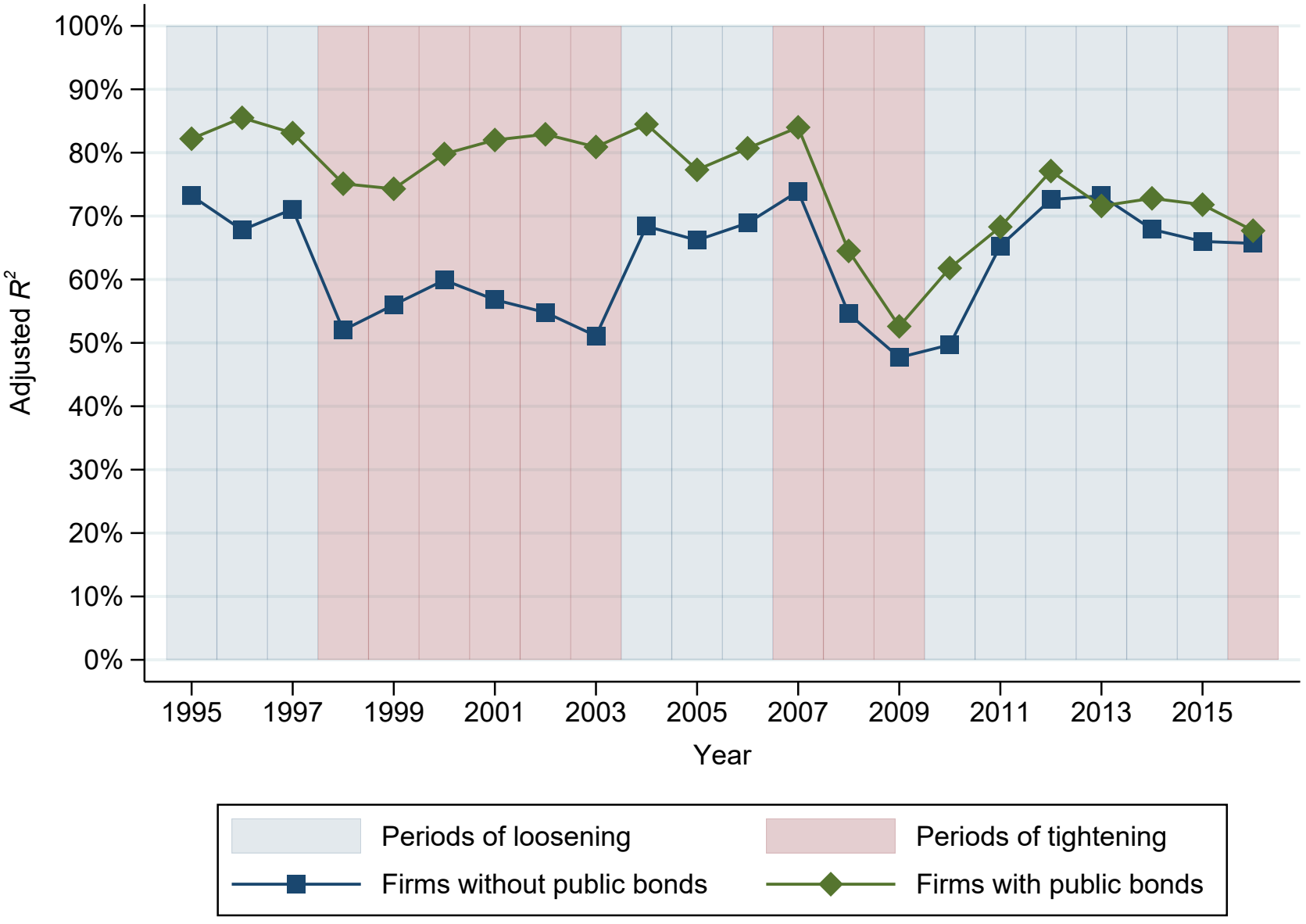


Incentives to Conduct Due Diligence

	(1)	(2)	(3)	(4)
	Firms with public bonds		Firms without public bonds	
	Loose periods Log(Loan spread)	Tight periods Log(Loan spread)	Loose periods Log(Loan spread)	Tight periods Log(Loan spread)
Commercial p. rating	-0.380***	-0.416***	-0.609***	-0.621***
	(0.021)	(0.035)	(0.109)	(0.088)
Log(Sales)	-0.017	-0.037*	-0.038**	-0.015
	(0.010)	(0.016)	(0.013)	(0.013)
Log(Assets)	-0.024*	0.017	-0.062***	-0.067***
	(0.012)	(0.019)	(0.016)	(0.016)
Debt-to-assets	0.285***	0.381***	0.542***	0.525***
	(0.034)	(0.060)	(0.046)	(0.050)
Current ratio	-0.018*	-0.000	-0.003	-0.018*
	(0.007)	(0.011)	(0.006)	(0.007)
ROA	-1.063***	-0.343***	-0.673***	-0.257***
	(0.088)	(0.102)	(0.081)	(0.062)
Return volatility	6.503***	2.658***	3.333***	1.487***
	(0.647)	(0.450)	(0.661)	(0.373)
Lead mkt. share	0.829	-0.005	0.790	2.486*
	(1.061)	(1.301)	(1.097)	(1.022)
Log(Amount)	-0.071***	-0.044***	-0.054***	0.002
	(0.008)	(0.013)	(0.010)	(0.010)
Maturity	-0.001	-0.004***	-0.001**	-0.001**
	(0.000)	(0.001)	(0.001)	(0.000)
# of lenders	-0.001	-0.000	0.001	0.002
	(0.001)	(0.002)	(0.002)	(0.003)
Secured	0.378***	0.453***	0.337***	0.272***
	(0.017)	(0.028)	(0.019)	(0.021)
Covenants	0.013	0.025	-0.094***	0.007
	(0.017)	(0.035)	(0.022)	(0.030)
Performance pricing	-0.076***	-0.065*	-0.067***	-0.004
	(0.016)	(0.029)	(0.019)	(0.024)
Prime base rate	0.313**	0.557***	0.369***	0.452***
	(0.107)	(0.064)	(0.039)	(0.030)
Fixed effects	Loan type, loan purpose, lead arranger, year.			
Observations				
Adjusted R^2	0.711	0.691	0.658	0.552

Conclusion

- **Research question**
  - Why are loan spreads sticky?
- **Approach**
  - A repeat loan pricing model that accounts all public info.
  - Use the CDS spreads to proxy for private information.
  - Conditions when banks have greater incentives to produce info.
- **Results**
  - CDS spreads are sticky, but only at loan dates.
  - Stickiness increases when private information is valuable.
  - Stickiness predicts future credit risk.
  - Loan regression R^2 are lower when credit standards are tight.
- **Implications**
  - Stickiness does not necessarily indicate loan mispricing, and could arise in the absence of rationing and anchoring biases.
  - Incentives for due diligence vary with borrower and market conditions, and tighter lending standards imply "better" loans are made.

First Stage Regressions

	Log(Loan spread)				Log(CDS spread)			
	Coefficients		Standard errors		Coefficients		Standard errors	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Commercial p. rating	-0.07	0.15	0.09	0.04	-0.15	0.25	0.16	0.07
Log(Sales)	-0.03	0.03	0.03	0.01	0.02	0.16	0.09	0.04
Log(Assets)	-0.02	0.05	0.03	0.01	-0.02	0.15	0.10	0.04
Debt-to-assets	0.30	0.17	0.10	0.05	0.52	0.52	0.37	0.18
Current ratio	-0.02	0.03	0.02	0.01	0.00	0.10	0.08	0.03
ROA	-0.49	0.33	0.18	0.09	-1.44	1.63	0.91	0.42
Return volatility	3.43	2.06	1.13	0.38	19.62	11.62	5.85	2.15
Lead mkt. share	-0.09	1.06	0.59	0.90	-0.04	0.40	0.46	1.15
Log(Amount)	-0.04	0.03	0.02	0.01	0.01	0.07	0.06	0.02
Maturity	0.000	0.002	0.001	0.000	0.000	0.006	0.004	0.002
# of lenders	0.001	0.006	0.003	0.002	-0.001	0.013	0.008	0.004
Secured	0.29	0.12	0.04	0.02	0.24	0.24	0.15	0.05
Covenants	-0.05	0.16	0.09	0.19	-0.02	0.20	0.14	0.06
Performance pricing	-0.09	0.16	0.07	0.09	-0.07	0.15	0.13	0.05
Prime base rate	0.40	0.34	0.13	0.09	0.10	0.37	0.62	0.11
	Observations		Adj. R^2		Observations		Adj. R^2	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
	917	339	0.70	0.08	184	88	0.84	0.05

Main Methodology

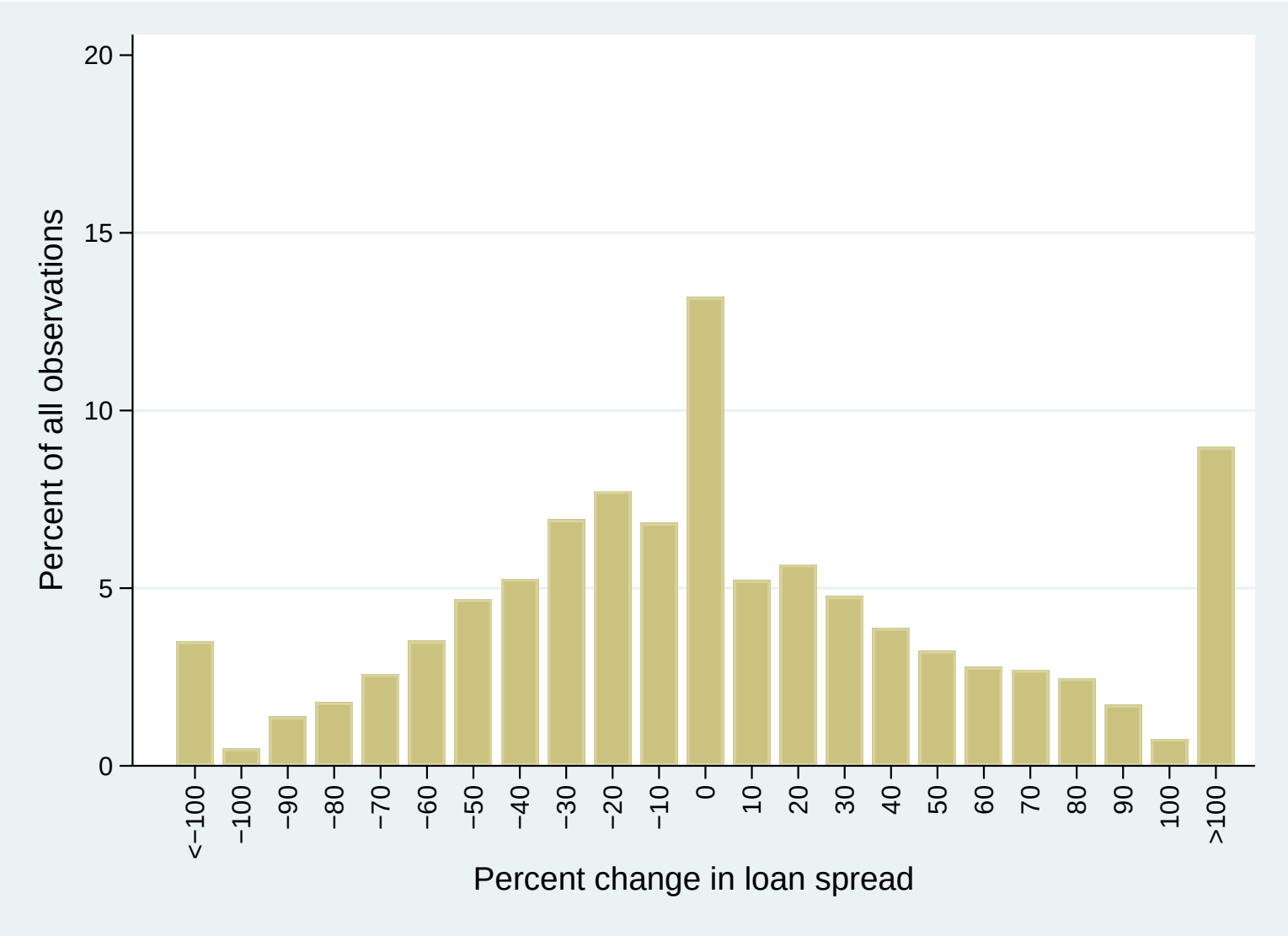
Sensitivity of Loan Spreads to LIBOR

	(1) Log(Loan spread)	(2) Log(Loan spread)	(3) Log(Loan spread)	(4) Log(CDS spread)	(5) Log(CDS spread)
Log(LIBOR 3m)	-0.309***	-0.260***	-0.212***	-0.267***	-0.191***
	(0.039)	(0.026)	(0.024)	(0.058)	(0.032)
Log(CDS spread)			0.252***		
			(0.024)		
Commercial p. rating		0.030	0.046		-0.061
		(0.032)	(0.022)		(0.063)
Log(Sales)		-0.019	-0.024		0.021
		(0.017)	(0.013)		(0.023)
Log(Assets)		0.033*	0.037***		-0.013
		(0.011)	(0.008)		(0.038)
Debt-to-assets		0.098	0.008		0.357**
		(0.077)	(0.065)		(0.104)
Current ratio		0.010	0.015		-0.020
		(0.015)	(0.015)		(0.023)
ROA		-0.885***	-0.625***		-1.032**
		(0.201)	(0.134)		(0.323)
Return volatility		9.507***	3.785**		22.714***
		(0.986)	(1.123)		(2.475)
Lead mkt. share	0.035	0.012	-0.003	0.098	0.060
	(0.026)	(0.019)	(0.016)	(0.046)	(0.029)
Log(Amount)	-0.129***	-0.045***	-0.050***	-0.118***	0.020
	(0.015)	(0.011)	(0.012)	(0.023)	(0.018)
Maturity	-0.004*	-0.003*	-0.002*	-0.005	-0.002
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)
# of lenders	-0.002	-0.004**	-0.004**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Secured	0.756***	0.303***	0.247***	1.152***	0.222***
	(0.059)	(0.050)	(0.041)	(0.048)	(0.054)
Covenants	0.088*	0.013	0.000	0.126	0.052
	(0.040)	(0.019)	(0.017)	(0.074)	(0.035)
Performance pricing	-0.051	-0.015	0.001	-0.173**	-0.066
	(0.043)	(0.034)	(0.029)	(0.053)	(0.038)
Prime base rate	1.494***	1.667***	1.672***	-0.266	-0.022
	(0.252)	(0.258)	(0.235)	(0.299)	(0.196)
Rating FE	N	Y	Y	N	Y
Loan type FE	Y	Y	Y	Y	Y
Loan purpose FE	Y	Y	Y	Y	Y
Lead arranger FE	Y	Y	Y	Y	Y
Observations	2946	2946	2946	2946	2946
Adjusted R^2	0.624	0.787	0.810	0.519	0.785

Main Methodology

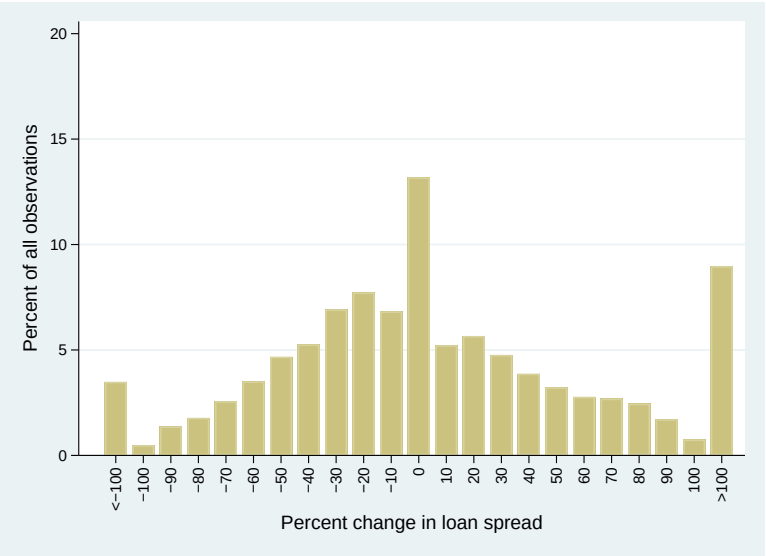
Motivation

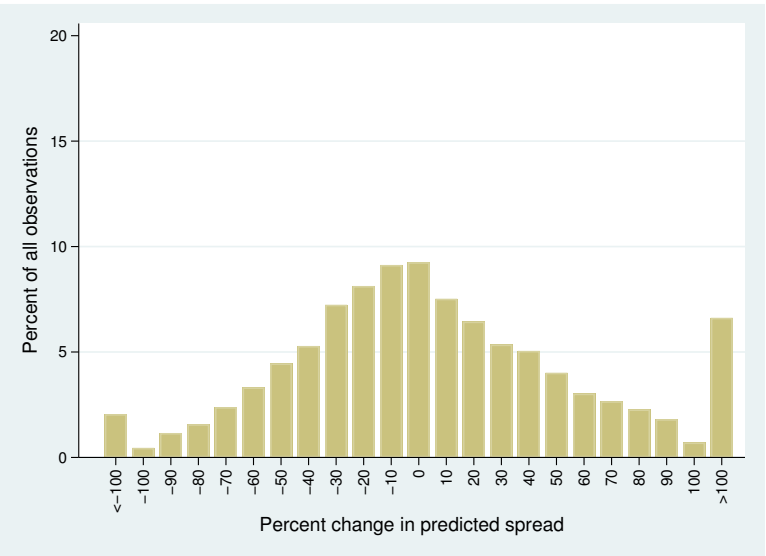
Distribution of Loan Spread Changes

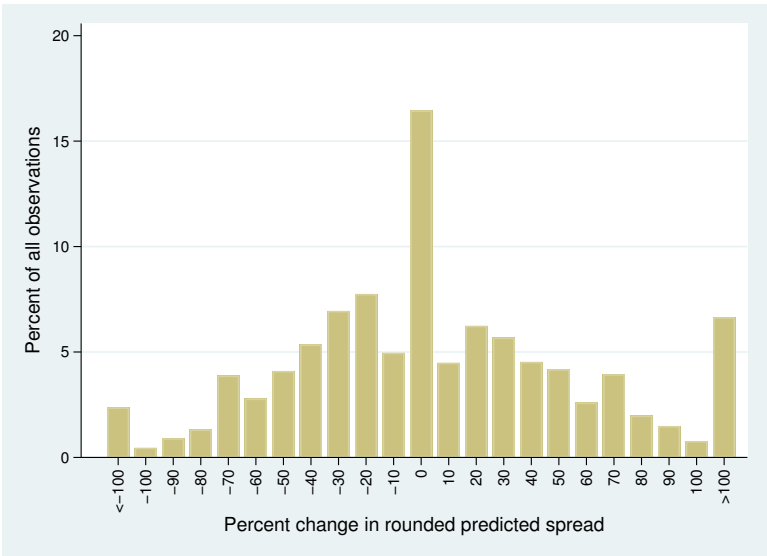


Descriptive Statistics

Rounding


Percent of all observations
0
5
10
15
20
<-100
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
>100
Percent change in loan spread


Percent of all observations
0
5
10
15
20
<-100
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
>100
Percent change in predicted spread


Percent of all observations
0
5
10
15
20
<-100
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
>100
Percent change in rounded predicted spread

Model - Does Evolution Reflect Private Information?

- Estimated model:

$$s_{i,t} = \underbrace{\beta \hat{s}_{i,t}}_{\text{Predicted spread}} + \underbrace{\delta(s_{i,r} - \hat{s}_{i,t})}_{\text{Spread evolution}} + \underbrace{\gamma(s_{i,r} - \hat{s}_{i,r})}_{\text{Previous residual}} + \epsilon_{i,t}$$

- True model:

$$s_{i,t} = \beta \hat{s}_{i,t} + \lambda u_{i,t} + \epsilon_{i,t}$$

  - where $\hat{s}_{i,t}$ and $u_{i,t}$ capture public and private information.

- Denote the change in public and private information:

$$\Delta c_{i,t} = \hat{s}_{i,t} - \hat{s}_{i,r}$$

$$\Delta p_{i,t} = u_{i,t} - u_{i,r}$$

- We can rewrite:

$$s_{i,t} = \beta \hat{s}_{i,t} + \delta(-\Delta c_{i,t}) + (\gamma + \delta)(s_{i,r} - \hat{s}_{i,r}) + \epsilon_{i,t}$$

Model - Does Evolution Reflect Private Information?

- We rewrite:

$$s_{i,t} = \beta \hat{s}_{i,t} + \delta(-\Delta c_{i,t}) + (\gamma + \delta)(s_{i,r} - \hat{s}_{i,r}) + \epsilon_{i,t}$$

- And:

$$\Delta c_{i,t} = \hat{s}_{i,t} - \hat{s}_{i,r}, \Delta p_{i,t} = u_{i,t} - u_{i,r}$$

- Assuming the importance of screening varies with credit is equivalent to assuming $cov(\Delta c_{i,t}, \Delta p_{i,t}) < 0$.
- If $cov(\Delta c_{i,t}, \Delta p_{i,t}) < 0$ then δ will be biased upward.
  - Because this implies $(-\Delta c_{i,t})$ is positively correlated with $u_{i,t}$.
- Therefore, our empirical analysis focuses on examining whether $\hat{\delta}$ reflects the effect of private information.
  - The idea is that importance of private information is a function of strength of the firm's relationship with the lender and firm's credit risk.