### Show Me Yours and I'll Show You Mine: Sharing Borrower Information in a Competitive Credit Market

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Motivation Contribution

## Credit registries

 Mandatory and coordinated sharing of borrower information among lenders

### Goal:

- Reduce information asymmetries in credit markets
- Mitigate adverse selection and moral hazard
- Improve (reduce) access to credit for creditworthy (overindebted) borrowers
- Improve loan quality
- Introduced in a growing number of advanced and developing countries

Motivation Contribution

## Information sharing: Does it work?

• A strong theoretical case can be made...

Pagano and Jappelli (1993), Padilla and Pagano, (2000), Gehrig and Stenbacka (2007), Hoff and Stiglitz (1997), Bennardo, Pagano and Piccolo (2015)

 ... and cross-country evidence is broadly supportive of a positive impact of information sharing on the quantity and quality of credit

Houston et al. (2010), Jappelli and Pagano (1993; 2002)

 Yet, recent anecdotal, cross-country, and micro evidence casts some doubt on earlier claims
 Martinez-Peria and Singh (2014), Giannetti, Liberti and Sturgess (2015), United Arab Emirates

Motivation Contribution

## Our contribution

- Exploit contract-level information from before and after the introduction of a credit registry in Bosnia and Herzegovina
  - Same lender under different information-sharing regimes
  - Loan-officer FE and borrower FE
  - Analyze role local credit-market competition
- Estimate the impact of mandatory information sharing on (1) rejection rates; (2) lending conditions; (3) loan quality
- Unique data on both granted and rejected loans
  - Rejection reasons: private (soft, hard) versus public (negative, positive) information

Credit Registry EKI Identification and estimation

## Bosnian central credit registry

- Private bureau since 2000: voluntary, incomplete, and ineffective ("We were completely blind")
- Unreliable informal information sharing
- July 2009: Full introduction central credit registry (CRK)<sup>1</sup>
- Public, comprehensive and mandatory:
  - Existing loans with other institutions
  - Past loans and repayment performance
  - Collateral and guarantees

<sup>1</sup>Centralni Registrar Kredita

Credit Registry EKI Identification and estimation

## Loan portfolio



• Over 200k loans approved (June 2002 - December 2012)

- Size, maturity, interest rate, collateral, purpose
- Repayment history, write-offs and recovered principal
- Over 130k unique borrowers
  - Income, education, gender, employment status, family size
- Loan officers: 458

Credit Registry EKI Identification and estimation



- We follow the life of a loan from application to repayment
- Compare lending decisions and repayment performance before and after the credit-registry introduction
- Identify impact in diff-in-diff setting by exploiting:
  - Branch variation in credit-market competition (1-local HHI or perception-based measure)
  - Difference between first-time and repeat borrowers

Credit Registry EKI Identification and estimation

## Estimation: Extensive and intensive lending margins

 $Y_{ibt} = \alpha_1 \cdot CreditRegistry_t + \alpha_2 \cdot Competition_b + \beta \cdot I_{bt} + \gamma \cdot X_{ibt} + \epsilon_{ibt} \quad (1)$ 

- $I_{bt} = CreditRegistry_t \cdot Competition_b$
- X = client and branch characteristics
- Cluster standard errors at loan-officer level
- Evaluation window July 2008 July 2009
- Treatment window August 2009 August 2010
- Robustness tests on window width and competition measure
- Placebo tests on time of introduction and local characteristics

Credit Registry EKI Identification and estimation

## Estimation: Extensive and intensive lending margins

$$Y_{ibt} = A_b + B_t + \beta \cdot I_{bt} + \gamma \cdot X_{ibt} + \epsilon_{ibt}$$
<sup>(2)</sup>

$$Y_{ibt} = A_b + B_t + \beta \cdot I_{bt} + \gamma \cdot X_{ibt} + \delta_0 time_t + \delta_1 time_t * Competition_b + \epsilon_{ibt}$$
(3)

- Extensive margin: Time and branch fixed effects
- Intensive margin: Time and loan officer fixed effects
- Group-specific trends

Loan applications Loan terms Loan quality Lender profitability

# Extensive margin: Loan applications

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## Loan applications: Rejection probability

TABLE 2. Extensive margin: Information sharing and loan rejections

Dependent variable $\rightarrow$ Loan rejected						
	Logit		Linear j	probabilit	y model	
	[1]	[2]	[3]	[4]	[5]	[6]
Credit registry	0.409***	0.043***	0.055***			
	(0.034)	(0.004)	(0.004)			
Competition	0.170***	0.016***		0.014***		
	(0.032)	(0.003)		(0.003)		
Credit registry*Competition	0.236***	0.044***	0.016***	0.050***	0.026***	0.041***
	(0.046)	(0.006)	(0.005)	(0.005)	(0.005)	(0.007)
No. of applications	63,893	63,893	63,893	63,893	63,893	63,893
(Pseudo) R-squared	0.022	0.019	0.036	0.028	0.043	0.043
Applicant covariates	Yes	Yes	Yes	Yes	Yes	Yes
Loan covariates	Yes	Yes	Yes	Yes	Yes	Yes
Branch fixed effects	No	No	Yes	No	Yes	Yes
Month fixed effects	No	No	No	Yes	Yes	Yes
Time trends	No	No	No	No	No	Yes

### More loan rejections (5 to 9 ppt) due to information sharing

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## Rejection reasons

- Public information (credit registry)
  - Positive: Outstanding debt
  - Negative: Prior defaults with other lenders
- Private information
  - Hard: Credit history at with lender (EKI), weak financials, insufficient collateral
  - Soft: Doubts about character, bad recommendation, unclear loan purpose

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## Loan applications: Rejection reason

	Public in	formation	Private i	formation		
	Positive	Negative	Hard	Soft		
	[1]	[2]	[3]	[4]		
Credit registry	1.165***	0.644***	0.657***	-0.452***		
	(0.104)	(0.053)	(0.061)	(0.074)		
Competition	-0.023	$0.642^{***}$	$0.409^{***}$	0.029		
	(0.108)	(0.057)	(0.060)	(0.059)		
Credit registry*Competition	-0.055	0.265***	-0.093	0.686***		
	(0.132)	(0.076)	(0.082)	(0.098)		
No. of applications	63.893					
Pseudo R-squared	0.026					
Applicant covariates	Yes					
Loan covariates		У	es			

### Rejections increasingly based on hard and public information

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# Intensive margin: Loan terms

Introduction	Loan applications
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1	(A)	Loan	amount

	[1]	[2]	[3]	[4]	[5]	[6]
Credit registry	-0.185***	-0.103***	-0.125***			
	(0.019)	(0.028)	(0.025)			
Competition		-0.039	0.028			
		(0.024)	(0.025)			
Credit registry*Competition		$-0.146^{***}$	$-0.127^{***}$	$-0.124^{***}$	$-0.103^{***}$	$-0.136^{***}$
		(0.033)	(0.031)	(0.029)	(0.027)	(0.030)
No. of loans	28,240	28,240	28,240	28,240	28,240	28,240
R-squared	0.435	0.439	0.443	0.461	0.461	0.464

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(B) Loan maturity							
	[1]	[2]	[3]	[4]	[5]	[6]	
Credit registry	-0.131***	-0.092***	-0.092***				
	(0.012)	(0.017)	(0.017)				
Competition		-0.043**	0.010				
		(0.017)	(0.017)				
Credit registry*Competition		-0.071***	$-0.076^{***}$	-0.060***	-0.044**	-0.079***	
		(0.022)	(0.023)	(0.020)	(0.019)	(0.021)	
No. of loans	28,240	28,240	28,240	28,240	28,240	28,240	
R-squared	0.332	0.337	0.339	0.356	0.356	0.357	
Month and loan officer fixed effects	No	No	No	Yes	Yes	Yes	
Group-specific trend	No	No	No	No	Yes	Yes	
Matching: Competition	No	No	Yes	No	No	No	
Perceived competition	No	No	No	No	No	Yes	

### Credit contraction: loans smaller (19-25 pct) and shorter

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(C) Interest rate							
	[1]	[2]	[3]	[4]	[5]	[6]	
Credit registry	$0.685^{***}$	$0.494^{***}$	$0.498^{***}$				
	(0.061)	(0.087)	(0.087)				
Competition		0.025	-0.207***				
		(0.073)	(0.075)				
Credit registry*Competition		$0.343^{***}$	$0.381^{***}$	$0.331^{***}$	0.409***	$0.312^{***}$	
		(0.120)	(0.123)	(0.124)	(0.115)	(0.121)	
No. of loans	28,240	28,240	28,240	28,240	28,240	28,240	
R-squared	0.241	0.243	0.247	0.315	0.315	0.315	

(D)	) Coll	lateral
\~~ .		

	[1]	[2]	[3]	[4]	[5]	[6]
Credit registry	0.320***	$0.117^{***}$	$0.107^{**}$			
	(0.041)	(0.044)	(0.043)			
Competition		$0.225^{***}$	$0.345^{***}$			
		(0.049)	(0.058)			
Credit registry*Competition		$0.357^{***}$	$0.185^{***}$	$0.231^{***}$	$0.204^{***}$	$0.167^{**}$
		(0.065)	(0.068)	(0.052)	(0.048)	(0.067)
No. of loans	28,228	28,228	28,228	28,228	28,228	28,228
R-squared	0.372	0.391	0.084	0.470	0.470	0.219
Month and loan officer fixed effects	No	No	No	Yes	Yes	Yes
Group-specific trend	No	No	No	No	Yes	Yes
Matching: Competition	No	No	Yes	No	No	No
Perceived competition	No	No	No	No	No	Yes

### Credit contraction: loans more expensive and collateralized

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## Loan terms: First time vs. repeat borrowers

Dependent variable $\rightarrow$	Amount granted	Maturity granted	Interest rate	Collateral
	[1]	[2]	[3]	[4]
Credit registry	-0.251***	-0.191***	1.036***	0.621***
	(0.021)	(0.016)	(0.077)	(0.038)
Credit registry*Competition	-0.073***	-0.041***	-0.008	0.271***
	(0.013)	(0.010)	(0.051)	(0.028)
2 <sup>nd</sup> loan	0.345***	0.284***	-1.045***	0.028
	(0.013)	(0.010)	(0.049)	(0.026)
3 <sup>rd</sup> loan	0.583***	0.475***	-1.720***	0.043
	(0.023)	(0.018)	(0.081)	(0.044)
4 <sup>th</sup> loan	0.774***	0.662***	-2.346***	0.076
	(0.034)	(0.028)	(0.118)	(0.061)
2 <sup>nd</sup> loan*Credit registry	0.051**	0.026	-0.115	-0.494***
	(0.021)	(0.016)	(0.076)	(0.037)
3 <sup>rd</sup> loan*Credit registry	0.104***	0.070***	-0.411***	-0.576***
	(0.026)	(0.021)	(0.097)	(0.049)
4 <sup>th</sup> loan*Credit registry	0.120***	0.070***	-0.348***	-0.564***
	(0.033)	(0.027)	(0.117)	(0.058)
Branch controls	Yes	Yes	Yes	Yes
Client fixed effects	Yes	Yes	Yes	Yes
No. of loans	81,883	81,883	81,883	81,883
R-squared	0.317	0.303	0.121	0.303

#### Good borrowers enjoy better loan terms under information sharing

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## Loan quality

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## Kaplan-Meier survival function



### Large effect of information sharing on early defaults

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## Survival function: Role of local competition



Information sharing more effective in high-competition areas Results hold in semi-parametric setting

Conclusion

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## Confirmed by a proportional hazard model

Functional form	Cox					
	[1]	[2]	[3]	[4]		
Credit registry	-0.860***	-0.577***	-0.507***	-0.486***		
	(0.127)	(0.078)	(0.091)	(0.083)		
Competition	-0.230	-0.175	-0.178	-0.188		
	(0.169)	(0.170)	(0.171)	(0.186)		
Credit registry*Comp.	-0.467***	$-0.511^{***}$	$-0.556^{***}$	$-0.496^{***}$		
	(0.170)	(0.117)	(0.126)	(0.126)		
First loan		-0.012	-0.009	-0.057*		
		(0.030)	(0.033)	(0.033)		
Credit registry*First loan		$-0.201^{**}$	-0.230**	$-0.201^{**}$		
		(0.096)	(0.107)	(0.101)		
No. of loans	101,883	185,934	162,746	185,934		
LiTS controls	No	No	Yes	No		
Branch stratification	Yes	Yes	No	No		
Loan sample	First	All	All	All		
Log-likelihood ratio	-45,728	-92,204	-102,917	-119,697		
Proportionality	Yes	Yes	Yes	No		

#### Lower default rates in high-competition areas and for first-time borrowers

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## Proportional hazard model: Placebo test



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# Lender profitability

Conclusion

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## Aggregate lender profitability



### Positive effect also on loan-level measure of profitability

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Findings Discussion

## Conclusion

- After the introduction of the credit registry, we observe tighter lending at the extensive margin based on the newly available public information (both positive and negative)
- Lending is tighter at the intensive margin as well. Yet, due to lower switching costs repeat borrowers gain from information sharing
- Tighter lending standards lead to better repayment performance and higher loan profitability
- These effects are particularly strong in high competition areas and for new borrowers

Findings Discussion

## Final thoughts

### Dynamics

- Short-term: Reduction in over borrowing (Bennardo, Pagano and Piccolo, 2015) and adverse selection (Pagano Jappelli, 1993).
- Longer-term: Better loan quality improves access to credit? (Jappelli and Pagano, 2002)
- Impact varies across borrowers
  - Loan terms improved mainly for repeat borrowers (Gehrig and Stenbacka, 2007)
  - Reduced lock-in effect (Petersen and Rajan, 1995)

Findings Discussion

## Impact global financial crisis?

- Smoking gun': Observe loan officers starting to use the registry at the time it is introduced
- Placebo tests: Results quickly dissipate when moving registry treatment closer to crisis period
- We document a strong positive effect on loan quality

Findings Discussion

## Placebo tests



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#### Findings Discussion

## Summary statistics

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Mean	Mean	Obs.	Median	St. dev.	Min	Max
	pre-Credit	post-Credit					
	registry	registry					
Loan rejected	0.082	$0.147^{***}$	210,044	0	0.322	0	1
Loan amount (BAM)	3,564	3,173***	236,893	3,000	2,802	500	15,000
Loan maturity	23	23.170	236,893	19	11.365	6	60
Interest rate	18.540	21.210***	236,893	20.500	3.903	12	26
Problem loan	0.059	0.017***	236,893	0	0.208	0	1
Loan/income ratio	3.186	2.975***	236,893	2.484	2.332	0.444	11.765
Borrower age	40	42***	236,893	40	12.094	20	68
Borrower male	0.593	$0.612^{***}$	236,893	1	0.490	0	1
Borrower education	1.93	$1.95^{***}$	236,893	3	0.392	2	4
Borrower monthly income (BAM)	1,212	$1,159^{***}$	236,893	1,031	577	350	3,691
Borrower urban	0.39	0.33***	236,893	2	0.674	1	3
Stable income	0.863	0.831***	236,893	1	0.353	0	1