

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

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## Background: The microcredit boom

- Rapid growth in microcredit: 139 million clients globally (2017)
- Microcredit markets increasingly competitive and saturated (McIntosh, de Janvry, and Sadoulet, 2005)
- Multiple loan-taking ('double-dipping') and the erosion of loan quality have led to repayment crises in Bangladesh, Bolivia, Cambodia, India, Morocco, Nicaragua, Nigeria, Pakistan...

## Credit registries to the rescue?

- Big picture: Can financial systems become more inclusive yet remain stable?
- Public credit registries require lenders to share borrower information
- May help to manage the potential trade-off between inclusion and stability in increasingly saturated microcredit markets
  - ▶ Challenge: Most credit registries exclude microloans
  - ▶ We use data from Bosnia and Herzegovina where a new credit registry includes data from microfinance institutions (MFIs)

## Credit registries to the rescue?

- A strong theoretical case...  
Pagano and Jappelli (1993), Hoff and Stiglitz (1997), Padilla and Pagano (2000), Gehrig and Stenbacka (2007), Bennardo, Pagano, and Piccolo (2015)
- ...and cross-country evidence shows a positive correlation between information sharing and credit quantity and quality  
Jappelli and Pagano (1993, 2002); Houston et al. (2010)
- 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

## Our contribution

- 1 Analyze how a new credit registry affects a competitive microcredit market (Bosnia and Herzegovina)
- 2 Exploit contract-level data from before and after the registry introduction:
  - Unique data on accepted and rejected microcredit applications; reason why rejected; loan characteristics; loan quality (complete repayment history)
  - Same lender under different info regimes: loan officer FE
  - Repeat versus new borrowers; immediate versus longer-term effects

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# Existing theory in a nutshell

## Theory: Mechanisms

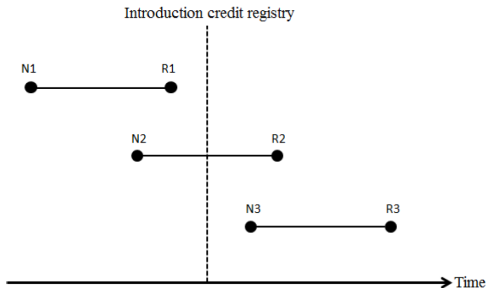
- 1 Reduces adverse selection and brings safe borrowers back into the market (Pagano and Jappelli, 1993)
- 2 Mitigates moral hazard (Padilla and Pagano, 1997; 2000)
  - ▶ Less fear of rent extraction by lenders
  - ▶ Reputation costs higher as defaults are immediately visible to all lenders (Hoff and Stiglitz, 1997)
- 3 Prevents 'double dipping' and overindebtedness (Bennardo, Pagano, and Piccolo, 2015)

## Theory: Expected impacts

- Loan quality: unambiguously positive
- Loan quantity:
  - ▶ Moral hazard: positive
  - ▶ Adverse selection: ambiguous
  - ▶ 'Double dipping': negative



## Theory: New versus repeat borrowers



Registry allows for a 'reality check' of existing lending relationships (N2-R2) and better screening of new relationships (N3-R3)

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# Setting

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# Bosnia and Herzegovina



## Bosnian central credit registry

- Private bureau since 2000: voluntary, incomplete, and ineffective ("We were completely blind")
- Unreliable informal information sharing
- July 2009: Introduction Centralni Registrar Kredita (CRK)
- Public, comprehensive and mandatory:
  - Existing loans with other institutions ('positive information')
  - Past loans and repayment performance ('negative information')

## Loan data (EKI)



- Loan applications: 136,557. Approved loans: 116,517
  - Size, maturity, interest rate, collateral, purpose
  - Repayment history, write-offs and recovered principal
- 80k unique borrowers (income, education, gender, employment status, family size)
- Loan officers: 375

# Borrowers



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# Empirical approach

## (1) Diff-in-Diff comparing new vs. repeat borrowers

$$Y_{ilt} = \alpha_1 \cdot \text{CreditRegistry}_t + \alpha_2 \cdot \text{New}_{il} + \beta \cdot I_{ilt} + \gamma \cdot X_{ilt} + \epsilon_{ilt} \quad (1)$$

$$Y_{ilt} = A_l + B_t + \beta \cdot I_{ilt} + \gamma \cdot X_{ilt} + \epsilon_{ilt} \quad (2)$$

- $I_{ilt} = \text{CreditRegistry}_t \cdot \text{New}_{il}$
- $X_{ilt}$  = client and branch characteristics
- Propensity score match new and repeat borrowers ([Abadie et al., 2004](#))
- Cluster standard errors at month\*loan-officer level
- Treatment window August 2009–August 2010



## (2) Survival analysis

$$h(t) = \lim_{\Delta t \rightarrow 0} \left\{ \frac{P(t \leq T < t + \Delta t | T \geq t, X(t), \beta)}{\Delta t} \right\} = h_0(t) \exp(\beta' X_t) \quad (3)$$

- Hazard rate: probability of default at  $t$  conditional on repayment until  $t$
- $\beta$ : partial impact of  $X$  on the log of the hazard rate
- Cluster by loan officer
- Sample July 2008 - August 2010
- Deals with right censoring and change in survival probability
- Cox specifies no shape for  $h_0(t)$ , semi-parametric
- Robustness: non-parametric (Kaplan Meier) and parametric specification  $h_0(t) = h\alpha t^{\alpha-1}$  (exponential and Weibull)

# Extensive margin: Loan applications

# Loan applications: Rejection probability

TABLE 2. Extensive margin: Information sharing and loan rejections

Dependent variable →	Loan rejected			Proportion granted		
	OLS			Tobit		
	[1]	[2]	[3]	[4]	[5]	[6]
Credit registry	0.072*** (0.005)			-0.055*** (0.005)		
New borrower	0.107*** (0.005)	0.105*** (0.005)	0.106*** (0.005)	-0.104*** (0.005)	-0.105*** (0.005)	-0.105*** (0.005)
Credit registry*New Borrower	0.038*** (0.008)	0.038*** (0.008)	0.037*** (0.008)	-0.035*** (0.008)	-0.034*** (0.008)	-0.037*** (0.008)
No. of applications	64,009	64,009	64,009	64,009	64,009	64,009
Adjusted (Pseudo) $R^2$	0.054	0.097	0.137	0.081	0.086	0.137
Applicant and loan covariates	Yes	Yes	Yes	Yes	Yes	Yes
Matching	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	No	Yes	No	No	Yes	No
Loan officer FE	No	Yes	No	No	Yes	No
Loan officer x month FE	No	No	Yes	No	No	Yes

- More loan rejections after the registry introduction, especially for new borrowers
- Multinomial logit: due to both 'positive' and 'negative' registry information

# Loan applications: Repeat loans only

TABLE 3. Extensive margin: Information sharing and loan rejections for repeat borrowers

Dependent variable →	Loan rejected			Proportion granted		
	OLS			Tobit		
	[1]	[2]	[3]	[4]	[5]	[6]
Credit registry	0.066*** (0.006)	0.052*** (0.008)		-0.073*** (0.007)	-0.061*** (0.009)	
Credit registry <i>No registry at time of previous loan</i>			0.054*** (0.008)			-0.063*** (0.009)
Credit registry <i>Registry at time of previous loan</i>			0.018 (0.013)			-0.023 (0.015)
No. of applications	32,034	12,198	12,198	32,034	12,198	12,198
Adjusted (Pseudo) $R^2$	0.045	0.051	0.052	0.074	0.078	0.079
Applicant and loan covariates	Yes	Yes	Yes	Yes	Yes	Yes
Loan officer FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All repeat	Narrow	Narrow	All repeat	Narrow	Narrow

- Loan officers more cautious about repeat loan applications but only for pre-registry client relationships (about whom they revise their view downwards)
- Mainly reflects use of 'positive' information on pre-existing debt

## Intensive margin: Loan terms

TABLE 5. Intensive margin: Information sharing and loan terms

(A) Loan amount

	[1]	[2]	[3]	[4]
Credit registry	-0.177*** (0.007)	-0.155*** (0.008)		
New borrower		-0.052*** (0.006)	-0.053*** (0.006)	-0.061*** (0.006)
Credit registry*New Borrower		-0.047*** (0.010)	-0.051*** (0.010)	-0.051*** (0.010)
No. of loans	57,417	57,417	57,417	57,417
Adj. $R^2$	0.554	0.556	0.561	0.541

- Credit tightening: loans smaller, shorter, more expensive, and more collateralized—both new and repeat loans

# Change in loan terms for repeat loans

TABLE 6. Intensive margin: Information sharing and repeat borrowers

Dependent variable →	Δ% Loan amount		Δ% Loan maturity		Δ% Interest rate		Δ% Collateral	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Credit registry	-0.341*** (0.029)		-0.194*** (0.027)		0.075*** (0.005)		0.160*** (0.026)	
Credit registry <i>No registry at time of previous loan</i>		-0.395*** (0.030)		-0.233*** (0.028)		0.087*** (0.005)		0.205*** (0.027)
Credit registry <i>Registry at time of previous loan</i>		0.161** (0.065)		0.176*** (0.048)		-0.033*** (0.006)		-0.259*** (0.047)
No. of loans	8,414	8,414	8,414	8,414	8,414	8,414	8,414	8,414
Adjusted $R^2$	0.098	0.105	0.088	0.092	0.073	0.090	0.118	0.127
Loan and branch covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan officer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

- When 'surprise effects' are no longer present, repeat loans grow faster and interest rates decline more with the registry (i.e., increased progressiveness)
- For lending relationships that start after the registry introduction, the initial tightening is overcome by the third loan cycle
- Steeper intertemporal interest-rate curve, less interest-rate smoothing (e.g. Petersen and Rajan, 1995; Bouckaert and Degryse, 2006; Gehrig and Stenbacka, 2007)

# Loan quality

## Loan quality: OLS

TABLE 7. Information sharing and loan quality: Regression analysis

	[1]	[2]	[3]	[4]
Credit registry	-0.048*** (0.005)	-0.024*** (0.003)		
New borrower	-0.000 (0.003)	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
Credit registry*New borrower	-0.018*** (0.004)	-0.009** (0.004)	-0.009** (0.004)	-0.009** (0.004)
No. of loans	57,445	57,445	57,445	57,445
Adjusted $R^2$	0.049	0.196	0.196	0.199
Borrower and loan covariates	Yes	Yes	Yes	Yes
Matching	Yes	Yes	Yes	Yes
Month FE	No	No	Yes	No
Loan officer FE	No	Yes	Yes	No
Loan officer x month FE	No	No	No	Yes

- Default probability 2.4 ppt (3.3 ppt) lower for repeat (new) borrowers



# Loan quality: Proportional hazard models

TABLE 8. Information sharing and loan quality: Hazard analysis

Dependent variable → Functional form →	Hazard ratio		
	Cox	Exponential	Weibull
	[1]	[2]	[3]
Credit registry	-0.674*** (0.067)	-0.610*** (0.071)	-0.642*** (0.068)
New borrower	0.031 (0.037)	0.004 (0.041)	0.017 (0.039)
Credit registry*New borrower	-0.330*** (0.107)	-0.326*** (0.113)	-0.326*** (0.110)
Ln(Alpha)			-0.645*** (0.023)
No. of loans	57,581	57,581	57,581
Log-likelihood ratio	-36,176	-22,904	-21,628
Borrower and loan covariates	Yes	Yes	Yes
Branch stratification	Yes	Yes	Yes

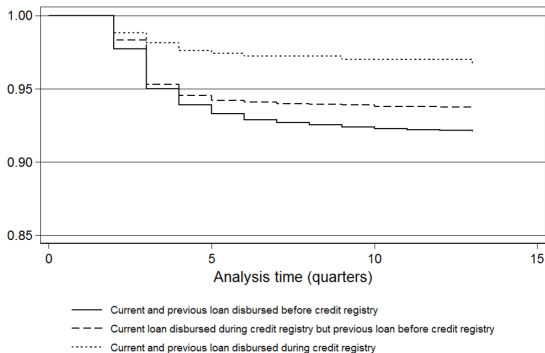
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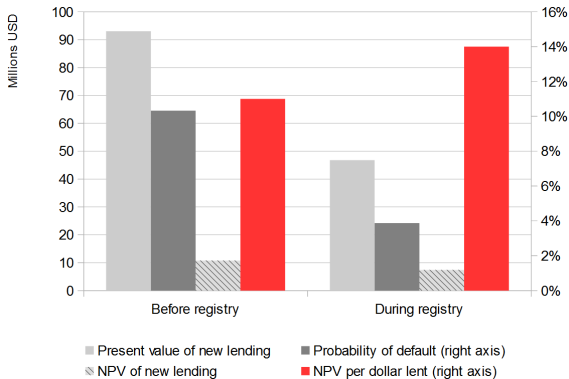
# Loan quality: Repeat loans only

FIGURE 4. Information sharing and loan quality: Effect on different types of repeat borrowers



- Improvement in loan quality is about 2.5 times larger for repeat loans that are part of relationships started with the registry already in place

## Aggregate lender profitability



- NPV per USD lent increased from 11 to 14 cents
- IRR on lending increased from 17.6 to 21.8 percent

## Conclusions (1)

- 1 Microcredit: increasingly competitive, saturated, and risky. Role mandatory information sharing?
- 2 Bosnian credit registry made loan officers initially more cautious at the extensive and intensive margin. Holds for both new and, to a lesser extent, existing borrowers
- 3 Views of existing borrowers were revised downwards based on new 'negative' and, especially, 'positive' info: the registry complemented EKI's proprietary information
- 4 Lending relationships established after the registry introduction: quicker increase in loan size as well as decline in interest rate

## Conclusions (2)

- Short term: Information sharing reduces coordination problems (Bolton and Scharfstein, 1996) and avoids double dipping (Bennardo, Pagano, and Piccolo, 2015)
- Longer term: Reduction in agency problems (Jappelli and Pagano, 2002) benefits repeat borrowers as lock-in effects are reduced (Gehrig and Stenbacka, 2007; Petersen and Rajan, 1995)
- Credit registries do not necessarily lead to an immediate increase in lending (see UAE case)

Thank you

## Impact global financial crisis?

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