Bivariate Tests of Credit Market Discrimination with an Application to Intersectionality

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Motivation (1)

- **Discrimination in credit market**
  - **Definition:** loan application rejected due to *personal* rather than *economic* characteristics of the borrower (Black et al., 1978)
    ⇒ **Economic AND ethical topic**
- **Social lending is not immune to discriminatory biases**
  - Female borrowers receive smaller loans than men in Brazil (Agier & Szafarz, 2013); France (Cozarenco & Szafarz, 2018; Brana, 2013); Italy (Alesinal et al., 2013); Peru (Buvinic & Berger, 1990); Paraguay (Fletschner, 2009).
  - Disabled people are discriminated against in Africa & Asia (Cramm & Finkenflugel, 2008); Uganda (Mersland et al., 2009; Labie et al., 2010); Zambia & Zimbabwe (Lewis, 2004).

Motivation (2)

Why do we need a new approach to detect biases in social lending?

- **Methodological issues**
  - Data limitations (Delis et al., 2020): Often no data on rejected applicants, amounts requested, default records
  - Tests on approval rates assume equal creditworthiness across groups
  - Coexistence of positive & negative biases depending on the reference group (Ruffle & Shtudiner, 2014)
  - New stream of papers using "outcome tests" (=profit for the lender) (Dobbie et al., 2020)
    - Major achievement in literature using lenders' profitability of marginal applicants

    ⇒ Not suitable for non-profit lenders

Objective of this paper

- **New approach to detect biases in social lending**
  - Outcome = recovery rate $\neq$ profit
  - Applicable to non-profit social lenders
- **Application to intersectional biases (women/migrants) in microcredit in France**

Test for discrimination (based on Ferguson & Peters, 1995)
Heckman (1979) approach to address selection bias:

$$Recovery\ rate_i = \alpha_{\mathbf{R}}\mathbf{F_i} + \beta'_R X_i + \epsilon_i$$

$$E[Approval_i|\mathbf{F_i}, Z_i] = \Phi(\alpha_{\mathbf{A}}\mathbf{F_i} + \beta'_A Z_i)$$

$\mathbf{F_i}$ =**Female**

	Higher approval rate for women: $\alpha_{\mathbf{A}} > 0$	**Nonsignificant difference between approval rates:** $\alpha_{\mathbf{A}} = 0$	**Lower approval rate for women:** $\alpha_{\mathbf{A}} < 0$
Higher recovery rate for women: $\alpha_{\mathbf{R}} > 0$	No bias detected	Weak negative bias	Strong negative bias
Insignificant difference between recovery rates: $\alpha_{\mathbf{R}} = 0$	Weak positive bias	No bias detected	Weak negative bias
Lower recovery rate for women: $\alpha_{\mathbf{R}} < 0$	Strong positive bias	Weak positive bias	No bias detected

Extension to intersectional discrimination

$$Recovery\ rate_i = \alpha_R \mathbf{F_i} + \theta_R \mathbf{D_i} + \mu_R \mathbf{F_i} \cdot \mathbf{D_i} + \beta'_R X_i + \epsilon_i$$

$$E[Approval_i | \mathbf{F_i}, \mathbf{D_i}, Z_i] = \Phi(\alpha_A \mathbf{F_i} + \theta_A \mathbf{D_i} + \mu_A \mathbf{F_i} \cdot \mathbf{D_i} + \beta'_A Z_i)$$

F_i =**Female,** D_i =**Migrant (non-EU)**

Panel I: Definition of coefficients

Comparing	**with EU men**	**with EU women**	**with migrant men**
EU women	$\delta_1 = \Phi(\alpha_A + \beta'_{\mathbf{A}} \mathbf{Z_i}) - \Phi(\beta'_{\mathbf{A}} \mathbf{Z_i})$ $\gamma_1 = \alpha_R$		
migrant men	$\delta_2 = \Phi(\theta_A + \beta'_{\mathbf{A}} \mathbf{Z_i}) - \Phi(\beta'_{\mathbf{A}} \mathbf{Z_i})$ $\gamma_2 = \theta_R$		
migrant women	$\delta_3 = \Phi(\alpha_A + \theta_A + \mu_A + \beta'_{\mathbf{A}} \mathbf{Z_i})$ $-\Phi(\beta'_{\mathbf{A}} \mathbf{Z_i})$ $\gamma_3 = \alpha_R + \theta_R + \mu_R$	$\delta_4 = \Phi(\alpha_A + \theta_A + \mu_A$ $+\beta'_{\mathbf{A}} \mathbf{Z_i}) - \Phi(\alpha_A + \beta'_{\mathbf{A}} \mathbf{Z_i})$ $\gamma_4 = \theta_R + \mu_R$	$\delta_5 = \Phi(\alpha_A + \theta_A + \mu_A$ $+\beta'_{\mathbf{A}} \mathbf{Z_i}) - \Phi(\theta_A + \beta'_{\mathbf{A}} \mathbf{Z_i})$ $\gamma_5 = \alpha_R + \mu_R$

Panel II: Test results and interpretation

$\forall j = 1, ..., 5$	$\delta_{\mathbf{j}} > \mathbf{0}$	$\delta_{\mathbf{j}} = \mathbf{0}$	$\delta_{\mathbf{j}} < \mathbf{0}$
$\gamma_{\mathbf{j}} > \mathbf{0}$	No bias detected	Weak negative bias	Strong negative bias
$\gamma_{\mathbf{j}} = \mathbf{0}$	Weak positive bias	No bias detected	Weak negative bias
$\gamma_{\mathbf{j}} < \mathbf{0}$	Strong positive bias	Weak positive bias	No bias detected

An application to microcredit in Europe

Context

- **Microcredit in Europe** is a nascent, yet growing market
- 1.26 million active borrowers in 2019, +14% since 2018
- 3.70 billion gross microloan portfolio outstanding
- Highly standardized loans
- **Main objective**: financial inclusion & job creation
- Strong dependence on subsidies

Hand-collected dataset from a French NGO

- Microcredit to **unbanked** individuals
- Gender & citizenship (EU vs. migrants)
- Average loan size: EUR 2,231
- Average duration: 33 months
- Fixed interest rate: 1% - 4%

An application to microcredit in Europe

Descriptive statistics

	Full sample	Panel I: Applicants		Panel II: Borrowers	
		Rejected	Accepted	Repaying	Defaulting
Variables	(1)	(2)	(3)	(4)	(5)
Percentage		0.437	0.563	0.871	0.129
Recovery rate				1.000	0.415
Female	0.485	0.450	0.511***	0.517	0.473*
Migrant	0.086	0.089	0.083	0.082	0.090
Observations	5,789	2,528	3,261	2,840	421

T-tests for equal means. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results (1) – Simple discrimination

	Recovery rate		**Approval**	
	Coef	SE	Marginal effect	SE
Female ($\hat{\alpha}$)	0.016**	(0.007)	0.028**	(0.014)
Migrant ($\hat{\theta}$)	-0.016	(0.014)	-0.009	(0.022)
Instruments:				
Unemployment rate in town of residence			0.016***	(0.004)
Unemployment rate at national level			-0.131***	(0.048)
Mills ratio	0.018***	(0.008)		
Number of observations	3,262		5,792	

*** p<0.01, ** p<0.05, * p<0.1

- **No bias**: women are more likely to receive a loan because they are more creditworthy than men
- Significant Mills ratio: Heckman approach is relevant

Results (2) – Intersectional discrimination

	Recovery rate		Approval	
	Coef	SE	Marginal effect	SE
Panel I: Marginal effects				
Female ($\hat{\alpha}$)	0.021***	(0.007)	0.020	(0.015)
Migrant ($\hat{\theta}$)	0.009	(0.016)	-0.050*	(0.027)
Female*Migrant ($\hat{\mu}$)	-0.055**	(0.027)	0.114***	(0.038)
Panel II: Total marginal effects				
Migrant women vs. EU women	-0.046**	(0.023)	0.065**	(0.032)
Migrant women vs. EU men	-0.025	(0.025)	0.085**	(0.033)
Migrant women vs. migrant men	-0.034	(0.028)	0.134***	(0.038)
EU women vs. EU men	0.021***	(0.007)	0.020	(0.015)
Migrant men vs. EU men	0.009	(0.016)	-0.050*	(0.027)

*** p<0.01, ** p<0.05, * p<0.1

- **Strong positive bias** in favor of migrant women vs. EU women
- **Weak positive bias** in favor of migrant women vs.EU/migrant men
- **Weak negative bias** against EU women vs. EU men
- **Weak negative bias** against migrant men vs. EU men

Summary of results

- **Expectation : Social mission**

	Men	Women
EU	$-$	$+$
Migrant	$+$	$++$

- **Reality: Social mission & Stereotypes**

	Men	Women
EU	$+$	$-$
Migrant	$-$	$++$

Conclusion

- **Case Study:**
  - Positive and socially consistent bias in favor of migrant women in pro-social lending can hide entrenched stereotypes

  $\Rightarrow$ Pro-social lenders are not immune to discriminatory attitude

- **Method:**
  - Our test detects biases otherwise invisible: Intersectional discrimination can occur even without any simple discrimination
  - Intersectional discrimination in lending deserves attention

  $\Rightarrow$ Our test design can be extended to any type of lender (for-profit, non-profit, hybrid)

Thank you for your attention.