Rational Herding in Microloan Markets

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Introduction

- Background of microloan markets
  - Have a long history (Bouman, 1995)
  - Develop fast based on Internet in recent years (Nance-Nash, 2011)
- Features of microloan markets
  - One borrower typically relies on multiple lenders
  - The social aspect of lending is prominent
  - Uncertainty of creditworthiness
  - “Herding” among lenders (Herzenstein et al. ,2011)

Introduction

- Irrational herding
  - lenders passively mimic others' choices, refer to others' decisions as a descriptive social norm, or follow well-funded and hence salient listings. (Croson and Shang 2008; Simonsohn and Ariely, 2008)
- Rational herding
  - Happens as a result of observational learning among lenders. (Banerjee 1992, Bikhchandani et al. 1992)

Introduction

- What strategies the supply side should undertake
  - If irrational herding dominates, it pays to build early momentum because herding will be self-reinforcing. (Simonsohn and Ariely 2008)
  - If rational herding dominates, the effects of momentum-building efforts are more nuanced.

Motivation

- The existence of herding
- Irrational herding or rational herding
- Borrower characteristics and rational herding

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- Fast-growing (start day)
- Project stream
  - Borrower creates a listing, which specifies the amount request, the borrower rate, and the duration.
  - Borrower submit a written statement to describe the purpose of the loan and provide a credit profile, which includes her debt-to-income ratio and a Prosper credit grade.

Table 1 Distribution of Credit Grades Across Listings

Credit grade	Credit score	Overall	Fully funded	Not fully funded	Mean difference	*z*-stat.	*p*-value
AA	760 and up	3.49%	17.45%	1.54%	15.91%	63.39	<0.0001
A	720–759	3.36%	15.72%	1.64%	14.08%	57.09	<0.0001
B	680–719	4.76%	17.73%	2.95%	14.78%	50.76	<0.0001
C	640–679	7.54%	18.08%	6.07%	12.01%	33.27	<0.0001
D	600–639	11.11%	15.04%	10.56%	4.48%	10.43	<0.0001
E	560–599	17.58%	8.39%	18.87%	−10.48%	−20.14	<0.0001
HR	520–559	51.93%	7.44%	58.15%	−50.71%	−74.26	<0.0001
NC	N/A	0.22%	0.15%	0.23%	−0.08%	−1.25	0.2118
Total		100.00%	100.00%	100.00%			
Number of observations		49,693	6,102	43,591			

Notes. This table presents the mapping between Prosper-assigned credit grades and Experian Scorex PLUS credit scores, the distribution of credit grades across all listings in the sample, and the distributions depending on whether the listing is fully funded. The *p*-values are based upon two-tailed tests.

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- Project stream
  - Borrower creates a listing, which specifies the amount request, the borrower rate, and the duration.
  - Borrower submits a written statement to describe the purpose of the loan and provide a credit profile, which includes her debt-to-income ratio and a Prosper credit grade.
  - Borrower can seek endorsements. They can also join Prosper member groups.

Prosper.com

- Project stream
  - Lender decides whether to fund a list and, if so (bid=1), the amount and the minimum interest rate.
  - When a listing is fully funded yet still active, lenders can continue to fund the listing by bidding down the interest rate.
  - Once a listing expires and the requested amount is fully funded, a loan is created. All Prosper loans are unsecured, 36-month, fixed-rate and fully amortizing loans. If a listing expires without full funding, all lenders receive their contributions back.

Table 2 Summary Statistics of All Listings

Variable	Mean	Std. dev.	Minimum	Maximum
Listing attributes				
Amount Requested	6,713.018	5,895.258	1,000	25,000
Borrower Rate	0.177	0.086	0	0.36
Credit_Risky (1 = yes)	0.521	0.500	0	1
Debt-to-Income Ratio	0.519	1.355	0	10.01
Endorsements	0.011	0.123	0	4
Group Member (1 = yes)	0.262	0.440	0	1
Homeowner (1 = yes)	0.311	0.463	0	1
First-day statistics				
Amount Funded	296.057	1,286.188	0	29,962.16
Bids	3.326	15.289	0	398
Rate	0.169	0.083	0	0.36
Last-day statistics				
Amount Funded	555.416	2,007.918	0	69,713.67
Bids	6.284	20.868	0	358
Rate	0.167	0.083	0	0.36
Funding outcome				
Total Amount Funded	1,674.275	5,210.504	0	70,270.05
Total Percent Funded	0.159	0.348	0	1
Fully Funded (1 = yes)	0.123	0.328	0	1
Number of observations	49,693			

Table 3 Summary Statistics by Funding Outcome

Variable	Fully funded		Not fully funded		Mean difference	*t*-stat.	*p*-value
	Mean	Std. dev.	Mean	Std. dev.			
Listing attributes							
Amount Requested	6,053.064	5,395.375	6,805.400	5,956.116	−752.336	−10.07	<0.0001
Borrower Rate	0.207	0.079	0.173	0.086	0.034	31.14	<0.0001
Credit_Risky (1 = yes)	0.076	0.265	0.584	0.493	−0.508	−122.90	<0.0001
Debt-to-Income Ratio	0.285	0.785	0.552	1.413	−0.267	−22.04	<0.0001
Endorsements	0.032	0.209	0.008	0.106	0.024	8.81	<0.0001
Group Member (1 = yes)	0.363	0.481	0.248	0.432	0.115	17.70	<0.0001
Homeowner (1 = yes)	0.492	0.500	0.286	0.452	0.206	30.49	<0.0001
First-day statistics							
Amount Funded	2,094.880	2,959.019	44.252	379.469	2,050.628	54.07	<0.0001
Bids	23.307	35.212	0.529	5.407	22.778	50.45	<0.0001
Rate	0.173	0.068	0.170	0.085	0.003	4.16	<0.0001
Last-day statistics							
Amount Funded	3,604.484	4,221.974	128.599	785.917	3,475.885	64.16	<0.0001
Bids	40.725	40.575	1.462	8.758	39.263	75.34	<0.0001
Rate	0.151	0.058	0.170	0.086	−0.019	−22.38	<0.0001
Funding outcome							
Total Amount Funded	11,462.597	9,740.330	304.076	1,543.134	11,158.521	89.33	<0.0001
Total Percent Funded	1	0	0.042	0.158	0.958	1,265.92	<0.0001
Number of observations	6,102		43,591				

Notes. This table reports the summary statistics for listings that are fully funded and not fully funded. All variable definitions are the same as in Table 2. The *p*-values are based upon two-tailed tests.

Main Analysis

- A naive test of herding
  - $y_{it} = \alpha Y_{j,t-1} + X_{jt}\beta_1 + Z_j\beta_2 + e_{jt}$
  - y_{it}: the amount of funding that listing *j* receives during its *t*th day
  - $Y_{j,t-1}$: cumulative amount of funding that listing *j* has received by the end of day *t-1*
  - X_{jt}: time-varying listing attributes
  - Z_j: time-invariant listing attributes

Main Analysis

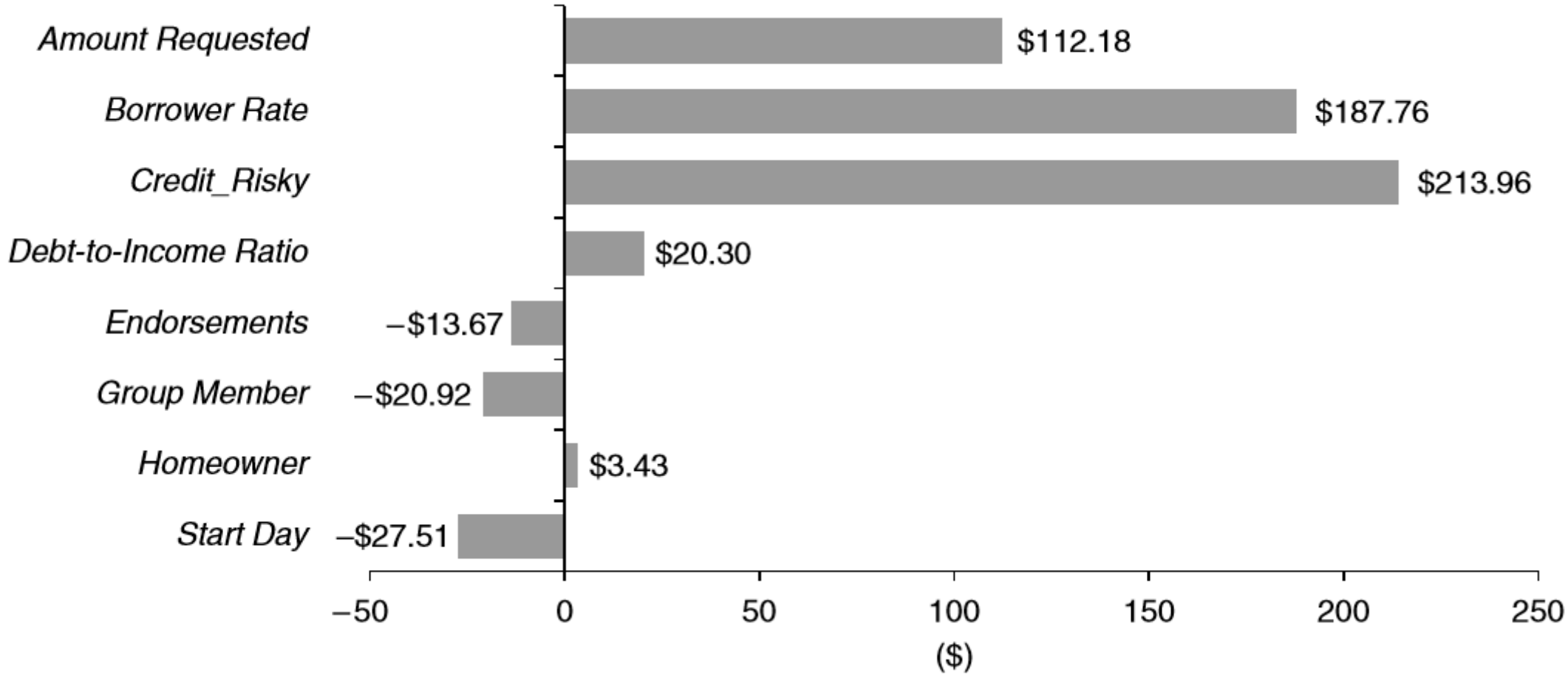
- Irrational vs. Rational Herding
  - $y_{it} = \alpha Y_{j,t-1} + X_{jt}\beta_1 + Z_j\beta_2 + Y_{j,t-1}Z_j\beta_3 + e_{jt}$
  - y_{it}: the amount of funding that listing *j* receives during its *t*th day
  - $Y_{j,t-1}$: cumulative amount of funding that listing *j* has received by the end of day *t-1*
  - X_{jt}: time-varying listing attributes
  - Z_j: time-invariant listing attributes

Table 4 Main Results—Rational Herding

	(1) Sequential correlation	(2) Herding	(3) First day	(4) Rational herding
Lag Total Amount	0.377***	0.256***		1.333***
	(0.003)	(0.004)		(0.102)
Lag Percent Needed (%)	−2.660***	−0.539***		−0.456*
	(0.115)	(0.190)		(0.242)
Lag Rate (%)	−1.568**	28.936***		35.632***
	(0.624)	(1.053)		(1.023)
Lag Total Bids	−16.982***	−22.505***		−1.733***
	(0.224)	(0.362)		(0.438)
Amount Requested (1,000)	12.766***		177.183***	
	(0.290)		(6.555)	
Borrower Rate (%)	9.428***		−85.089***	
	(0.609)		(4.872)	
Credit_Risky (1 = yes)	−183.464***		−321.450**	
	(3.527)		(140.003)	
Debt-to-Income Ratio (%)	−0.141***		−2.236***	
	(0.012)		(0.426)	
Endorsements	98.182***		660.580***	
	(12.931)		(163.952)	
Group Member (1 = yes)	79.493***		208.773**	
	(3.977)		(83.233)	
Homeowner (1 = yes)	83.864***		83.512	
	(3.579)		(71.202)	
Start Day	0.083***		0.543***	
	(0.007)		(0.181)	
Days Before Default			0.005***	
			(0.002)	

Lag Total Amount × *Lag Percent Needed* (%)		0.005***		0.002***
		(5.3E–05)		(6.0E–05)
Lag Total Amount × *Amount Requested* (1,000)				0.019***
				(2.1E–04)
Lag Total Amount × *Borrower Rate* (%)				0.022***
				(1.9E–04)
Lag Total Amount × *Credit_Risky*				0.214***
				(0.012)
Lag Total Amount × *Debt-to-Income Ratio* (%)				1.5E–04***
				(1.0E–05)
Lag Total Amount × *Endorsements*				−0.111***
				(0.006)
Lag Total Amount × *Group Member*				−0.021***
				(0.003)
Lag Total Amount × *Homeowner*				0.003
				(0.002)
Lag Total Amount × *Lag Total Bids*				−0.001***
				(1.2E–05)
Lag Total Amount × *Start Day*				−1.0E–04***
				(6.0E–06)
Day-of-week fixed effects	Yes	Yes	Yes	Yes
Day-of-listing fixed effects	Yes	Yes	No	Yes
Listing fixed effects	No	Yes	No	Yes
Number of observations	347,851	347,851	5,940	347,851
Adjusted/pseudo-R^2	0.294	0.489	0.195	0.526

Figure 1 **Moderating Effects of Listing Attributes on Herding**



Robustness Checks

- Dynamic GMM
- Fix Effects Poisson
- Multicollinearity
- Additional Covariates
- Alternative Measures of Herding Momentum

Table 5 Robustness Checks

	(1) Dynamic GMM	(2) Fixed effects Poisson	(3) Multicollinearity check	(4) Lag total amount squared	(5) Credit grades	(6) Time-varying herding
Lag Total Amount	2.710***	0.835***	1.463***	1.343***	0.499***	
	(0.240)	(0.026)	(0.096)	(0.102)	(0.128)	
Lag Percent Needed (%)	−2.120***	−2.320***	−0.260	−0.457*	−0.623**	−9.727***
	(0.037)	(0.123)	(0.237)	(0.242)	(0.245)	(0.223)
Lag Rate (%)	18.813***	31.451***	35.764***	35.585***	33.929***	34.383***
	(0.617)	(0.435)	(1.022)	(1.024)	(1.021)	(0.927)
Lag Total Bids	2.224***	−2.021***		−2.398***	−5.617***	3.220***
	(0.389)	(0.130)		(0.656)	(0.451)	(0.398)
Lag Total Amount × *Lag Percent Needed* (%)	0.008***	0.006***	0.002***	0.002***	0.003***	0.003***
	(1.4E−04)	(2.1E−05)	(6.0E−05)	(6.1E−05)	(6.0E−05)	(5.5E−05)
Lag Total Amount × *Amount Requested* (1,000)	0.023***	0.035***	0.019***	0.019***	0.020***	0.030***
	(4.7E−04)	(0.001)	(2.0E−04)	(2.2E−04)	(2.2E−04)	(2.0E−04)
Lag Total Amount × *Borrower Rate* (%)	0.039***	0.015***	0.022***	0.022***	0.017***	0.021***
	(4.3E−04)	(1.5E−04)	(1.9E−04)	(1.9E−04)	(2.6E−04)	(1.7E−04)
Lag Total Amount × *Credit_Risky*	0.113***	0.141***	0.218***	0.213***		0.109***
	(0.024)	(0.004)	(0.012)	(0.012)		(0.011)
Lag Total Amount × *Debt-to-Income Ratio* (%)	1.1E−04***	0.001***	1.5E−04***	1.5E−04***	1.7E−04***	1.2E−04***
	(2.6E−05)	(2.5E−04)	(1.0E−05)	(1.0E−05)	(1.0E−05)	(9.1E−06)
Lag Total Amount × *Endorsements*	−0.026***	−0.012***	−0.111***	−0.111***	−0.105***	−0.071***
	(0.010)	(0.002)	(0.006)	(0.006)	(0.006)	(0.005)
Lag Total Amount × *Group Member*	−0.066***	−0.005	−0.020***	−0.021***	−0.025***	−0.008***
	(0.006)	(0.007)	(0.003)	(0.003)	(0.003)	(0.002)
Lag Total Amount × *Homeowner*	0.042***	0.004	0.004*	0.004	0.016***	0.019***
	(0.006)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)
Lag Total Amount × *Lag Total Bids*	−0.003***	−0.004***	−0.001***	−0.001***	−0.001***	−0.002***
	(5.6E−05)	(0.001)	(1.1E−05)	(2.8E−05)	(1.2E−05)	(1.1E−05)
Lag Total Amount × *Start Day*	−2.3E−04***	−2.6E−04***	−1.1E−04***	−1.0E−04***	−2.3E−05***	−9.6E−05***
	(3.4E−05)	(1.9E−05)	(5.6E−06)	(6.0E−06)	(6.5E−06)	(5.4E−06)
Lag Total Amount Squared				−4.0E−07		
				(2.8E−07)		

				(2.6E−07)		
Lag Total Amount × Credit Grade_AA					−0.557***	
					(0.070)	
Lag Total Amount × Credit Grade_A					−0.469***	
					(0.070)	
Lag Total Amount × Credit Grade_B					−0.415***	
					(0.070)	
Lag Total Amount × Credit Grade_C					−0.429***	
					(0.070)	
Lag Total Amount × Credit Grade_D					−0.467***	
					(0.070)	
Lag Total Amount × Credit Grade_E					−0.286***	
					(0.070)	
Lag Total Amount × Credit Grade_HR					−0.184***	
					(0.070)	
Lag Total Amount × 2nd Day						0.594***
						(0.093)
Lag Total Amount × 3rd Day						0.684***
						(0.092)
Lag Total Amount × 4th Day						0.771***
						(0.092)
Lag Total Amount × 5th Day						0.870***
						(0.092)
Lag Total Amount × 6th Day						0.992***
						(0.092)
Lag Total Amount × 7th Day						1.169***
						(0.092)
Day-of-week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-listing fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Listing fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	347,851	347,851	347,851	347,851	347,851	347,851
Adjusted/pseudo-R^2	0.370	0.514	0.526	0.526	0.529	0.611

Table 6 Alternative Measures of Herding Momentum

	(1) *Momemtum = Lag Percent Funded*	(2) *Momemtum = Lag Total Bids*	(3) *Momemtum = Lag Average Amount*	(4) *Momemtum = Previous Day Amount*
Momentum	97.775***	220.167***	131.411***	3.398***
	(5.996)	(9.113)	(4.415)	(0.231)
Lag Percent Needed (%)		−8.843***	−0.859***	4.070***
		(0.216)	(0.172)	(0.153)
Lag Rate (%)	34.253***	38.642***	31.164***	33.364***
	(1.059)	(1.029)	(1.071)	(1.045)
Momentum × *Lag Percent Needed* (%)	0.393***	0.470***	−0.026***	0.002***
	(0.005)	(0.005)	(0.001)	(9.0E–05)
Momentum × *Amount Requested* (1,000)	0.620***	1.086***	0.154***	0.012***
	(0.016)	(0.016)	(0.008)	(3.7E–04)
Momentum × *Borrower Rate* (%)	0.884***	1.947***	0.386***	0.032***
	(0.011)	(0.017)	(0.010)	(4.2E–04)
Momentum × *Credit_Risky*	3.904***	25.432***	0.096	0.250***
	(0.352)	(1.331)	(0.164)	(0.024)
Momentum × *Debt-to-Income Ratio* (%)	0.022***	0.036***	0.003***	2.2E–04***
	(0.001)	(0.001)	(4.5E–04)	(2.6E–05)
Momentum × *Endorsements*	−4.092***	−11.894***	−1.215***	−0.099***
	(0.325)	(0.475)	(0.307)	(0.010)
Momentum × *Group Member*	−1.161***	−0.707***	−1.907***	−0.083***
	(0.177)	(0.246)	(0.115)	(0.006)
Momentum × *Homeowner*	−0.027	0.514**	−0.171	0.027***
	(0.156)	(0.213)	(0.114)	(0.006)
Momentum × *Start Day*	−0.007***	−0.016***	−0.008***	−2.3E–04***
	(3.4E–04)	(0.001)	(2.6E–04)	(1.3E–05)
Day-of-week fixed effects	Yes	Yes	Yes	Yes
Day-of-listing fixed effects	Yes	Yes	Yes	Yes
Listing fixed effects	Yes	Yes	Yes	Yes
Number of observations	347,851	347,851	347,851	347,851
Adjusted/pseudo-R^2	0.497	0.523	0.472	0.493

Conclusion

- Herding does exist
- Rational herding dominates
- Obvious defects amplify a listing’s herding momentum
- Favorable borrower characteristics weaken the herding effect

Thank you!

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