Monetary Normalizations and Consumer Credit: Evidence from Fed Liftoff and Online Lending[1]

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IBEFA Session - January 5, 2018

[1] The views expressed in this presentation are solely the responsibility of the authors and should not be interpreted as reflecting the official views of Sveriges Riksbank.

Research question & main findings

- How does the monetary normalization process affect interest rates in the consumer lending market?
- Evidence from Fed liftoff and P2P lending segment
  - Hourly data from *Prosper.com*, a US-based crowdlending platform (CLP)
  - Origination data from *LendingClub.com*
- Main findings:
  1. average interest rates decreased on newly posted Prosper loans by 16.9-22.6 basis points (bps)
  2. the spread decreased between high and low credit risk bins by 16%
  3. perceived default probability reduction dominated interest rate pass-through

Fed announcement

FOMC announcement on Wednesday, 16 Dec. 2015:

- increase in the target federal funds rate from the range $0 - 25$ bps to $25 - 50$ bps
- guidance on future hikes ("gradual"; 4x25 bps in 2016)
- positive assessment of current and future labor market conditions

Policy Normalization Principles and Plans, Sep. 2014:

- "When economic conditions and the economic outlook warrant a less accommodative monetary policy, the Committee will raise its target range for the federal funds rate."

Market expectations

- The federal funds rate hike *exceeded* market expectations in mid December 2015
- Bloomberg: Futures contracts implied a .84 probability of the federal funds rate range increasing from 0-25 bps to 25-50 bps and a .16 probability of remaining at 0-25 bps

Table: Selected interest rates around Fed liftoff

Date	Commercial Paper	Corporate Bonds
Dec. 9	0.23	2.76
Dec. 16	0.35	2.93
Dec. 23	0.39	2.92

Notes. The rates given are for 1-month, AA financial commercial paper and 3-5 year effective yields on U.S. corporate bonds.

Theoretical framework

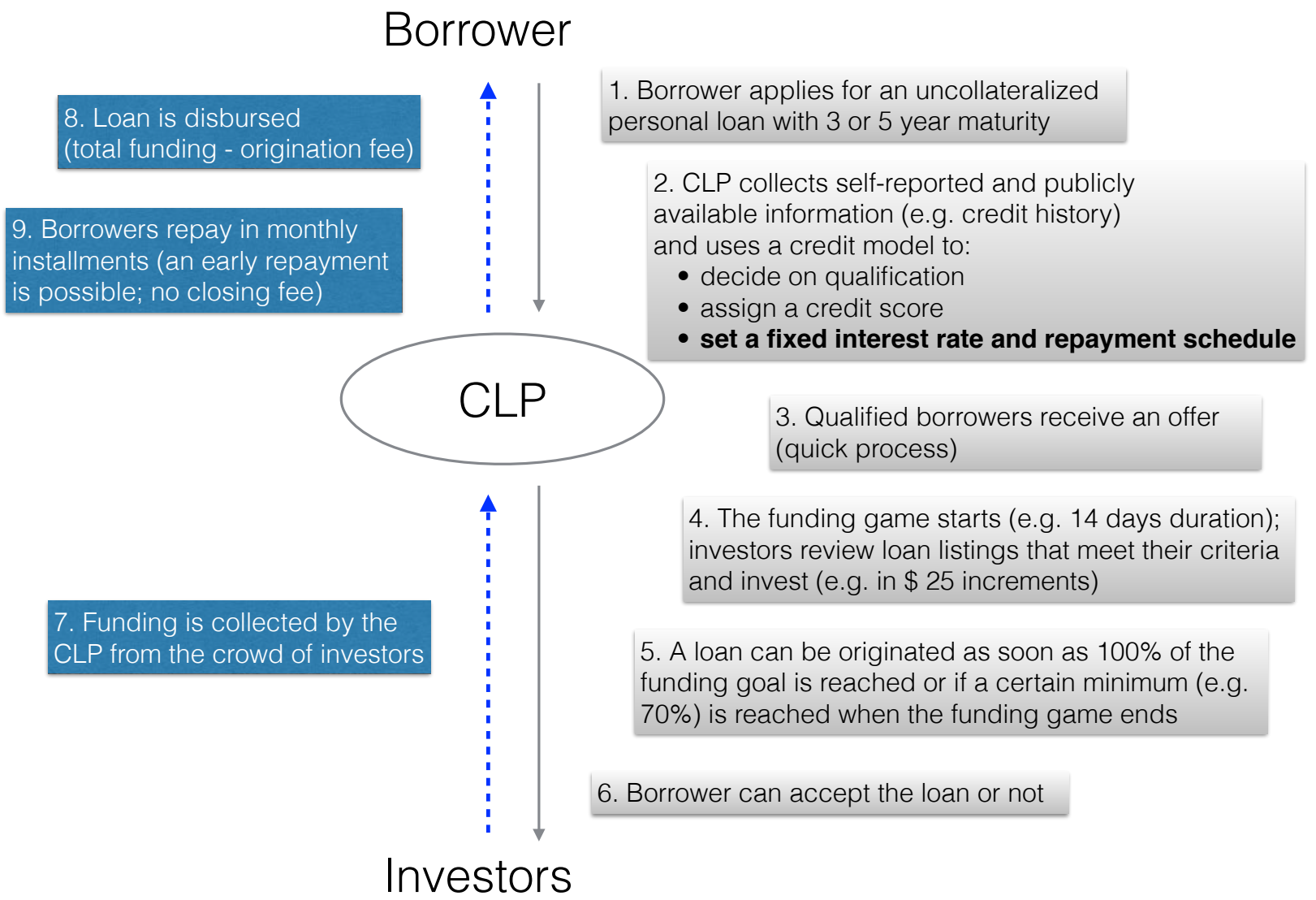
Two key channels

1. **Risk-free rate channel:** monetary contractions literature (e.g., Cook & Hahn '89 and Kuttner '01)
2. **Credit risk channel:** credit spreads
   - increase after surprise monetary contractions (Gertler & Karadi '15)
   - are countercyclical and regarded as a leading indicator for economic activity (Gilchrist & Zakrajsek '12)

Online lending

- employment risk is a key determinant of credit risk

How does P2P lending work?



P2P lending in the US and *Prosper.com*

- $12bn loans originated by US CLPs in 2015
- Yearly growth of the market is around 100%. PWC study expects P2P lending to reach 10% of the volume of revolving US consumer debt by 2025.
- Prosper is oldest US-based CLP; operating since Feb. '06
- Prosper is the second largest CLP (31% marketshare) for unsecured consumer credit after the market leader *LendingClub.com* and has more than 2 million members (investors and borrowers)

How does Prosper make money?

- Fees
  - Origination fee: 0.5 - 5%
  - Annual loan servicing fee: 1% paid by lenders and accrued in the same way as the interest payment
  - Failed payment fee: $15
  - Fees that are passed on:
    - ◇ Late payment: 5% of unpaid installment (min. $15)
    - ◇ Collection agency recovery fee
- The Prosper pricing problem
  - Objective: maximize the origination volume

Main data set

- Source: *Prosper.com* website
- Main sample: 326,044 loan-hour observations (Nov. 20 - Jan. 20)
- Observed characteristics: loan purpose, size, interest rate, maturity, monthly payment, employment status, income category, debt-to-income ratio, Prosper credit rating
- Employment status: employed, self-employed, unemployed
- Prosper rating: AA, A, B, C, D, E, HR
- Out of 4,257 loan applications in the dataset, 3,015 loans are identified as successfully originated

Table II: Descriptive statistics

Panel A: Full Sample

	mean	sd	min	max	obs		obs	pct		obs	pct
size	13.10	7.13	2.00	35.00	4,257	Business	93	2.18	$1-24,999	175	4.11
int-rate	14.22	6.46	4.32	30.25	4,257	Cons.	415	9.75	$25,000-49,999	1,682	39.51
DTI	27.32	12.33	1	68	4,257	Debt	3,222	75.69	$50,000-74,999	1,213	28.49
maturity	3.77	0.97	3	5	4,257	Other	344	8.08	$75,000-99,999	601	14.12
verif.	2.30	0.76	1	3	4,257	Special	183	4.30	$100,000+	586	13.77
Δfunding	0.95	3.91	0	99	322,600	Total	4,257	100	Total	4,257	100

Panel B1: Sample before the Liftoff

	mean	sd	min	max	obs
size	13.05	7.25	2.00	35.00	2,029
int-rate	14.29	6.46	4.32	30.25	2,029
DTI	27.10	12.24	1	63	2,029
maturity	3.85	0.99	3	5	2,029
verif.	2.30	0.76	1	3	2,029

Panel B2: Sample after the Liftoff

	mean	sd	min	max	obs
size	13.14	7.01	2.00	35.00	2,228
int-rate	14.15	6.46	4.32	30.25	2,228
DTI	27.52	12.41	1	68	2,228
maturity	3.69	0.95	3	5	2,228
verif.	2.30	0.76	1	3	2,228

Panel C1: EMP==Employed

	mean	sd	min	max	obs
size	13.80	7.43	2.00	35.00	3,166
int-rate	13.66	6.35	4.32	30.25	3,166
DTI	27.35	12.05	1	68	3,166
maturity	3.77	0.97	3	5	3,166
CreditBin	0.95	0.76	0	2	3,166

Panel C2: EMP==Self-employed

	mean	sd	min	max	obs
size	10.59	3.66	2.00	15.00	520
int-rate	17.42	6.40	5.76	30.25	520
DTI	23.60	12.12	1	63	520
maturity	3.74	0.97	3	5	520
CreditBin	1.34	0.66	0	2	520

Panel C3: EMP==Unemployed

	mean	sd	min	max	obs
size	11.49	7.07	2.00	35.00	571
int-rate	14.37	6.27	4.32	30.25	571
DTI	30.54	13.12	1	63	571
maturity	3.75	0.97	3	5	571
CreditBin	1.04	0.73	0	2	571

Panel D1: CR==High

	mean	sd	min	max	obs
size	13.28	6.44	2.00	35.00	1,198
int-rate	7.28	1.37	4.32	9.43	1,198
DTI	24.84	10.21	1	62	1,198
maturity	3.80	0.98	3	5	1,198

Panel D2: CR==Middle

	mean	sd	min	max	obs
size	14.38	7.84	2.00	35.00	1,825
int-rate	13.06	2.21	9.49	16.97	1,825
DTI	27.87	12.52	1	66	1,825
maturity	3.79	0.98	3	5	1,825

Panel D3: CR==Low

	mean	sd	min	max	obs
size	11.02	6.11	2.00	30.00	1,234
int-rate	22.65	3.90	17.61	30.25	1,234
DTI	28.90	13.53	2	68	1,234
maturity	3.69	0.95	3	5	1,234

Histogram of interest rates

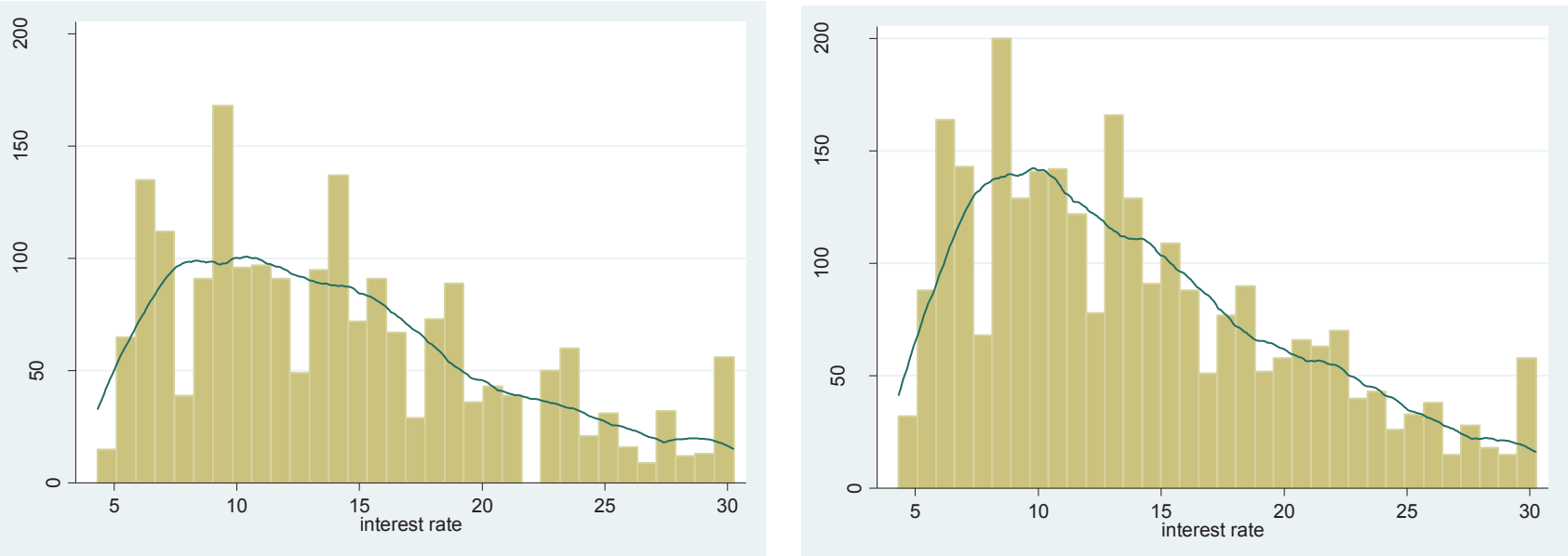


Figure: Histogram of interest rates for loans in our observed period, before (left panel) and after (right panel) Fed liftoff on December 16th, 2015.

Interest rate dynamics

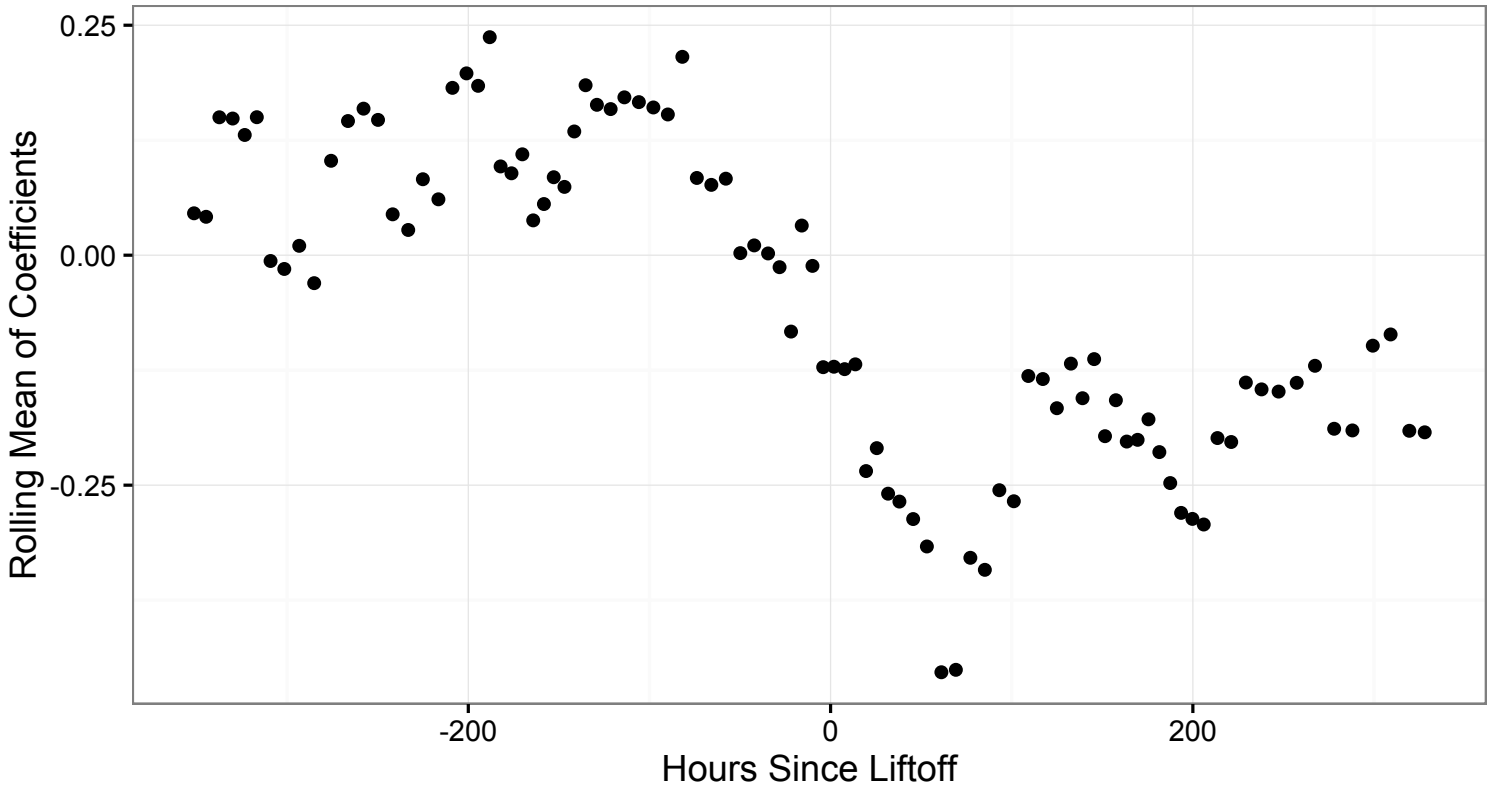


Figure: Plot of the rolling mean of the coefficients from a regression of the interest rate residuals on time dummies over a $\pm$14-day window around liftoff.

Main result 1: interest rate reduction

	Dependent variable: Interest rate			
	(1)	(2)	(3)	(4)
Explanatory variables				
Liftoff	-0.195*	-0.229***	-0.173***	-0.169***
	(-1.74)	(-3.10)	(-3.17)	(-4.36)
Controls				
Loan Characteristics	x	x	x	x
Borrower Characteristics	x	x	x	x
Main Effects				
Weekday FE		x	x	x
Hour FE	x	x	x	x
Adj. R^2	0.971	0.972	0.972	0.970
Observations	445	987	1,818	4,257
Window Size (days)	±3d	±7d	±14d	60d

Notes. The baseline regression of

$$\text{InterestRate}_{i,t} = \alpha_t + \beta_1 \text{Liftoff}_t + \gamma_1 \text{LoanCharacteristics}_i + \gamma_2 \text{BorrowerCharacteristics}_i + \epsilon_{i,t}.$$

The interest rate is in percentage points. The variable Liftoff_t is a dummy that equals 1 after the liftoff announcement on December 16, 2015. t statistics are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Main result 2: credit spread reduction

	Dependent variable: Interest rate			
	(1)	(2)	(3)	(4)
Explanatory variables				
Liftoff	-1.810***	-1.884***	-1.891***	-1.934***
	(-2.81)	(-2.92)	(-2.87)	(-2.94)
$1\{EMP, HighCR\}$	-10.360***	-10.376***	-9.605***	-9.629***
	(-21.52)	(-21.37)	(-17.61)	(-17.55)
$1\{EMP, HighCR\} \times$ Liftoff	1.536**	1.654**	1.601**	1.658**
	(2.01)	(2.16)	(2.08)	(2.15)
Controls				
Loan Characteristics			×	×
Borrower Characteristics			×	×
Main Effects				
Weekday FE		×		×
Hour FE		×		×
Pre-Liftoff, int.rate mean $1\{EMP, HighCR\} = 0$	17.805	16.085	19.974	19.315
Adj. R^2	0.663	0.668	0.671	0.675
Observations	355	355	355	355

Notes. We focus on ±7-day windows around liftoff. The interest rate is regressed on the liftoff dummy, borrower riskiness (Employment and Credit Rating), and their interaction terms.

$$\begin{aligned} \text{InterestRate}_{i,t} = \; & \alpha + \alpha_d + \alpha_h + \beta_0 1\{EMP, High\}_i + \beta_1 \text{Liftoff}_t + \beta_2 1\{EMP, High\}_i \times \text{Liftoff}_t \\ & + \gamma_1 \text{LoanCharacteristics}_i + \gamma_2 \text{BorrowerCharacteristics}_i + \epsilon_{i,t}. \end{aligned}$$

Supply measures

We use three measures for the dependent variable $Y_{i,t}$

- the success of loan origination: $1\{LoanFunded\}_i$
- the increase of funding for each loans:
  $\text{Funding Increase}_{i,t} = \Delta(\text{Funding Percentage})_{i,t}$
- the speed of funding increase:
  $\text{Funding Speed}_{i,t} = \Delta(\text{Funding Increase})_{i,t}$.

Supply regressions

Dependent variable	(1) $1\{LoanFunded\}$	(2) Funding Increase	(3) Funding Speed
Explanatory variables			
Liftoff	0.238**	0.137***	0.028**
	(2.39)	(11.23)	(1.98)
Controls			
Loan Characteristics	x	x	x
Borrower Characteristics	x	x	x
Main Effects			
Weekday FE	x	x	x
Hour FE	x	x	x
R^2	0.094	0.098	0.015
Observations	2,858	237,296	237,296
Window size (days)	60d	60d	60d

Notes. Funding success is regressed on a liftoff dummy, loan-borrower characteristics (as in previous regressions), and time dummies. The corresponding regressions are

$$Y_{i,t} = \alpha_t + \beta_1 \text{Liftoff}_t + \gamma_1 \text{LoanCharacteristics}_i + \gamma_2 \text{BorrowerCharacteristics}_i + \epsilon_{i,t}.$$

Results are from OLS regressions, except for a Logit regression with the funding probability $1\{LoanFunded\}$. t statistics are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Funding gap and demand regressions

	(1) FundingGap	(2) FundingGap	(3) Demand	(4) Demand
Explanatory variables				
Liftoff	-0.474***	-0.383***	0.031***	0.017**
	(-23.12)	(-10.84)	(5.81)	(2.23)
Controls				
Loan Characteristics		✓		✓
Borrower Characteristics		✓		✓
Main Effects				
Weekday FE		✓		✓
Hour FE		✓		✓
Window size	60d	60d	60d	60d
Adj. R^2	0.113	0.555	0.023	0.397
Observations	1,403	1,403	1,403	1,403

Notes. We focus on the LONG window size, using the main sample over the period November 20, 2015 till January 20, 2016. We regress funding gaps and demand (in millions of USD) on liftoff, and intra-day and intra-week dummies. We include all borrower types in the aggregation. Additional controls include sample average loan characteristics and average borrower characteristics. t statistics are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness: before/after regressions using LendingClub data

	Dependent variable: Interest rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables						
Liftoff	-0.158***	-0.210***	-0.169***	-0.363**	-0.335**	-0.279*
	(-3.55)	(-5.55)	(-4.33)	(-2.33)	(-2.34)	(-1.93)
$1\{EMP, High\}$				-2.670***	-1.263***	-1.200**
				(-21.14)	(-2.70)	(-2.57)
$1\{EMP, High\} \times$ Liftoff				0.389**	0.289*	0.262*
				(2.26)	(1.82)	(1.65)
Controls						
Loan Characteristics		✓	✓		✓	✓
Borrower Characteristics		✓	✓		✓	✓
Main Effects						
Weekday FE	✓		✓	✓		✓
Window size	60d	60d	60d	±7d	±7d	±7d
Adj. R^2	0.002	0.231	0.232	0.058	0.196	0.198
Observations	37717	37717	37717	13880	13880	13880

Notes. These regressions use the daily loan-origination reports of LendingClub, another major P2P lender in the US, to the US Securities and Exchange Commission. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness: control changes in risk appetite

	Dependent variable: Interest rate	
	(1)	(2)
Explanatory variables		
Liftoff	-0.174***	-1.933***
	(-4.38)	(-2.92)
$1\{EMP, High\}$		-9.630***
		(-17.52)
$1\{EMP, High\} \times$Liftoff		1.658**
		(2.14)
VRP	-0.0264	-0.0203
	(-1.21)	(-0.03)
Controls		
Loan Characteristics	✓	✓
Borrower Characteristics	✓	✓
Main Effects		
Weekday FE	✓	✓
Hour FE	✓	✓
Window size	60d	±7d
Adj. R^2	0.971	0.674
Observations	4,257	355

Notes. The interest rate is regressed on the liftoff dummy and variance risk premium (VRP), a model-free measure of investors' risk appetite proposed in Bollerslev, Tauchen, Zhou (2009). Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness: baseline regressions for the Jan. 27, 2016 FOMC meeting

	Dependent variable: Interest rate		
	(1)	(2)	(3)
Explanatory variables			
Post-Announcement	-0.105	0.002	0.025
	(-0.54)	(0.08)	(0.72)
Controls			
Loan Characteristics		✓	✓
Borrower Characteristics		✓	✓
Main Effects			
Weekday FE	✓		✓
Hour FE	✓		✓
Sample	PLACEBO	PLACEBO	PLACEBO
Adj. R^2	0.001	0.969	0.969
Observations	6,589	6,589	6,589

Notes. t statistics are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Liftoff and state heterogeneity

	Dependent variable: Interest rate		
	(1)	(2)	(3)
Explanatory variables			
Liftoff	-0.294***	-0.438***	-0.237***
	(-3.26)	(-3.70)	(-3.90)
1{Unemp}	0.207**		
	(2.35)		
1{Unemp}×Liftoff	-0.049		
	(-0.39)		
1{CreditCard}		-0.058	
		(-0.62)	
1{CreditCard}×Liftoff		0.244*	
		(1.69)	
1{BankDeposit}			0.191**
			(2.10)
1{BankDeposit}×Liftoff			-0.398**
			(-2.65)
Controls			
Loan Characteristics	✓	✓	✓
Borrower Characteristics	✓	✓	✓
Main Effects			
Weekday FE	✓	✓	✓
Hour FE	✓	✓	✓
Window size	60d	60d	60d
Benchmark int.rate mean	15.291	15.500	15.463
Adj. R^2	0.839	0.838	0.839
Observations	4,257	4,257	4,257

Robustness tests

- Placebo tests
- Variance risk premium
- Unemployment
- Real yield curve slope
- Composition
- Lending club data

Conclusions

- Impact of monetary normalization on consumer credit market
- Main findings:
  - average interest rate declined
  - spread declined
  - reduction in perceived default probabilities dominated pass-through
- Results may depend on content and strength of signals