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

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[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

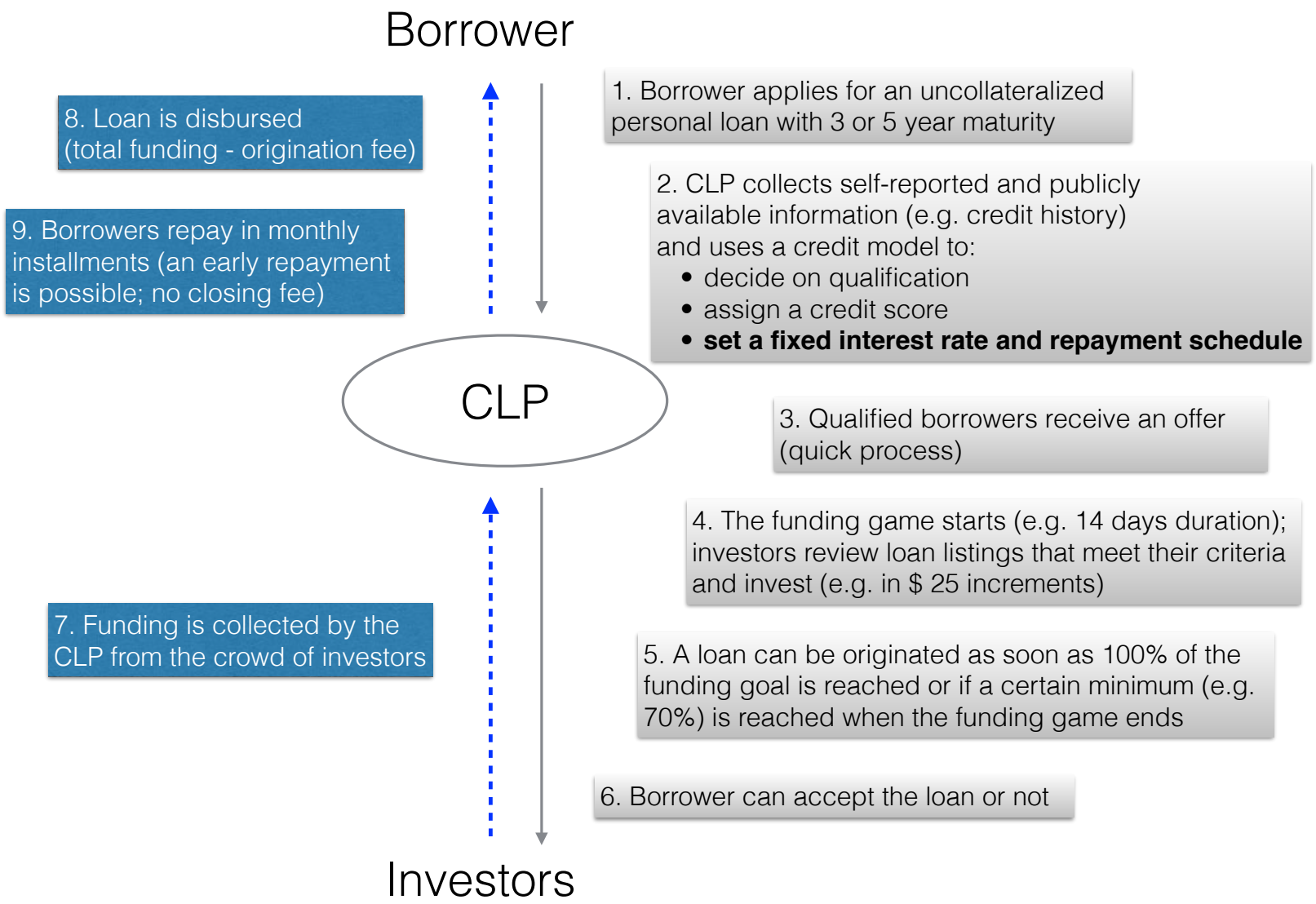
Two key channels

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

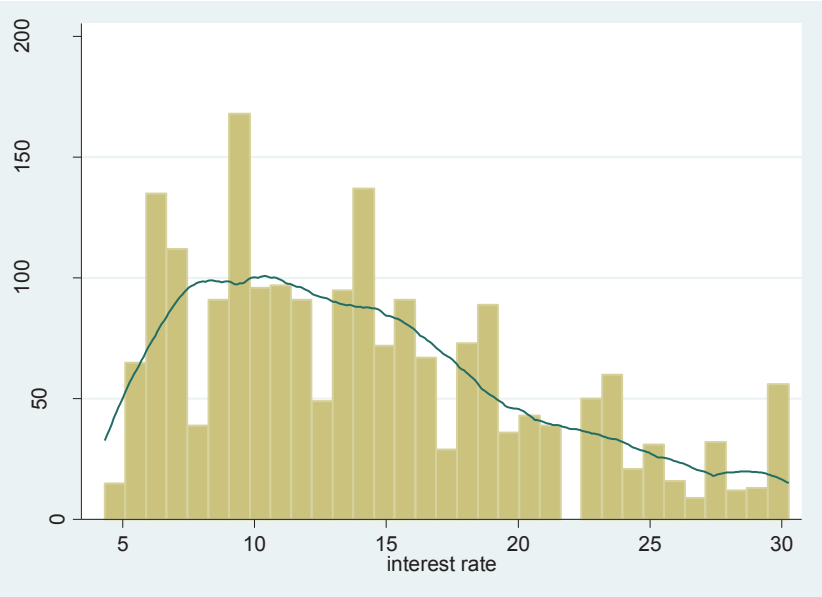
Panel D2: CR==Middle

	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



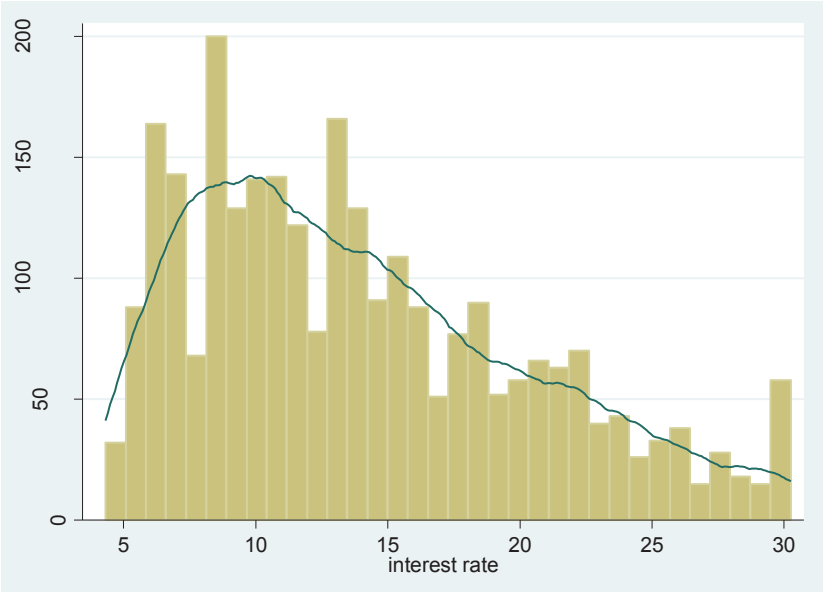


Figure: Histogram of interest rates for loans in our observed period, before (left panel) and after (right panel) Fed liftoff on December 16th, 2015.

Interest rate dynamics

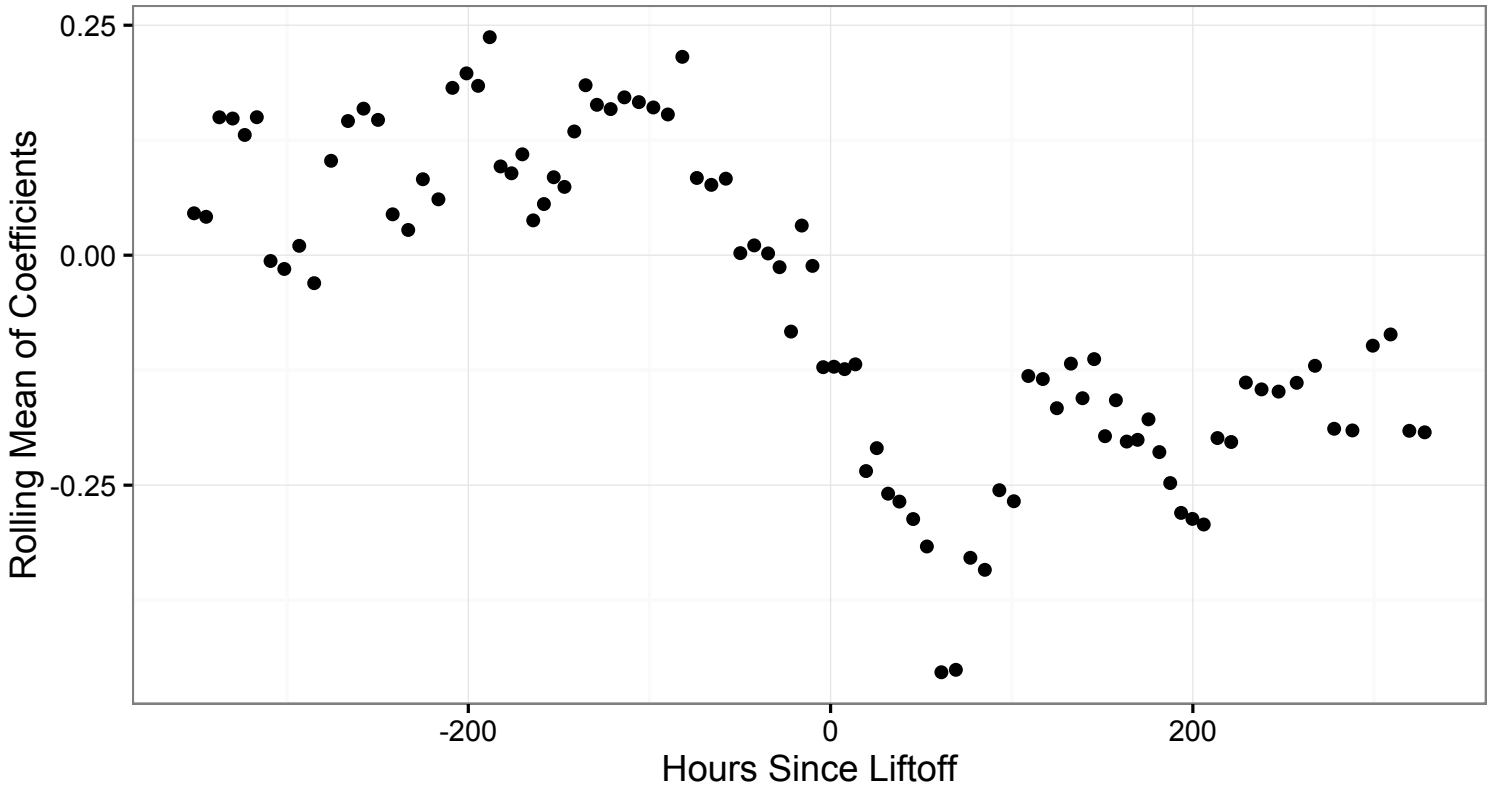


Figure: Plot of the rolling mean of the coefficients from a regression of the interest rate residuals on time dummies over a $\pm$14-day window around liftoff.

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.

$$\begin{aligned} \text{InterestRate}_{i,t} \quad = \quad & \alpha + \alpha_d + \alpha_h + \beta_{\mathbf{0}} 1\{EMP, High\}_i + \beta_{\mathbf{1}} \text{Liftoff}_t + \beta_{\mathbf{2}} 1\{EMP, High\}_i \times \text{Liftoff}_t \\ & + \gamma_{\mathbf{1}} \text{LoanCharacteristics}_i + \gamma_{\mathbf{2}} \text{BorrowerCharacteristics}_i + \epsilon_{i,t}. \end{aligned}$$

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

Panel A: aggregate	(1) FundingGap	(2) FundingGap	(3) Demand	(4) Demand
Explanatory variables				
Liftoff	-0.474***	-0.477***	0.031***	0.030***
	(-23.12)	(-23.47)	(5.81)	(5.79)
Controls				
Main Effects				
Weekday FE		✓		✓
Hour FE		✓		✓
Window size	60d	60d	60d	60d
Pre-Liftoff, $\{UnEMP, LowCR\}$ mean	2.475	2.347	0.103	0.087
Adj. R^2	0.113	0.128	0.023	0.039
Observations	1,403	1,403	1,403	1,403

Notes. 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