Quick on the Draw: Line Adjustment and Draw Behavior in Failing Banks

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[1]Views and opinions expressed in this presentation reflect those of the authors and do not necessarily reflect those of the FDIC or the United States.

HELOC Characteristics

What is a Home Equity Line of Credit (HELOC)?

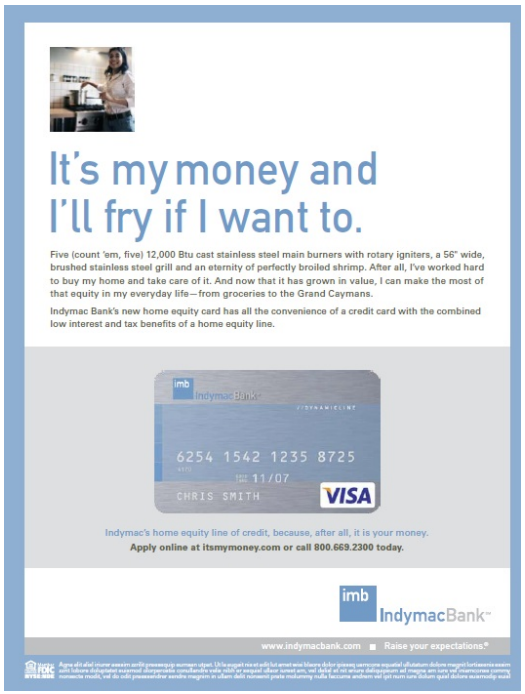
- Revolving lines of credit secured by the borrower's home.
- Buyers only pay interest on the draw period of 5-10 years
- After the draw period, the balance is converted to a term loan over 10-20 years
- Usually considered "unconditionally cancellable"

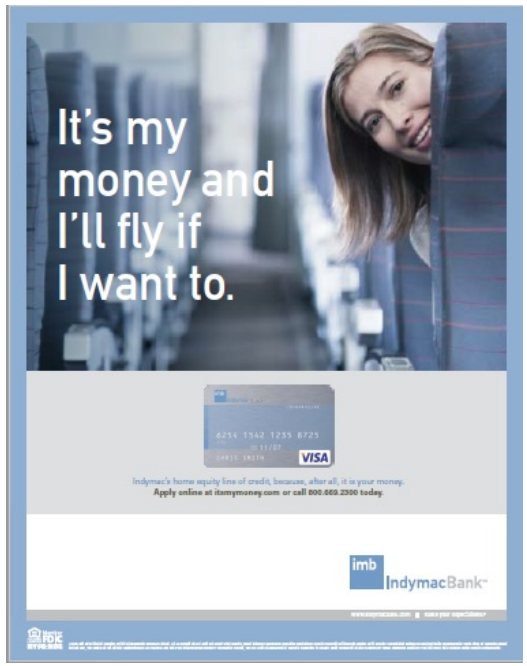
HELOCs fueled consumer spending and exploded in the run-up to the financial crisis

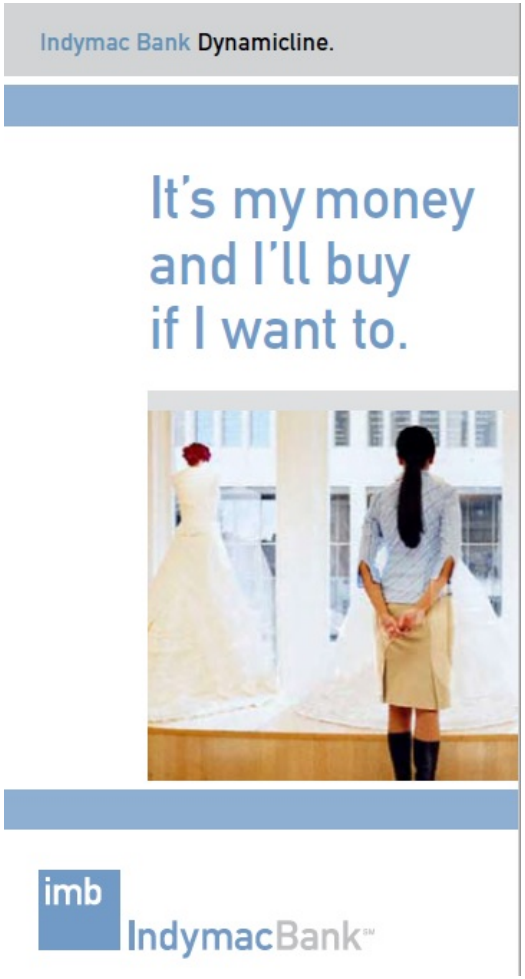
For example, IndyMac's Dynamic Line (a HELOC with a physical credit attached) advertised,

"It's my money, and I'll (action) if I want to."

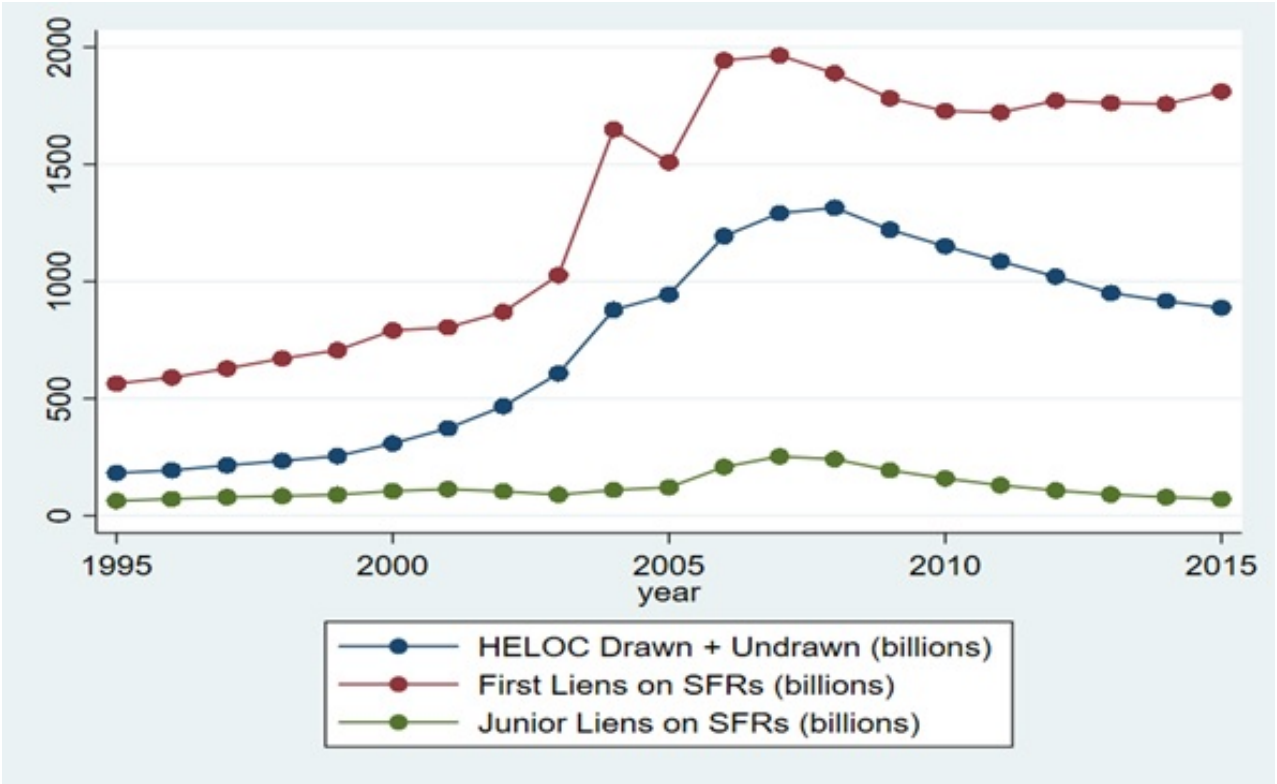
IndyMac's Dynamic Line Example





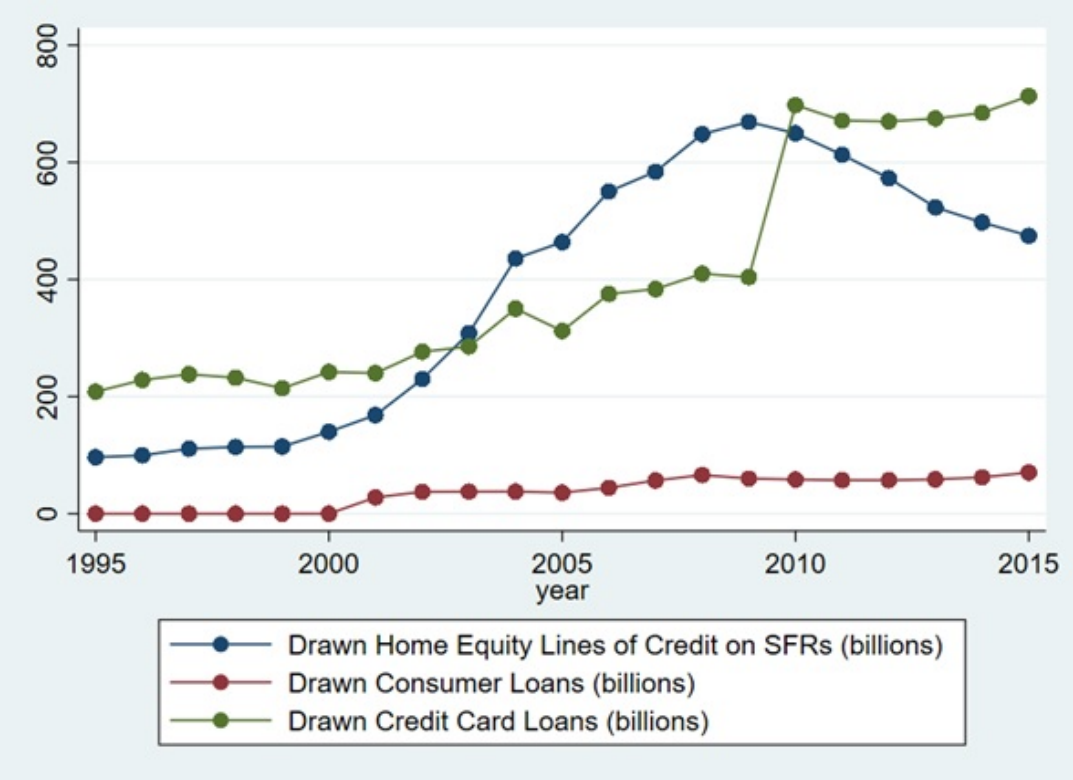


From 2003-2006, HELOC volume doubled to $1.3 trillion



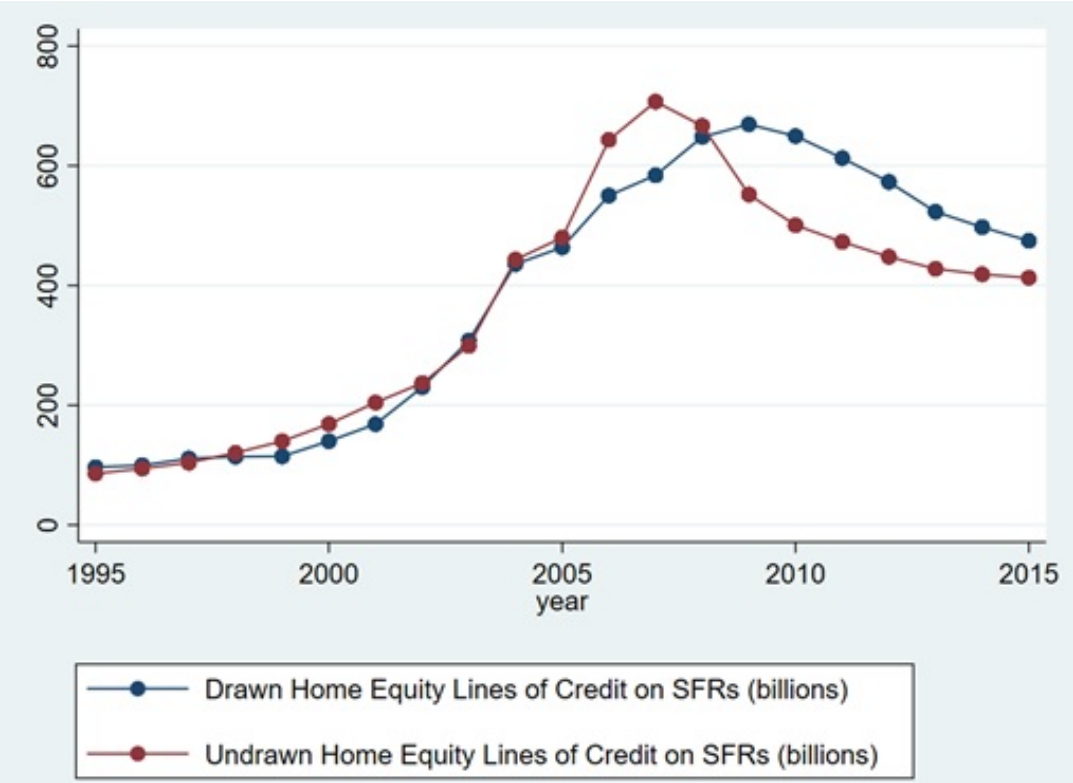
Source: Call Reports

From 2003-2007, HELOC drawdowns increased dramatically compared to credit cards



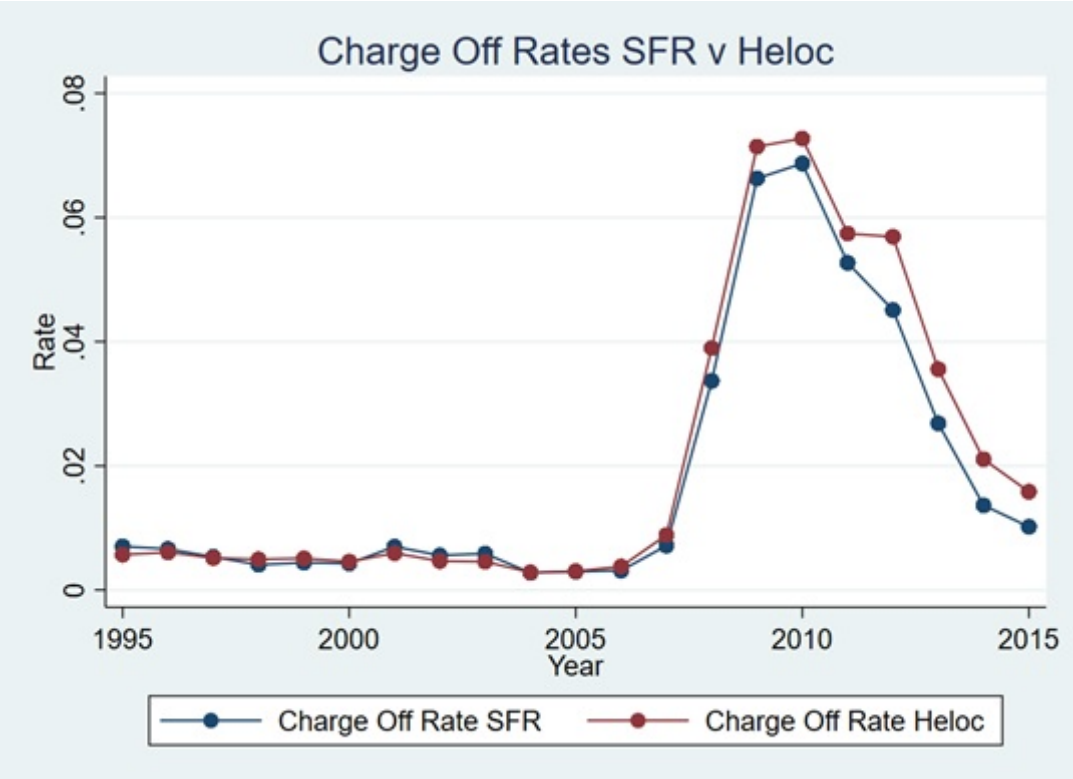
Source: Call Reports

During the crisis, HELOC drawdown rates increased



Source: Call Reports

Housing prices decreased, HELOC charge-offs increased



Source: Call Reports

Motivation

- Literature suggests that borrowers exhibit a number of "early warning signals" before defaulting on their HELOCs (Agarwal, Ambrose, Chomsisengphet, and Liu, 2006).
- Banks have the ability to revoke lines if they fear borrowers will be unable to pay back the loans.

Research Question

1. Do banks actively manage their HELOCs?
2. Does this management get more aggressive as their financial health declines and their incentives to strategically deploy capital are amplified?
3. Are borrowers more likely to draw down on their HELOCs as their banks approach failure?

Motivation

Banks may not consider borrower characteristics when rationing credit

- Diamond (1984): Model says that if banks hold a diversified loan portfolio they can maintain their diversification by cutting all loans equally

Alternatively, borrower characteristics may be important determinants

- Assuming a constant demand for credit, a contraction in the supply increases the cost of lending
- Banks could cut riskier and less profitable loans (flight-to-quality effect in Bernanke, Gertler, and Gilchrist, 1996)

Relationship banking literature shows that relationships are valuable because banks...

- Insure borrowers with stronger relationships against shocks (Berger and Udell, 1992, 1995; Berlin and Mester, 1999; Liberti and Sturgess, 2018)
- Realize more profits (Sharpe, 1990; Rajan, 1992; Von Thadden, 1995; Bolton, Freixas, Gambacorta, and Mistrulli, 2013)
- Have greater capabilities to monitor these loans (Holstrom and Tirole, 1997; Boot and Thakor, 2000).

However, not all banking relationships may matter equally.

Related Literature and Contributions

1) We build on studies examining the determinants of borrower credit line default

- Riskier borrowers default (prepay) on their HELOCs more (less): Agarwal, Ambrose, Chomsisengphet, and Liu (2006)
- German consumers exhibiting abnormal drawdowns and penalties are more likely to default: Norden and Weber (2010)
- Risk profile of the Spanish corporate borrower, bank, and business cycle impact credit line usage: Jimenez, Lopez, and Saurina (2009)

2) We build on studies showing that deteriorations in bank financial health leads to credit supply contractions.

- Kashyap and Stein (2000); Peek and Rosengren (2000); Lishan and Opiela (2000); Ashcraft (2006); Khwaja and Mian (2008); Paravisini (2008); Jimenez, Ongena, Peydro and Saurina (2012); Liberti and Sturgess (2018)

Contribution: Banks manage credit in line with "early warning signals," and this management becomes more aggressive as their financial health deteriorates.

Related Literature and Contributions

3) We contribute to a small body of literature understanding the conditions under which borrowers draw down on their credit lines (run).

- Parallels between deposit and LOC runs: Kayshyap, Rajan, and Stein (2002)
- Empirical literature finds limited evidence of this phenomena pre-COVID
  - Conditional on firms having LOC with multiple banks, corporations drew down on banks more exposed to the dry-up of the European interbank market: Ippolito, Peydro, Polo, and Setts (2016)
  - Conditional on firms having LOC with multiple banks, corporations drew down on banks with more co-syndication with Lehman Brothers: Ivashina and Scharfstein (2010)
- COVID crisis: Acharya and Steffen (2020) show corporate borrowers drew down, and Kapan and Minoiu (2021) show that banks with a higher risk of drawdowns tightened loan supply

Contribution: On average, we find no evidence of consumers running on their HELOCs as bank health deteriorates.

Data Sources

1) FDIC's proprietary database assembled from five banks that failed during the financial crisis

- Banks have staggered failure dates between 2008-2011
- Granular, transaction-level daily data pertaining to HELOCs
- We can observe when banks revoke credit lines
- We can also observe borrower drawdowns

Variables of Interest

Primary Variables of Interest:

- Line Cut : Indicator variable that takes a value of 1 on the first day the bank revokes the HELOC
- Used Proportion Change Past Month: Difference between used proportion of credit over the last month
- Close To Fail: Indicator variable that is 1 during the three months before failure

Loan-Level Variables:

- Credit Score: Borrower credit score at HELOC initiation
- LTV: ratio of the loan to the value of its collateral at HELOC initiation
- Origination Spread: Origination interest rate over the effective federal funds rate

Variables of Interest

Time-Varying Variables:

- Historic Delinquency: Indicator variable that is 1 if the borrower became 60 dpd more than 60 days ago
- Recent Delinquency: Indicator variable that is 1 if the last time the borrower became 60 dpd more than 60 days ago
- Lagged Proportion 31 Days: Proportion of the line in use one month ago
- Line Change Earlier, Up: Indicator variable that is 1 if the borrower had a line increase in the time between the loan origination and present day
- Relationship Variable indicators: Deposit Account or Other Loan

Empirical Design

Sample is 87,000 HELOCs and 1.25 million loan-month obs.

- LoanChar: vector of time-invariant loan characteristics
- Var: vector of time-varying variables
- Close to Fail: indicator taking a value of 1 the three months before failure

$$\text{LineCut}_{hbt} = \beta_1' \, \text{LoanChar}_{hb} + \delta_t + \xi_b + \epsilon_{hbt} \tag{1}$$

$$\text{LineCut}_{hbt} = \beta_1' \, \text{Var}_{hbt} + \delta_t + \upsilon_h + \epsilon_{hbt} \tag{2}$$

$$\begin{aligned} \text{LineCut}_{hbt} = {} & \beta_1' \, \text{CloseToFail}_{bt} + \beta_2' \, \text{CloseToFail}_{bt} \times \text{LoanChar}_{hb} \\ & + \delta_t + \xi_b + \epsilon_{hbt} \end{aligned} \tag{3}$$

$$\begin{aligned} \text{LineCut}_{hbt} = {} & \beta_1' \, \text{CloseToFail}_{bt} + \beta_2' \, \text{CloseToFail}_{bt} \times \text{Var}_{hbt} \\ & + \delta_t + \upsilon_h + \epsilon_{hbt} \end{aligned} \tag{4}$$

- Include daily (δ_t) fixed effects
- Include bank-level (ξ_b) *OR* HELOC-level (υ_h) fixed effects

Empirical Design

Implement a similar setup for borrower runs

- Used Proportion Change Past Month: Difference between used proportion of credit over the previous month
- LoanChar: vector of time-invariant loan characteristics
- Var: vector of time-varying variables
- Close to Fail: indicator taking a value of 1 the three months before failure

$$\begin{aligned} \mathrm{UsedProportionChange}_{hbt} = {} & \beta_1' \, \mathrm{CloseToFail}_{bt} + \\ & \beta_2' \, \mathrm{CloseToFail}_{bt} \times \mathrm{LoanChar}_{hb} \\ & + \delta_t + \xi_b + \epsilon_{hbt} \end{aligned} \tag{5}$$

$$\begin{aligned} \mathrm{UsedProportionChange}_{hbt} = {} & \beta_1' \, \mathrm{CloseToFail}_{bt} + \\ & \beta_2' \, \mathrm{CloseToFail}_{bt} \times \mathrm{Var}_{hbt} \\ & + \delta_t + \upsilon_h + \epsilon_{hbt} \end{aligned} \tag{6}$$

- Include bank-level (ξ_b) OR HELOC-level (υ_h) fixed effects
- Include daily (δ_t) fixed effects

Summary Statistics: Full Sample

(1) Variable	(2) Mean	(3) Median	(4) SD	(5) N
Original Loan Commitment	79305.14	50000	159,000	1,244,156
Original Balance	15023.5	4898	80065.37	562,206
Line Cut or Closed	1	0	1	1,244,156
Credit Score	732.21	745	63.96	907,223
LTV	37.36	25	30.45	1,177,438
Loan Term	11.74	11.67	6.01	1,244,156
Origination Spread	2.4	2.59	2.02	1,186,837
End of Month Principal	45665.79	21981	92620	1,244,156
End of Month Line	80794.1	50000	161,000	1,244,156
Historic Delinquency	0.04	0	0.2	1,244,156
Recent Delinquency	0	0	0.07	1,244,156
Used Proportion Past Month	58.82	68.16	37.04	1,230,373
Used Proportion Change Past Month	0.48	0	9.81	1,143,104
Previous Line Increase	0.04	0	0.2	1,244,156
Deposit Account	0.54	1	0.5	1,244,156
Other Loan	0.21	0	0.41	1,244,156
Zillow Price Index Change	-0.35	-0.2	1.27	1,079,703
Close to Fail	0.11	0	0.31	1,244,156
N				1,244,156

Summary Statistics: Loan-Level

(1) Variable	(2) Mean	(3) Median	(4) SD	(5) N
Original Loan Commitment	87,643.85	60,000	111,000	87,698
Original Balance	13,597.96	1,966	68,904.62	12,044
Line Cut or Closed	15	0	36	87,698
Credit Score	716.38	723	67.62	76,719
LTV	44.09	48.36	28.9	83,169
Loan Term	17.33	20	28.9	87,698
Origination Spread	3.7	3.73	1.77	85,008
End of Month Principal	60,983.95	40,990	82,752.73	87,698
End of Month Line	88,062.36	60,000	112,000	87,698
Recent Delinquency	0.02	0	0.14	87,698
Historic Delinquency	0.025	0	0.15	87,698
Used Proportion Past Month	72.15	93.36	35.78	87,269
Used Proportion Change Past Month	-0.03	0	8.06	84,991
Previous Line Increase	0.01	0	0.12	87,698
Deposit Account	0.18	0	0.38	87,698
Other Loan	0.43	0	0.5	87,698
Zillow Price Index Change	-1.45	-1.26	1.3	83,940
Close to Fail	0.84	1	0.36	87,698
N				87,698

Summary Statistics: Treated Loans

(1) Variable	(2) Mean	(3) Median	(4) SD	(5) N
Line Cut	100	100	0	4,312
Original Loan Commitment	75,802.2	40,000	225,000	4,312
Original Balance	16,923.24	60,000	134,000	2,133
Credit Score	734.36	747	59.92	2,587
LTV	48.14	33.01	36.36	3,940
Loan Term	9.74	10	5.91	4,312
Origination Spread	2.61	2.59	1.61	4,078
End of Month Principal	23,346.14	6,428	71,264.14	4,312
End of Month Line	76,216.05	40,000	226,000	4,312
Recent Delinquency	0.06	0	0.24	4,312
Historic Delinquency	0.08	0	0.28	4,312
Used Proportion Past Month	39.6	26	41	4,307
Used Proportion Change Past Month	-0.15	0	11.82	4,303
Previous Line Increase	0.02	0	0.16	4,312
Deposit Account	0.55	1	0.5	4,312
Other Loan	0.18	0	0.39	4,312
Zillow Price Index Change	-0.8	-0.54	0.93	3,885
Close to Fail	0.31	0	0.46	4,312
N				4,312

Are banks more likely to revoke risky HELOCs?

Agarwal, Ambrose, Chomsisengphet, and Liu (2006) identify characteristics associated with HELOC default

- Borrower credit scores
- Loan-to-value ratio (LTV)

Additional variables

- Interest rate: this may be a reflection of hard and soft information

Alternatively, banks may not consider borrower characteristics when rationing credit

Does HELOC management become more aggressive as the bank approaches failure?

FDICIA mandates that banks are resolved within 90 days of breaching capital requirements

- Banks incentives to strategically deploy capital are magnified
- Capital is scarce and difficult to acquirer

It's an empirical question whether banks...

- Do not consider borrower characteristics
- Consistently manage HELOCs but become more aggressive
- Adjust their credit management strategies

Results: Loan Origination Characteristics

	(1) Line Cut	(2) Line Cut	(3) Line Cut	(4) Line Cut
Credit Score	0.0000232		0.0000457	
	(0.26)		(0.47)	
LTV	0.00461***	0.00667***	0.00409***	0.00669***
	(17.04)	(26.80)	(13.43)	(24.28)
Origination Spread	0.0199***	0.0195***	0.0163***	0.0177***
	(5.83)	(6.37)	(4.88)	(5.75)
Close to Fail			-0.253	-0.135
			(-1.06)	(-1.47)
Credit Score * Close to Fail			0.0000471	
			(0.17)	
LTV * Close to Fail			0.00266***	-0.000166
			(3.08)	(-0.20)
Origination Spread * Close to Fail			0.0245*	0.0168
			(1.79)	(1.42)
Zillow Price Index Growth	Yes	Yes	Yes	Yes
HELOC FE	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Zip 3 * Year FE	Yes	Yes	Yes	Yes
SE Clustered at Loan Level	Yes	Yes	Yes	Yes
N	734,500	959,190	734,500	959,190
R-sq	0.065	0.049	0.065	0.049

Do banks act on borrower behavior?

After loan initiation, borrowers exhibit different behaviors

Delinquency can lead to default

- Agarwal, Ambrose, Chomsisengphet, and Liu (2006)
- Norden and Weber (2010)

Abnormal drawdowns are related to future default: Norden and Weber (2010)

- Banks may interpret this as an "early warning signal"
- However, this also leaves banks with less credit to manage

Bottom line: The effect of increased drawdowns on bank HELOC management is ultimately an empirical question.

HELOCs are cut when lines have more credit

	(1) Line Cut	(2) Line Cut	(3) Line Cut	(4) Line Cut
Recent Delinquency	5.355***	5.122***	5.035***	4.794***
	(15.05)	(15.27)	(13.49)	(13.67)
Historic Delinquency	1.048***	0.418***	0.975***	0.401***
	(10.87)	(10.15)	(9.92)	(9.79)
Used Proportion Past Month	-0.00922***	-0.00665***	-0.00875***	-0.00662***
	(-20.61)	(-31.44)	(-19.74)	(-30.80)
Previous Line Increase	-0.607***	-0.101**	-0.510***	-0.0316
	(-8.34)	(-2.34)	(-7.07)	(-0.71)
Used Proportion Change Past Month	-0.00368***	-0.00492***	-0.00319***	-0.00465***
	(-4.50)	(-6.45)	(-3.95)	(-6.04)
Close to Fail			0.627***	-0.0528
			(3.49)	(-0.44)
Recent Delinquency * Close to Fail			2.690**	2.851**
			(2.31)	(2.48)
Historic Delinquency * Close to Fail			0.431*	0.212
			(1.75)	(0.91)
Used Proportion Past Month * Close to Fail			-0.00987***	-0.000333
			(-4.95)	(-0.34)
Previous Line Increase * Close to Fail			-1.152***	-1.030***
			(-8.44)	(-7.68)
Used Proportion Change Past Month * Close to Fail			-0.00864	-0.00514
			(-1.03)	(-1.16)
Zillow Price Index Growth	0.00681	0.00199	0.00710	0.00219
	(0.56)	(0.19)	(0.58)	(0.21)
HELOC FE	Yes	No	Yes	No
Bank FE	No	Yes	No	Yes
Month FE	Yes	Yes	Yes	Yes
Zip 3 * Year FE	Yes	Yes	Yes	Yes
SE Clustered at Loan Level	Yes	Yes	Yes	Yes
N	978,125	978,125	978,125	978,125
R-sq	0.049	0.049	0.050	0.049

Do relationships matter?

There is an extensive literature dedicated to showing the benefits of relationships

- Borrowers are insured against shocks
- Banks have greater monitoring capabilities and realize more profits

However, all banking relationships may not be equally valuable

- Depositors are generally assumed to be valuable to banks
- Banks holding multiple loans with a borrower are more exposed to the borrower
- Relationships are sticky

The differential effect of relationships on bank HELOC management is ultimately an empirical question

Deposit Relationships are valuable

	(1)	(2)	(3)	(4)
	Line Cut	Line Cut	Line Cut	Line Cut
Deposit Account	-0.0768	-0.0455***	-0.0778	-0.0460***
	(-1.42)	(-3.33)	(-1.43)	(-3.51)
Other Loan	0.0388	-0.00400	0.0204	-0.0221
	(0.59)	(-0.27)	(0.31)	(-1.30)
Close to Fail			-0.155	-0.156
			(-1.26)	(-1.42)
Deposit Account * Close to Fail			0.0102	0.0407
			(0.08)	(0.36)
Other Loan * Close to Fail			0.363**	0.0803**
			(2.14)	(2.26)
Zillow Price Index Growth	0.00848	0.00676	0.00827	0.00698
	(0.74)	(0.74)	(0.72)	(0.77)
HELOC FE	Yes	No	Yes	No
Bank FE	No	Yes	No	Yes
Month FE	Yes	Yes	Yes	Yes
Zip 3 * Year FE	Yes	Yes	Yes	Yes
SE Clustered at Loan Level	Yes	Yes	Yes	Yes
N	1,071,396	1,071,396	1,071,396	1,071,396
R-sq	0.045	0.045	0.045	0.045

Do borrowers run on their HELOCs as failure approaches?

One potential reason banks may cut lines is to preempt borrower runs

Borrowers may drawdown on credit lines analogous to the way depositors may run

- Kayshyap, Rajan, and Stein (2002)
- Empirically, there is limited evidence of this within the corporate sector

Certain borrowers may have a difficult time obtaining subsequent credit

- Risky borrowers
- Borrowers with a history of problems
- Some relationships may be severed as the failed bank is acquired

It is an empirical question whether borrowers run on their HELOCs.

On average, borrowers do not run

	(1) Used Proportion Change Past Month	(2) Used Proportion Change Past Month
Credit Score	-0.00191***	
	(-10.35)	
LTV	-0.00272***	-0.00244***
	(-7.32)	(-7.65)
Origination Spread	0.0302***	0.0120**
	(5.15)	(2.45)
Close to Fail	-3.027***	-0.0334
	(-8.38)	(-0.34)
Credit Score * Close to Fail	0.00416***	
	(8.73)	
LTV * Close to Fail	0.00149	0.00159
	(1.45)	(1.63)
Origination Spread * Close to Fail	-0.0221	-0.0235
	(-1.22)	(-1.56)
Zillow Price Index Growth	0.0179	0.0319*
	(0.92)	(1.91)
HELOC FE	No	No
Bank FE	No	Yes
Month FE	Yes	Yes
Zip 3 * Year FE	Yes	Yes
SE Clustered at Loan Level	Yes	Yes
N	666,520	885,177
R-sq	0.007	0.007

...EVEN IF THEY HAVE AVAILABLE CREDIT

	(1) Used Proportion Change Past Month	(2) Used Proportion Change Past Month
Recent Delinquency	-0.449**	0.552***
	(-2.51)	(3.53)
Historic Delinquency	-0.0986	0.559***
	(-0.77)	(10.72)
Used Proportion Past Month	-0.156***	-0.0458***
	(-106.22)	(-92.50)
Previous Line Increase	1.953***	0.558***
	(9.44)	(6.63)
Close to Fail	-3.102***	-4.259***
	(-23.00)	(-35.31)
Recent Delinquency * Close to Fail	0.282	-0.742**
	(0.74)	(-2.17)
Historic Delinquency * Close to Fail	-0.857***	-0.921***
	(-6.84)	(-8.35)
Used Proportion Past Month * Close to Fail	0.0481***	0.0636***
	(34.47)	(56.27)
Previous Line Increase * Close to Fail	-0.342*	-0.468**
	(-1.77)	(-2.52)
Zillow Price Index Growth	0.0233	0.00856
	(1.18)	(0.54)
HELOC FE	Yes	No
Bank FE	No	Yes
Month FE	Yes	Yes
Zip 3 * Year FE	Yes	Yes
SE Clustered at Loan Level	Yes	Yes
N	1097421	1097421
R-sq	0.099	0.031

...EVEN ONES WITH RELATIONSHIPS

	(1) Used Proportion Change Past Month	(2) Used Proportion Change Past Month
Deposit Account	0.148*	0.108***
	(1.81)	(5.57)
Other Loan	-0.459***	0.0784***
	(-4.87)	(2.95)
Close to Fail	-0.0762	-0.0918
	(-0.76)	(-0.97)
Deposit Account * Close to Fail	0.0959	0.120*
	(1.17)	(1.66)
Other Loan * Close to Fail	0.140	0.00283
	(1.20)	(0.05)
Zillow Price Index Growth	0.0294	0.0185
	(1.55)	(1.17)
HELOC FE	Yes	No
Bank FE	No	Yes
Month FE	Yes	Yes
Zip 3 * Year FE	Yes	Yes
SE Clustered at Loan Level	Yes	Yes
N	978125	978125
R-sq	0.007	0.006

Tax Rate as a Source of Exogenous Variation

Disentangling supply-side from demand-side effects is difficult

- Many features of the relationship between the borrower and bank are unobservable
- For example, borrowers may have income shocks that are known to the bank but are unobservable in the data

We add the bank earnings tax rate to regressions

- Bank tax rate affects the incentive for banks to cut HELOCs
- Banks receive larger tax benefits from charging off bad loans in states with larger tax benfits
- Bank tax rate does not influence behavior of borrowers

Bank incentives play a crucial role in HELOC cancellations under our definition of line terminations

Tax Rate as a Source of Exogenous Variation

	(1) Line Cut	(2) Line Cut
Tax Rate	-0.195*	-0.274**
	(-2.59)	(-3.23)
Close to Fail		0.127
		(0.20)
		(1.10)
Direct Effects	Yes	Yes
Close to Fail Interactions	Yes	Yes
HELOC FE	No	No
Bank FE	No	No
Month FE	Yes	Yes
Zip 3	No	Yes
SE Clustered at State Level	Yes	Yes
N	1,235,144	885,177
R-sq	0.022	0.033

Conclusion

1) We show that banks manage HELOCs

- Borrowers exhibiting certain "early warning signals" are more likely to be managed
- Relationships have differential effects

2) For the most part, this management becomes more aggressive approaching failure

- All banking relationships are valuable as the bank approaches failure
- Banks are less likely to cut profitable loans

2) On average borrower do not run on their HELOCs

- Certain characteristics are associated with runs on a *relative* basis

Our paper has implications for understanding the

- Types of borrowers are harmed as bank financial health deteriorates
- Welfare trade-offs of HELOCs

Thank You!!