Online Empirical Appendix to "The Impact of Regulatory Changes on Mortgage Risk: Evidence from India"

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Table A1: 90 Day Delinquency Model

This table presents coefficient estimates and standard errors from the equation below. The estimation takes place in two stages. First, cross-sectional estimates are produced for each year. Coefficients are produced from the cross-sectional estimates by classical minimum distance (See Wooldridge 2002, p442-446). Coefficients on borrower (B) and loan (L) characteristics, the initial interest rate (r), and the fixed rate mortgage dummy (α_r) are reported below. Excluded from the table are monthly (α_m), cohort (α_c), and branch (α_b) fixed effects, and separate macroeconomic scaling effects Z_t for fixed and variable rate mortgages (which are shown as Figure A1). Standard errors are given in italics to the right of coefficients, and are computed by bootstrapping calendar years. Coefficients that are statistically significant at 5% and 10% two-sided level are in bold and italicized type respectively. All coefficients and standard errors are multiplied by 100 for readability.

$$Prob[\delta_i] = Z_{r,t-1}\left(\alpha_m + \alpha_r + \alpha_c + \alpha_b + \sum\nolimits_j \chi_j B_{ijt} + \sum\nolimits_k \beta_{rk} L_{ikt} + \rho_r r_i\right) + e_{it}$$

	Coefficient	S.E.
Borrower Characteristics:		
Log Number of Dependents	-0.047	*0.052*
Male Borrower	**0.236**	*0.024*
Married Borrower	*0.059*	*0.033*
Borrower age 36-45	**0.095**	*0.012*
Age 46 and up	**0.240**	*0.043*
Dummy: Repeat Borrower	**0.397**	*0.110*
Dummy: Qualification Missing or Unidentified	**-0.142**	*0.055*
Dummy: HSC Equivalent	**-0.480**	*0.067*
Dummy: BA Equivalent	**-0.741**	*0.093*
Dummy: Post-Grad Equivalent	**-1.123**	*0.091*
Dummy: Finance-Related Qualification	**0.189**	*0.029*
Loan Characteristics:		
Initial Interest Rate (Variable Rate Mortgages)	**0.449**	*0.041*
Initial Interest Rate (Fixed Rate Mortgages)	**0.321**	*0.038*
Change in One-Year Government Bond Yield Since Disbursal (Variable Rate Mortgages Only)	*0.078*	*0.041*
Regional Log Home Price Appreciation Since Disbursal	**-0.952**	*0.248*
Log Loan to Income Ratio (winsorized at 1st, 99th)	**0.792**	*0.065*
Log Loan Amount	**-0.835**	*0.109*
Loan to Cost Ratio	**2.958**	*0.127*
Dummy: Usually Paid by Salary Deduction	**-1.889**	*0.102*
Dummy: Loan administered through employers	**-0.268**	*0.054*
Dummy: Loan is a Refinancing	**0.448**	*0.098*
Dummy: Loan is for a Home Extension	**-0.160**	*0.043*
Dummy: Loan is for a Home Improvement	**0.239**	*0.076*
Dummy: Tranched Issuance	**-0.524**	*0.124*
Dummy: 6 to 10 Year Loan (Variable Rate Mortgages)	**0.191**	*0.081*
Dummy: 11 to 15 Year Loan (Variable Rate Mortgages)	**0.653**	*0.115*
Dummy: 16 Year+ Loan (Variable Rate Mortgages)	**1.496**	*0.178*
Dummy: 6 to 10 Year Loan (Fixed Rate Mortgages)	**0.754**	*0.117*
Dummy: 11 to 15 Year Loan (Fixed Rate Mortgages)	**1.228**	*0.142*
Dummy: 16 Year+ Loan (Fixed Rate Mortgages)	**0.646**	*0.116*
Dummy: Fixed Rate Mortgage	**1.790**	*0.649*
Dummy: Year of Loan Issuance	**-2.531**	*0.133*
Dummy: Disbursed Within 12 Months of State Election	-0.010	*0.047*

Table A2: Impact of PSL Regulation on Abnormal Delinquency Rate - Alternative Delinquency Rate Specifications

This table provides compares parameters of interest across alternative specifications to the Cox model estimated with Equations 1 (in section A) and 4 (in section B) in the paper. Specifically, in place of Equation 1, the NLLS (non-linear least squares) model uses the equation $Pr[\delta_{i,t}]=Z_{t-1}(\alpha_c+\beta r_i+\tau' D_i)+e_{i,t}$, and the OLS model uses $Pr[\delta_{i,t}]=\alpha_c+\alpha_{fixed}+\alpha_t+\beta ri+\tau' D_i+e_{i,t}$, where the additional dummies capture interest rate type and year fixed effects. In each model, loans disbursed within 2% of the PSL threshold are used (the set of observations is the same). Otherwise, methodology follows that in Table 5. Standard errors (reported in parentheses) are computed by bootstrapping years of the panel data, with bold and italicized type representing statistical significance at the five and ten percent level respectively.

Model:	Cox	NLLS	OLS
Using a Six-month Time Window Around PSL Threshold Changes			
Observations (Above Threshold):	1,378	1,378	1,378
Observations (At/Below Threshold):	32,400	32,400	32,400
Using a Three-month Time Window Around PSL Threshold Changes			
Observations (Above Threshold):	659	659	659
Observations (At/Below Threshold):	16,481	16,481	16,481
A. Difference-in-Difference Specification			
Using a Six-month Time Window Around PSL Threshold Changes			
[i]: $\tau_{old,below} - \tau_{old,above}$	**0.47**	**0.44**	**0.38**
	(0.14)	(0.16)	(0.17)
[ii]: $\tau_{new,below} - \tau_{new,above}$	-0.07	0.14	-0.10
	(0.19)	(0.13)	(0.17)
[i]-[ii]	**0.54**	0.30	*0.48*
	(0.23)	(0.25)	(0.27)
Using a Three-month Time Window Around PSL Threshold Changes			
[i]: $\tau_{old,below} - \tau_{old,above}$	**0.55**	**0.47**	**0.55**
	(0.15)	(0.16)	(0.17)
[ii]: $\tau_{new,below} - \tau_{new,above}$	0.02	0.35	0.01
	(0.32)	(0.23)	(0.25)
[i]-[ii]	**0.52**	0.12	**0.53**
	(0.24)	(0.23)	(0.27)
B. Abnormal Delinquencies as a Function of PSL Constraint Tightness Proxy			
Using a Six-month Time Window Around PSL Threshold Changes			
η	-0.02	-0.05	-0.10
	(0.16)	(0.11)	(0.15)
Using a Three-month Time Window Around PSL Threshold Changes			
η	0.03	-0.21	-0.01
	(0.18)	(0.14)	(0.17)

Table A3: Impact of PSL Regulation on Abnormal Delinquency Rate - With 12 Month Time Window Around PSL Threshold Changes

This table is constructed in the same manner as Table 5, but defines the "just before" and "just after" loan cohorts using a twelve-month window (instead of a three or six month window). Standard errors (reported in parentheses) are computed by bootstrapping years of the panel data, with bold and italicized type representing statistical significance at the five and ten percent level respectively.

Loan Size Window:	1.5%	2.0%	2.5%	3.0%
Observations (Above Threshold):	1,633	2,841	3,834	4,770
Observations (At/Below Threshold):	59,029	60,372	61,628	62,638
A. Difference-in-Difference Specification (Equation 1)				
[i]: $\tau_{old,below} - \tau_{old,above}$	0.15	*0.20*	0.06	0.08
	(0.23)	(0.12)	(0.12)	(0.10)
[ii]: $\tau_{new,below} - \tau_{new,above}$	0.09	-0.30	-0.19	-0.20
	(0.29)	(0.21)	(0.16)	(0.20)
[i]-[ii]	0.05	**0.50**	*0.25*	0.28
	(0.38)	(0.22)	(0.15)	(0.18)
B. Abnormal Delinquencies as a Function of PSL Constraint Tightness Proxy (Equation 4)				
η	-0.03	-0.04	-0.05	-0.06
	(0.14)	(0.14)	(0.14)	(0.14)

Table A4: Impact of Risk Weight Regulation on Abnormal Delinquency Rate - Alternative Delinquency Rate Specifications

This table provides compares parameters of interest across alternative specifications to the Cox model estimated with Equations 1 (in sections A) and 7 (in sections B) in the paper. Specifically, in place of Equation 1, the NLLS (non-linear least squares) model uses the equation $Pr[\delta_{i,t}]=Z_{t-1}(\alpha_c+\beta r_i+\tau' D_i)+e_{i,t}$, and the OLS model uses $Pr[\delta_{i,t}]=\alpha_c+\alpha_{fixed}+\alpha_t+\beta ri+\tau' D_i+e_{i,t}$, where the additional dummies capture interest rate type and year fixed effects. In each model, loans disbursed within 2% of a 75% loan-cost ratio are used (the set of observations is the same). Otherwise, methodology follows that in Table 6. Standard errors (reported in parentheses) are computed by bootstrapping years of the panel data, with bold and italicized type representing statistical significance at the five and ten percent level respectively.

Model:	Cox	NLLS	OLS
Using a Six-month Time Window Around Risk Weight Changes			
Observations (Above 75% Loan-Cost):	78,518	78,518	78,518
Observations (At/Below 75% Loan-Cost):	130,412	130,412	130,412
Using a Three-month Time Window Around Risk Weight Changes			
Observations (Above 75% Loan-Cost):	38,508	38,508	38,508
Observations (At/Below 75% Loan-Cost):	63,782	63,782	63,782
A. Difference-in-Difference Specification			
Using a Six-month Time Window Around Risk Weight Changes			
[i]: $\tau_{far,below} - \tau_{far,above}$	0.03	-0.09	**-0.15**
	(0.06)	(0.08)	(0.05)
[ii]: $\tau_{close,below} - \tau_{close,above}$	*-0.12*	-0.04	0.01
	(0.07)	(0.15)	(0.08)
[i]-[ii]	0.15	-0.05	-0.16
	(0.10)	(0.15)	(0.11)
Using a Three-month Time Window Around Risk Weight Changes			
[i]: $\tau_{far,below} - \tau_{far,above}$	**0.21**	-0.05	-0.03
	(0.09)	(0.05)	(0.09)
[ii]: $\tau_{close,below} - \tau_{close,above}$	-0.04	-0.06	0.11
	(0.11)	(0.23)	(0.13)
[i]-[ii]	*0.25*	0.01	-0.13
	(0.13)	(0.24)	(0.14)
B. Abnormal Delinquencies as a Function of Risk Weight Advantage			
Using a Six-month Time Window Around Risk Weight Changes			
η	0.10	**0.83**	**0.36**
	(0.19)	(0.33)	(0.14)
Using a Three-month Time Window Around Risk Weight Changes			
η	**0.60**	**0.96**	**0.69**
	(0.11)	(0.15)	(0.11)

Table A5: Cumulative Installment Deficit Around Delinquencies

The top panel of this table corresponds to the series plotted in Figure 7, abnormal CID around 30 day delinquencies before and after the NPA definition change was adopted by our lender. The bottom panel replicates a variation of this analysis based on cumulative installment deficits around 90 day (instead of 30 day) delinquencies. Standard errors are given in italics and are computed by bootstrapping calendar years before and after the NPA change. Coefficients that are statistically significant at a 5% or 10% two-sided level are in bold and italiczed type respectively.

Month Relative	180 Day NPA Regime		90 Day NPA Regime		Cumulative Difference Around t	
to Default	**Value**	**SE**	**Value**	**SE**	**Value**	**SE**
Panel A: 30 Day Delinquencies						
t-12	0.02	*0.01*	**0.04**	*0.02*	0.02	*0.15*
t-11	0.03	*0.02*	**0.06**	*0.02*	0.03	*0.14*
t-10	0.03	*0.03*	*0.04*	*0.02*	0.01	*0.14*
t-9	0.04	*0.03*	*0.04*	*0.02*	0.00	*0.12*
t-8	0.04	*0.03*	0.04	*0.04*	0.00	*0.09*
t-7	0.02	*0.04*	0.04	*0.05*	0.01	*0.09*
t-6	0.02	*0.05*	0.04	*0.04*	0.02	*0.06*
t-5	-0.01	*0.06*	0.03	*0.06*	0.04	*0.05*
t-4	-0.05	*0.05*	-0.01	*0.06*	0.04	*0.04*
t-3	*-0.10*	*0.06*	-0.02	*0.06*	**0.07**	*0.03*
t-2	**-0.18**	*0.06*	-0.05	*0.07*	**0.12**	*0.04*
t-1	**-0.46**	*0.06*	**-0.39**	*0.07*	**0.07**	*0.03*
t	**-1.09**	*0.08*	**-1.09**	*0.07*		
t+1	**-1.27**	*0.10*	**-0.91**	*0.10*	**0.35**	*0.13*
t+2	**-1.17**	*0.10*	**-0.74**	*0.13*	**0.42**	*0.19*
t+3	**-1.13**	*0.11*	**-0.59**	*0.16*	**0.54**	*0.24*
t+4	**-1.07**	*0.12*	**-0.52**	*0.16*	**0.54**	*0.25*
t+5	**-1.07**	*0.10*	**-0.46**	*0.18*	**0.60**	*0.24*
t+6	**-1.05**	*0.11*	**-0.43**	*0.18*	**0.62**	*0.24*
t+7	**-1.06**	*0.11*	**-0.40**	*0.17*	**0.65**	*0.24*
t+8	**-1.08**	*0.12*	**-0.40**	*0.17*	**0.68**	*0.23*
t+9	**-1.06**	*0.13*	**-0.41**	*0.17*	**0.65**	*0.25*
t+10	**-1.05**	*0.12*	**-0.41**	*0.17*	**0.64**	*0.23*
t+11	**-1.14**	*0.12*	**-0.41**	*0.18*	**0.72**	*0.24*
t+12	**-1.15**	*0.12*	**-0.38**	*0.18*	**0.76**	*0.23*
Panel B: 90 Day Delinquencies						
t-12	-0.01	*0.02*	0.01	*0.03*	**-0.44**	*0.18*
t-11	0.00	*0.02*	0.02	*0.04*	**-0.44**	*0.16*
t-10	-0.01	*0.03*	0.01	*0.05*	**-0.44**	*0.16*
t-9	-0.03	*0.02*	0.02	*0.05*	**-0.42**	*0.14*
t-8	-0.06	*0.04*	0.04	*0.06*	**-0.37**	*0.12*
t-7	**-0.10**	*0.04*	0.01	*0.06*	**-0.35**	*0.12*
t-6	**-0.18**	*0.05*	-0.03	*0.06*	**-0.31**	*0.10*
t-5	**-0.30**	*0.05*	-0.06	*0.08*	**-0.22**	*0.11*
t-4	**-0.41**	*0.05*	*-0.16*	*0.09*	**-0.21**	*0.10*
t-3	**-0.63**	*0.05*	**-0.26**	*0.10*	-0.09	*0.09*
t-2	**-1.12**	*0.06*	**-0.69**	*0.10*	-0.04	*0.06*
t-1	**-1.78**	*0.07*	**-1.31**	*0.10*	0.01	*0.03*
t	**-2.58**	*0.07*	**-2.12**	*0.11*		
t+1	**-2.55**	*0.11*	**-1.80**	*0.10*	**0.28**	*0.14*
t+2	**-2.15**	*0.11*	**-1.40**	*0.11*	**0.28**	*0.13*
t+3	**-2.02**	*0.07*	**-1.31**	*0.10*	**0.26**	*0.07*
t+4	**-1.92**	*0.11*	**-1.28**	*0.13*	*0.17*	*0.10*
t+5	**-1.93**	*0.08*	**-1.23**	*0.13*	**0.24**	*0.09*
t+6	**-1.93**	*0.09*	**-1.16**	*0.13*	**0.31**	*0.08*
t+7	**-1.99**	*0.09*	**-1.11**	*0.15*	**0.42**	*0.11*
t+8	**-1.90**	*0.09*	**-1.04**	*0.13*	**0.40**	*0.12*
t+9	**-1.97**	*0.09*	**-1.00**	*0.11*	**0.51**	*0.17*
t+10	**-1.97**	*0.11*	**-0.96**	*0.14*	**0.55**	*0.21*
t+11	**-2.03**	*0.11*	**-0.96**	*0.15*	**0.60**	*0.24*
t+12	**-2.00**	*0.10*	**-0.97**	*0.15*	**0.56**	*0.22*

Table A6: Loan Term by Disbursal Year

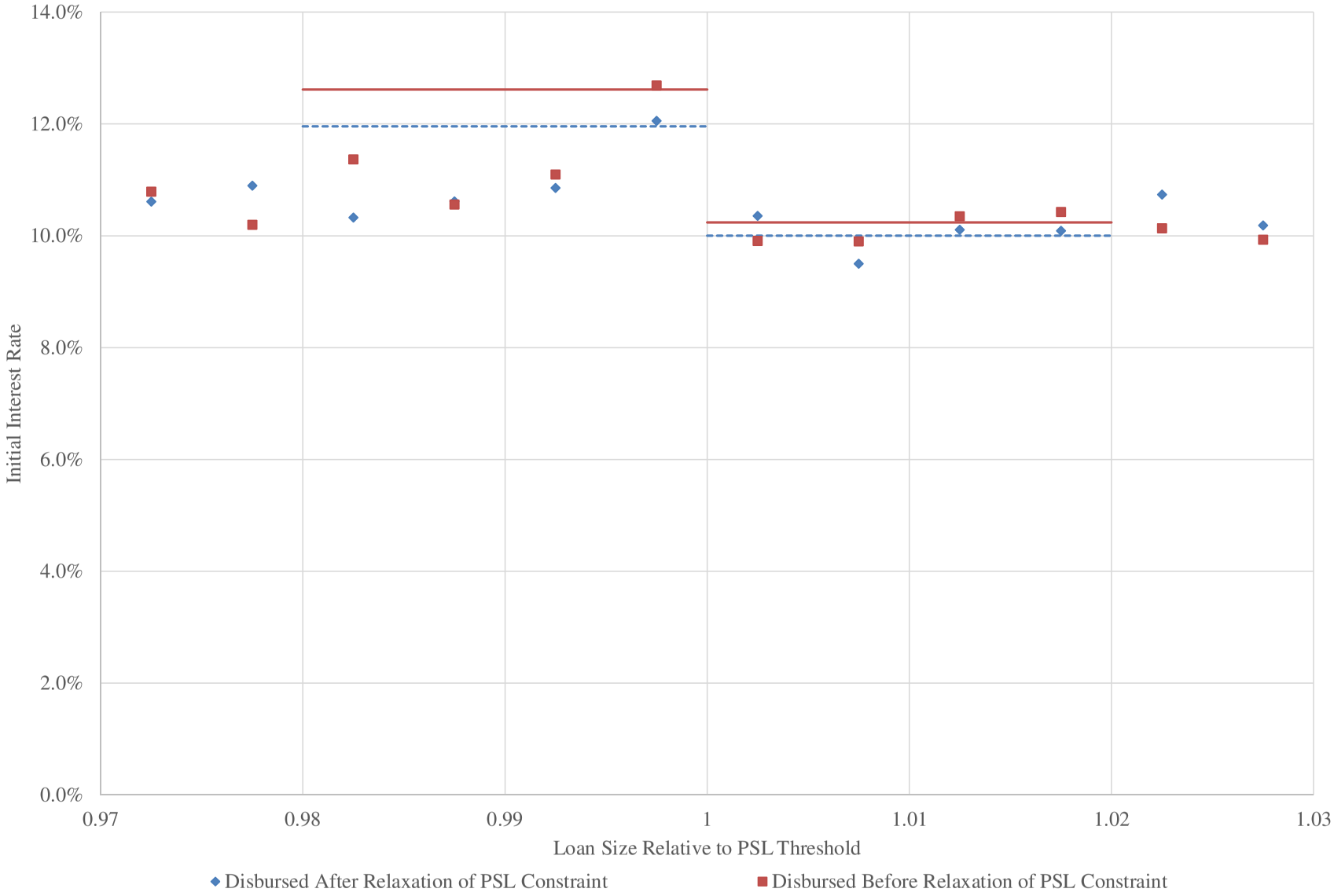
Statistics below cover the more than 1.2 million mortgage loans disbursed by our lender. Statistics for fixed rate disbursals are removed for the years 2008 through 2010 as these account for well under one percent of disbursals in these years.

	Cross-Sectional Means		Cross-Sectional Standard Deviations	
	Variable	Fixed	Variable	Fixed
1995	13.96	11.66	2.51	4.24
1996	13.21	10.89	2.73	4.26
1997	13.18	10.38	2.72	4.49
1998	13.08	10.06	2.81	4.69
1999	12.88	10.63	3.00	4.52
2000	12.95	10.55	3.61	4.57
2001	12.72	10.23	3.97	4.56
2002	13.15	10.03	4.43	4.63
2003	12.88	12.76	4.85	4.77
2004	14.07	15.13	4.97	4.55
2005	15.16	15.17	4.92	4.52
2006	15.23	15.59	4.95	4.48
2007	15.03	14.68	4.41	4.78
2008	15.38		4.57	
2009	14.31		5.00	
2010	15.59		4.55	

Figure A1: Estimated Macro Effects Z(t) from 90 Day Delinquency Model (Table A1)

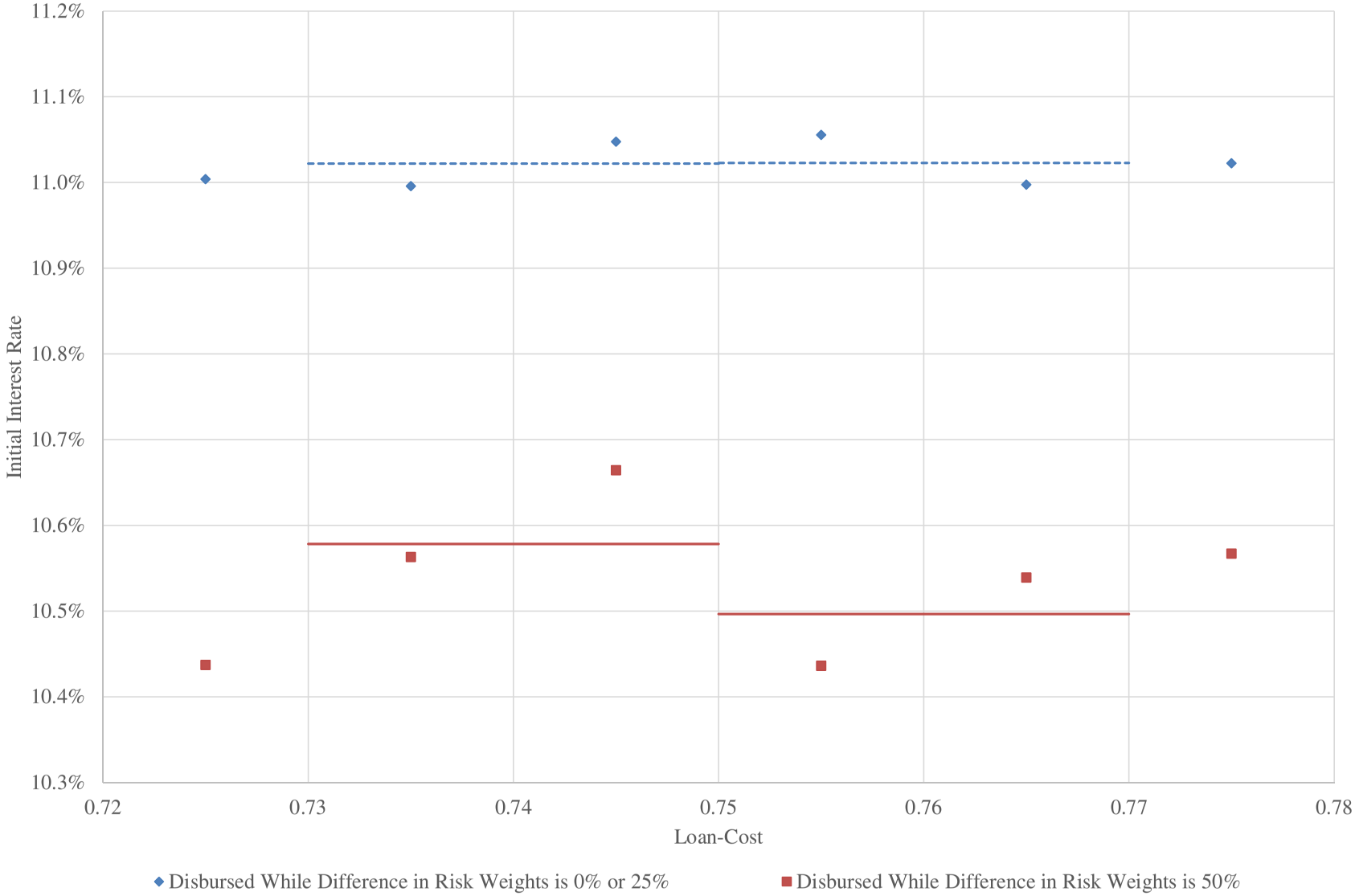
The macro effects are the parameters Z_t estimated in the delinquency model. Each is scaled to a time-series mean of one.

Figure A2: Average Initial Interest Rates of Loans Disbursed Near the PSL Threshold



Each data point reflects the average initial interest rate for loans disbursed in an interval of 0.5% of the PSL threshold in the six months before or after a PSL threshold reset date. Statistics are aggregated across cohorts disbursed around each of the four PSL threshold reset dates. The horizontal lines reflect averages across loan size intervals spanning from 0.98 to 1.00, and from 1.00 to 1.02 times the PSL threshold.

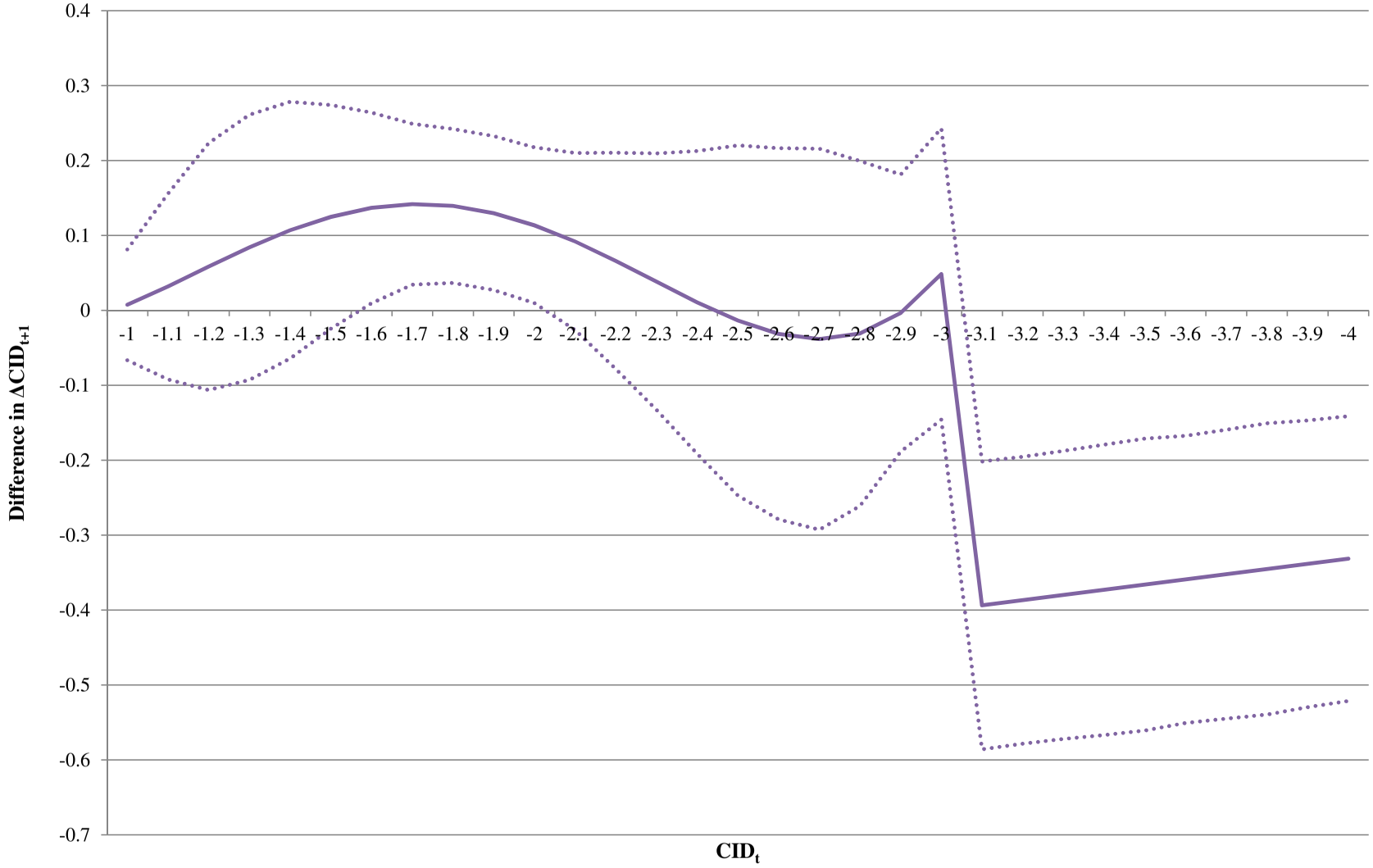
Figure A3: Average Initial Interest Rates of Loans Disbursed Near a 75% Loan-Cost Ratio



Each data point reflects the average initial interest rate for loans by loan-cost (at origination) for loans disbursed in the six months before or after risk-weights on less leveraged loans change. Statistics are aggregated across cohorts disbursed around each of the dates of risk weight changes. The horizontal lines reflect averages across loan size intervals spanning from loan-cost ratios of 0.73 to 0.75, and from 0.75 to 0.78.

Figure A4: Difference in Predicted ΔCID_{t+1} Following First 30 Day Delinquency, with 90% Confidence Interval

Post-NPA Definition Change ΔCID_{t+1} minus Pre-NPA Definition Change ΔCID_{t+1}



The solid line represents the difference in expected debt collection rates (ΔCID) around delinquencies before and after the lender adopted the redefinition of non-performing assets. The expected debt collection rates are produced from a regression of the form described in Figure 8. The dotted lines represent a 90% confidence interval for the difference constructed by bootstrapping the month of the initial 30 day delinquency.