Empirical Appendix to "How Do Regulators Influence Mortgage Risk? Evidence from an Emerging Market"

September 8, 2012

John Y. Campbell, Tarun Ramadorai, and Benjamin Ranish

Table A1: Delinquency Model

Cohort effects are decomposed into an unconditional average and cohort-specific component below, i.e. the delinquency rate for each cohort is the sum of the unconditional average and cohort-specific component. See Table 3 for a further description of the model.

	Variable Rate	Fixed Rate
B: Cohort and Macroeconomic Effects		
Unconditional Average Cohort Delinquency Rate		
	1.876	3.475
	0.062	*0.197*
Cohort Specific Delinquency Rate		
1995	-0.693	-1.417
	0.267	*0.477*
1996	-0.775	-1.108
	0.287	*0.503*
1997	-1.128	-1.019
	0.264	*0.391*
1998	-0.932	-1.057
	0.170	*0.385*
1999	-0.496	-0.536
	0.122	*0.439*
2000	-0.015	0.041
	0.123	*0.410*
2001	0.190	1.175
	0.087	*0.482*
2002	0.929	2.381
	0.125	*0.343*
2003	0.947	0.871
	0.157	*0.339*
2004	0.693	-0.197
	0.232	*0.426*
2005	0.267	-0.357
	0.157	*0.382*
2006	0.037	-0.965
	0.182	*0.355*
2007	-0.164	-0.891
	0.284	*0.548*
2008	-0.130	0.637
	0.276	*0.464*
2009	0.121	1.613
	0.618	*2.920*
2010	1.150	0.827
	0.561	*1.121*

Continued on Next Page

	Variable Rate	Fixed Rate
Macroeconomic Effects - z(t)		
1995	1.009	1.031
	0.099	*0.051*
1996	0.961	1.035
	0.076	*0.035*
1997	1.033	1.251
	0.064	*0.037*
1998	1.003	1.245
	0.056	*0.028*
1999	1.032	1.351
	0.053	*0.039*
2000	1.290	1.536
	0.051	*0.038*
2001	1.757	1.939
	0.079	*0.034*
2002	1.995	1.893
	0.074	*0.028*
2003	1.204	1.077
	0.060	*0.031*
2004	0.717	0.585
	0.034	*0.017*
2005	0.624	0.473
	0.035	*0.017*
2006	0.753	0.546
	0.060	*0.026*
2007	0.643	0.417
	0.057	*0.019*
2008	0.607	0.379
	0.046	*0.019*
2009	0.371	0.242
	0.034	*0.013*

Table A2: Cumulative Abnormal Monthly Installment Deficit Around Delinquencies

This table presents results from estimates of equation (1) in the paper. This model expresses monthly installment deficits as a linear function of time-to-delinquency dummies intereacted with a dummy for post March 2004 delinquencies (the coefficients in the "through March 2004" and "difference" columns below), as well as annual time and cohort fixed effects. Cumulative abnormal monthly installment deficit is the cumulative sum of the time-to-delinquency dummies starting 12 months before delinquency. Standard errors are given in italics and are computed by bootstrapping calendar years before and after January 1, 2004. Coefficients that are statistically significant at a 5% two-sided level are in bold type. The null hypothesis is that all coefficients equal zero (i.e. cumulative monthly installment deficits are explained completely by cohort and time effects).

Month Relative	Through March 2004		From April 2004		Cumulative Difference Around t	
to Default	**Value**	**SE**	**Value**	**SE**	**Value**	**SE**
Panel A: 30 Day Delinquencies						
t-12	0.02	*0.01*	**0.05**	*0.02*	-0.22	*0.18*
t-11	0.04	*0.02*	**0.09**	*0.03*	-0.19	*0.17*
t-10	0.06	*0.03*	0.10	*0.05*	-0.16	*0.15*
t-9	0.06	*0.04*	**0.13**	*0.07*	-0.18	*0.13*
t-8	0.07	*0.05*	0.15	*0.08*	-0.14	*0.11*
t-7	0.07	*0.06*	0.16	*0.10*	-0.15	*0.10*
t-6	0.07	*0.07*	0.19	*0.12*	-0.12	*0.08*
t-5	0.06	*0.08*	0.20	*0.14*	-0.10	*0.06*
t-4	0.04	*0.09*	0.20	*0.15*	-0.07	*0.05*
t-3	-0.01	*0.10*	0.19	*0.15*	-0.06	*0.03*
t-2	-0.07	*0.10*	0.17	*0.17*	-0.01	*0.03*
t-1	**-0.36**	*0.11*	-0.14	*0.18*	0.02	*0.02*
t	**-1.05**	*0.13*	**-0.83**	*0.20*		
t+1	**-1.38**	*0.14*	**-0.87**	*0.19*	**0.30**	*0.04*
t+2	**-1.46**	*0.13*	**-0.82**	*0.20*	**0.43**	*0.05*
t+3	**-1.44**	*0.14*	**-0.70**	*0.19*	**0.53**	*0.09*
t+4	**-1.41**	*0.16*	**-0.61**	*0.22*	**0.59**	*0.09*
t+5	**-1.39**	*0.15*	**-0.59**	*0.22*	**0.59**	*0.10*
t+6	**-1.40**	*0.17*	**-0.60**	*0.24*	**0.59**	*0.13*
t+7	**-1.41**	*0.17*	-0.52	*0.26*	**0.68**	*0.12*
t+8	**-1.43**	*0.18*	**-0.55**	*0.28*	**0.66**	*0.14*
t+9	**-1.43**	*0.19*	**-0.58**	*0.28*	**0.64**	*0.14*
t+10	**-1.41**	*0.18*	**-0.56**	*0.26*	**0.64**	*0.12*
t+11	**-1.50**	*0.19*	-0.52	*0.27*	**0.77**	*0.12*
t+12	**-1.51**	*0.19*	-0.51	*0.26*	**0.79**	*0.12*
Cohort Fixed Effects?						Yes
Time (Year) Fixed Effects?						Yes

Continued on Next Page

Month Relative	Through March 2004		From April 2004		Cumulative Difference Around t	
to Default	**Value**	**SE**	**Value**	**SE**	**Value**	**SE**
Panel B: 90 Day Delinquencies						
t-12	0.00	*0.01*	0.01	*0.03*	**-0.47**	*0.19*
t-11	-0.01	*0.02*	0.04	*0.05*	**-0.46**	*0.18*
t-10	-0.01	*0.03*	0.03	*0.07*	**-0.42**	*0.15*
t-9	-0.02	*0.04*	0.02	*0.08*	**-0.42**	*0.14*
t-8	-0.06	*0.05*	0.04	*0.11*	**-0.42**	*0.12*
t-7	-0.09	*0.05*	0.02	*0.11*	**-0.37**	*0.10*
t-6	**-0.16**	*0.07*	-0.02	*0.12*	**-0.36**	*0.09*
t-5	**-0.27**	*0.08*	-0.03	*0.15*	**-0.33**	*0.08*
t-4	**-0.37**	*0.08*	-0.10	*0.16*	**-0.23**	*0.07*
t-3	**-0.56**	*0.09*	-0.19	*0.17*	**-0.20**	*0.05*
t-2	**-1.04**	*0.11*	**-0.61**	*0.18*	**-0.10**	*0.04*
t-1	**-1.69**	*0.12*	**-1.22**	*0.19*	-0.04	*0.02*
t	**-2.48**	*0.12*	**-2.01**	*0.20*		
t+1	**-2.44**	*0.16*	**-1.70**	*0.21*	**0.27**	*0.07*
t+2	**-2.07**	*0.17*	**-1.36**	*0.23*	**0.24**	*0.09*
t+3	**-1.91**	*0.15*	**-1.24**	*0.21*	**0.21**	*0.07*
t+4	**-1.85**	*0.18*	**-1.21**	*0.23*	**0.17**	*0.08*
t+5	**-1.81**	*0.16*	**-1.17**	*0.23*	**0.17**	*0.07*
t+6	**-1.79**	*0.17*	**-1.16**	*0.25*	0.17	*0.09*
t+7	**-1.84**	*0.18*	**-1.08**	*0.24*	**0.30**	*0.09*
t+8	**-1.77**	*0.18*	**-0.96**	*0.25*	**0.34**	*0.09*
t+9	**-1.82**	*0.18*	**-0.88**	*0.26*	**0.47**	*0.13*
t+10	**-1.86**	*0.19*	**-0.83**	*0.28*	**0.56**	*0.14*
t+11	**-1.88**	*0.19*	**-0.82**	*0.30*	**0.59**	*0.15*
t+12	**-1.88**	*0.20*	**-0.82**	*0.32*	**0.60**	*0.17*
Cohort Fixed Effects?						Yes
Time (Year) Fixed Effects?						Yes

Table A3: Loan and Borrower Characteristics, Full Dataset and Detailed 10,000 Mortgage Subsample

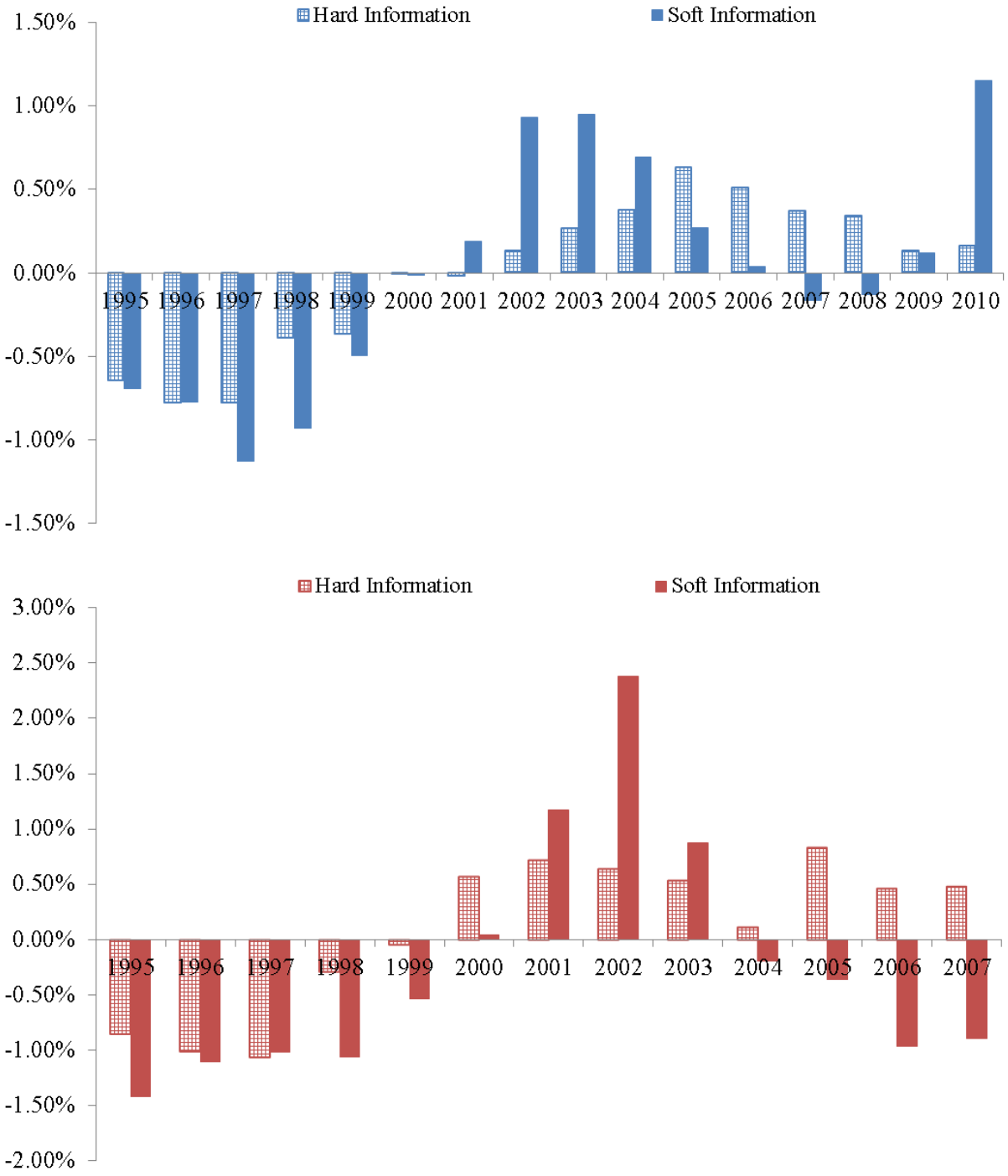
The 10,000 mortgage subsample is a stratified random sample of 1,250 loans in each of eight categories. This table provides sample and full-population means for each of these categories. The eight categories are formed by three splits of the data ($8=2^3$) based on whether the loan is disbursed before/after January 1, 2000, is fixed or variable rate, and ultimately registers a 90 day delinquency. Borrowers with finance related qualifications are primarily those holding bachelors or masters degrees in commerce or business administration.

	Mortgages With No Eventual 90 Day Delinquencies				Mortgages With Eventual 90 Day Delinquencies			
	Disbursed 1995-1999		Disbursed 2000-2004		Disbursed 1995-1999		Disbursed 2000-2004	
Characteristic	**Full**	**Subsample**	**Full**	**Subsample**	**Full**	**Subsample**	**Full**	**Subsample**
Panel A: Variable Rate Mortgages								
Initial Interest Rate (%)	14.64	14.65	11.09	11.09	14.75	14.83	11.87	11.90
Loan Term (Years)	13.07	13.07	13.00	13.01	13.40	13.45	14.01	14.15
Employer Administered Loans	0.16	0.17	0.24	0.23	0.07	0.07	0.12	0.12
Loan Paid by Salary Deduction	30%	31%	23%	21%	12%	13%	10%	9%
Tranched Issuance	0%	0%	0%	0%	0%	0%	0%	0%
Refinancing	0%	0%	5%	7%	0%	0%	4%	5%
Home Extension	6%	6%	6%	8%	5%	5%	5%	5%
Home Improvement	2%	2%	12%	12%	3%	3%	12%	11%
Male Borrower	87%	87%	86%	86%	86%	87%	86%	84%
Married Borrowers	94%	94%	95%	95%	94%	93%	95%	95%
Borrower Age	38.07	38.18	39.79	39.40	37.63	37.20	39.11	38.90
Number of Dependents	1.54	1.50	1.52	1.48	1.55	1.50	1.65	1.63
Loan-Cost Ratio	0.60	0.61	0.70	0.70	0.62	0.62	0.72	0.72
Loan-Income Ratio	3.66	3.65	3.53	3.52	3.68	3.68	3.58	3.59
HSC Equivalent	18%	19%	18%	19%	17%	19%	20%	19%
BA Equivalent	36%	36%	34%	36%	36%	38%	31%	33%
Post-Grad Equivalent	16%	16%	18%	17%	13%	12%	12%	12%
Finance Related Qualification	12%	11%	13%	13%	13%	13%	11%	13%
Panel B: Fixed Rate Mortgages								
Initial Interest Rate (%)	14.65	14.63	10.74	10.78	14.75	14.72	11.69	11.75
Loan Term (Years)	10.45	10.50	11.19	10.95	11.66	11.62	11.73	12.05
Employer Administered Loans	0.00	0.00	0.16	0.15	0.00	0.00	0.04	0.04
Loan Paid by Salary Deduction	26%	28%	27%	26%	14%	12%	14%	15%
Tranched Issuance	0%	0%	0%	0%	0%	0%	0%	0%
Refinancing	0%	0%	2%	3%	0%	0%	1%	0%
Home Extension	7%	7%	7%	7%	6%	5%	6%	5%
Home Improvement	18%	20%	20%	20%	13%	14%	17%	17%
Male Borrower	85%	86%	86%	87%	87%	86%	86%	85%
Married Borrowers	94%	94%	94%	95%	94%	94%	95%	96%
Borrower Age	40.00	39.52	40.46	40.95	39.17	38.94	40.26	40.21
Number of Dependents	1.43	1.36	1.58	1.54	1.54	1.49	1.88	1.84
Loan-Cost Ratio	0.56	0.56	0.68	0.68	0.60	0.60	0.70	0.70
Loan-Income Ratio	3.35	3.35	3.31	3.29	3.47	3.46	3.38	3.42
HSC Equivalent	16%	16%	17%	17%	15%	15%	18%	18%
BA Equivalent	36%	36%	32%	30%	31%	32%	24%	24%
Post-Grad Equivalent	16%	16%	16%	16%	10%	9%	8%	8%
Finance Related Qualification	13%	14%	13%	12%	11%	13%	8%	8%

Figure A1: Decomposition of Cohort Delinquencies Not Explained by Initial Interest Rates, or Loan and Borrower Characteristics into Cohort Quantity and Cohort Average Interest Rate Effects - Issuance Weighted Average of Fixed and Variable Rate Mortgages

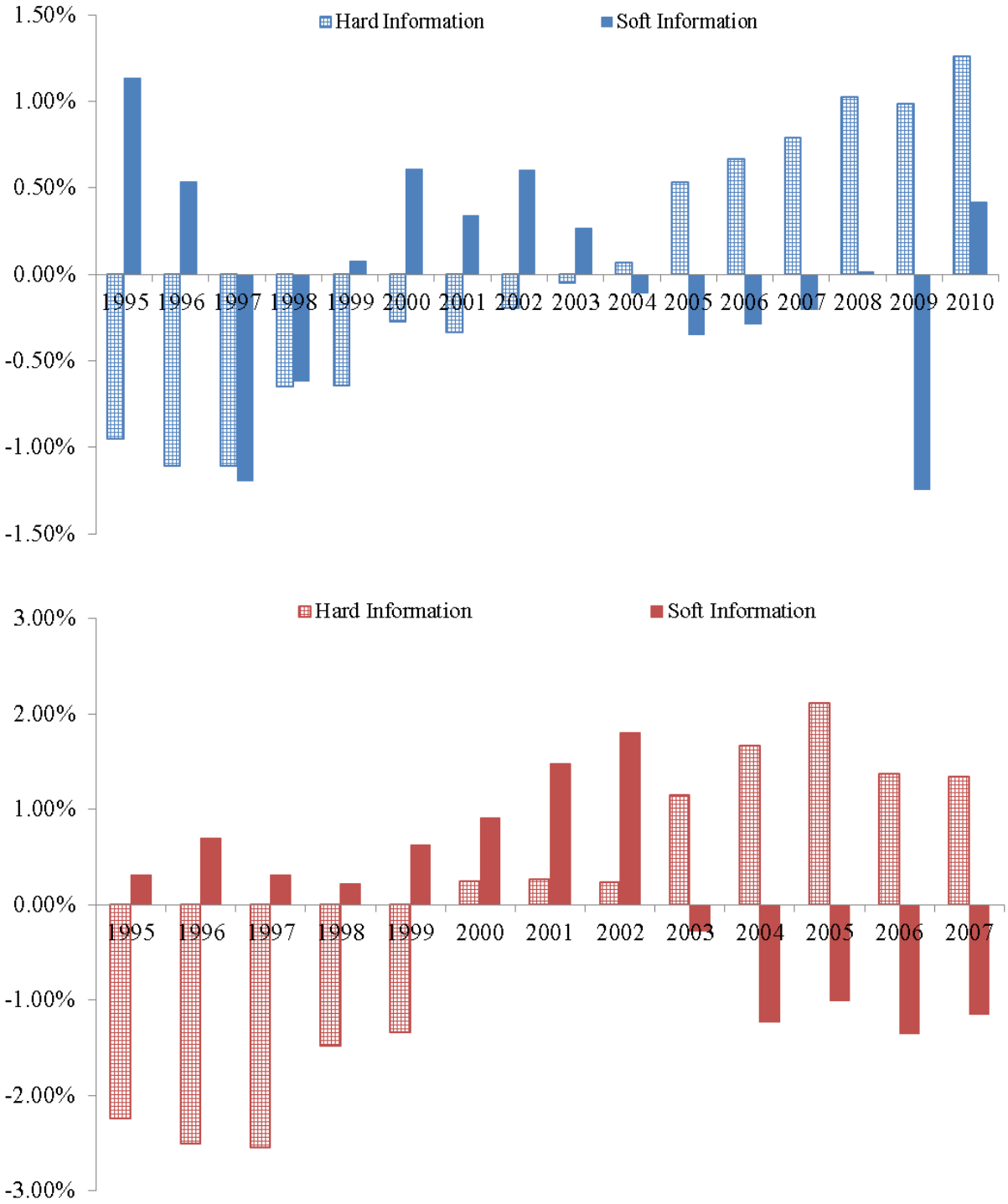
The decomposition is obtained by regressing the cohort fixed effects from the delinquency model (seen as "soft information" in Figure 7) on cohort average initial interest rates. The fitted values from this regression are the cohort average interest rate effects, and the residual is the cohort quantity effect. This decomposition is performed separately for variable and fixed rate mortgages and the issuance weighted average of the decomposition is plotted in the figure.

Figure A2: Abnormal Cohort Delinquencies Attributed to Loan and Borrower Characteristics (Hard Information) and Other Cohort Effects (Soft Information) - Variable Rate Mortgages (Top) and Fixed Rate Mortgages (Bottom)



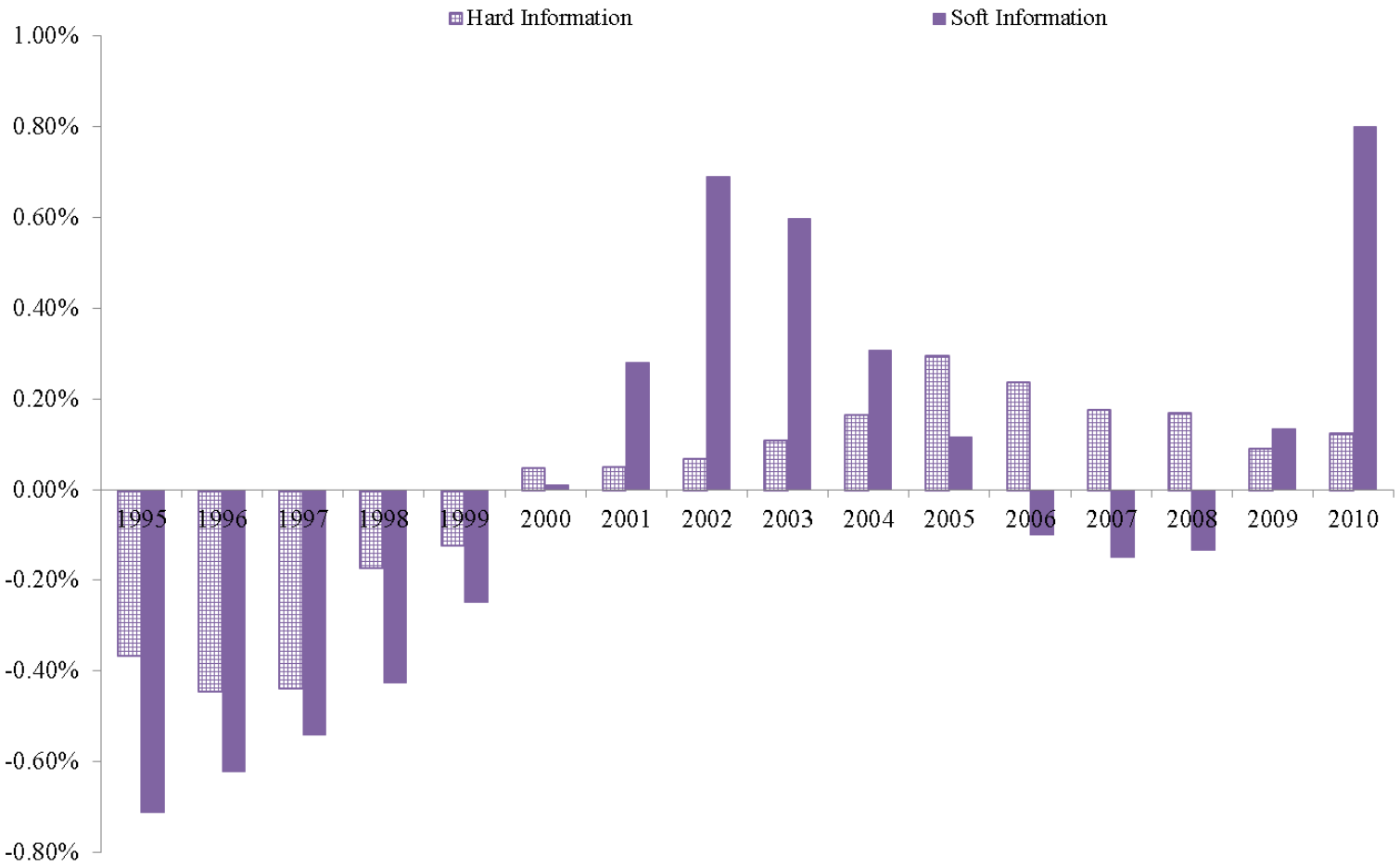
This plot shows the decomposition in Figure 7 performed separately for variable and fixed rate mortgages.

Figure A3: Abnormal Cohort Delinquencies Attributed to Loan and Borrower Characteristics (Hard Information) and Other Cohort Effects (Soft Information) - Variable Rate Mortgages (Top) and Fixed Rate Mortgages (Bottom)



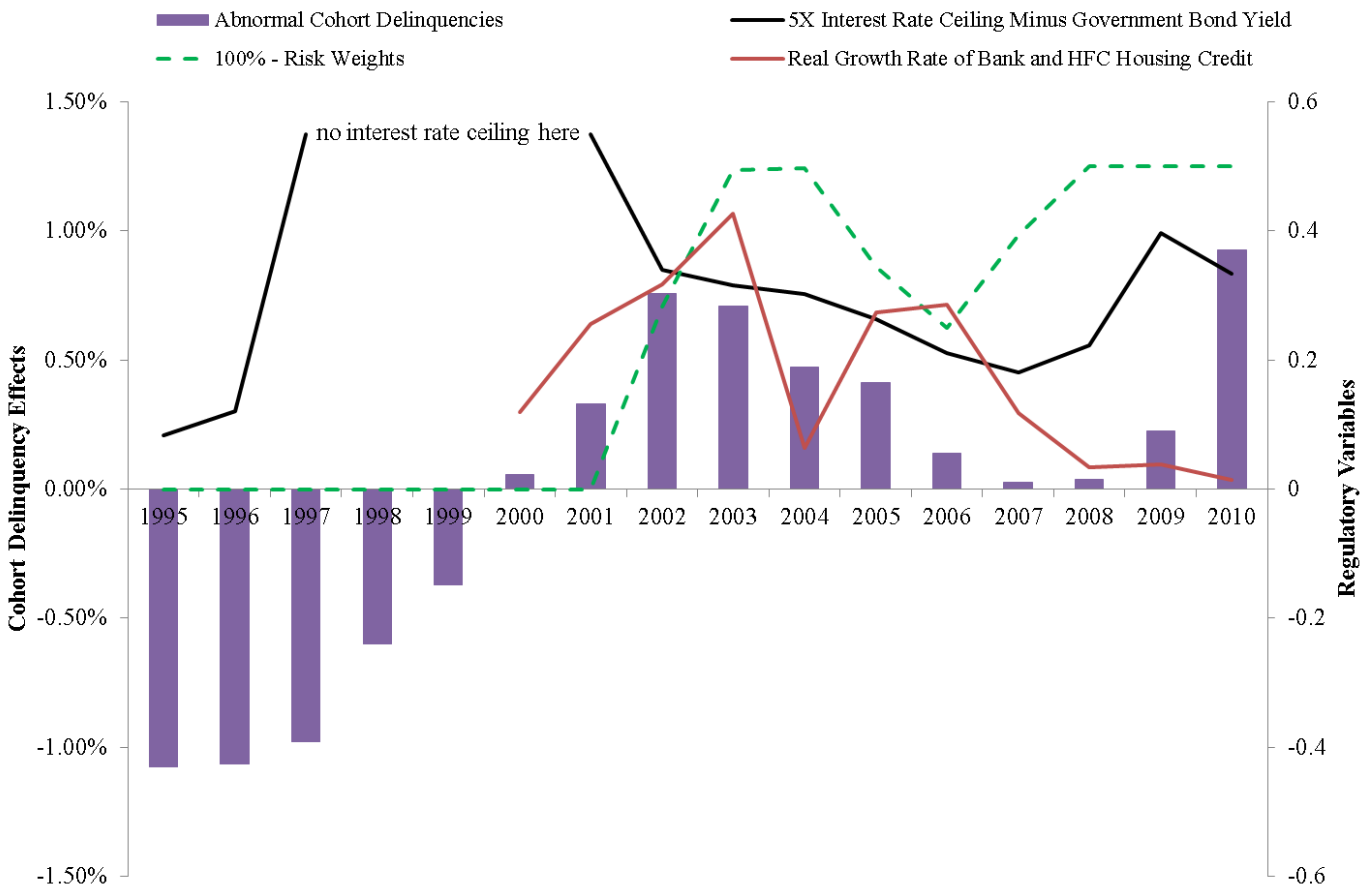
This plot is equivalent to Figure A2 where the yield on three month (for variable rate mortgages) or ten year (for fixed rate mortgages) Indian Government Treasury Bonds is subtracted from the initial interest rate that is included in the delinquency model. This specification assumes that the government yield contains no useful information about defaults.

Figure A4: Abnormal Cohort Delinquencies Attributed to Loan and Borrower Characteristics (Hard Information) and Other Cohort Effects (Soft Information) - Issuance Weighted Average of Fixed and Variable Rate Mortgages - 180 Day Delinquencies



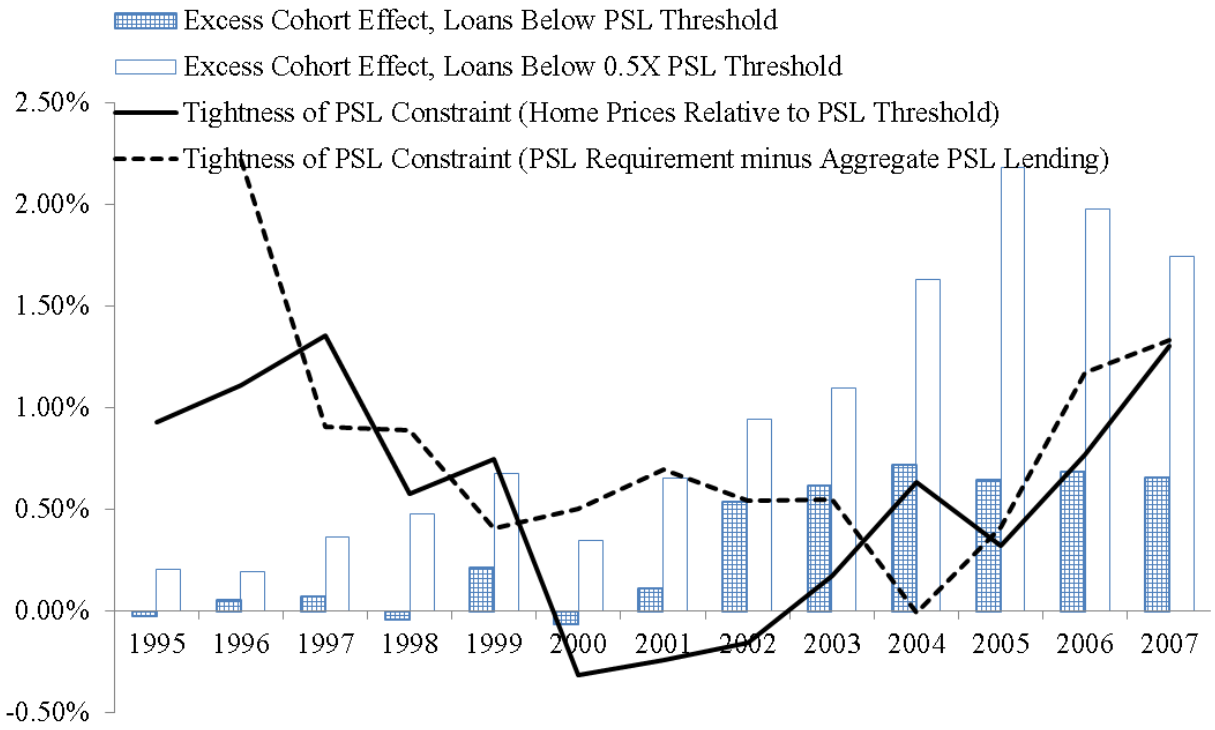
This plot shows the decomposition in Figure 7 constructed using the model to predict 180 day delinquencies instead of 90 day delinquencies.

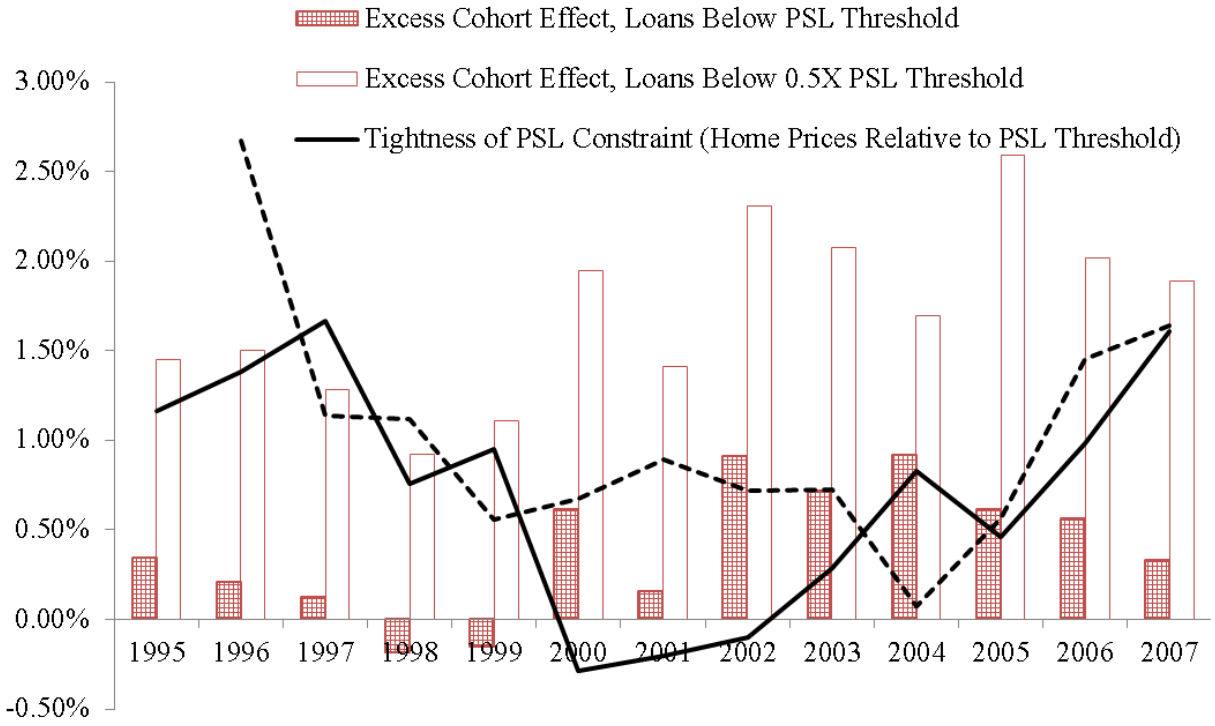
Figure A5: Abnormal Cohort Delinquencies - Issuance Weighted Average of Fixed and Variable Rate Mortgages - 180 Day Delinquencies



This plot shows abnormal cohort delinquencies as in Figure 6, but here they are de-meaned and constructed using the model to predict 180 day delinquencies instead of 90 day delinquencies. The risk weight and interest rate ceiling series are the same as elsewhere (e.g. Figure 7). The real growth of housing credit is computed using data from the National Housing Bank and Reserve Bank of India with use of the World Bank's GDP deflator.

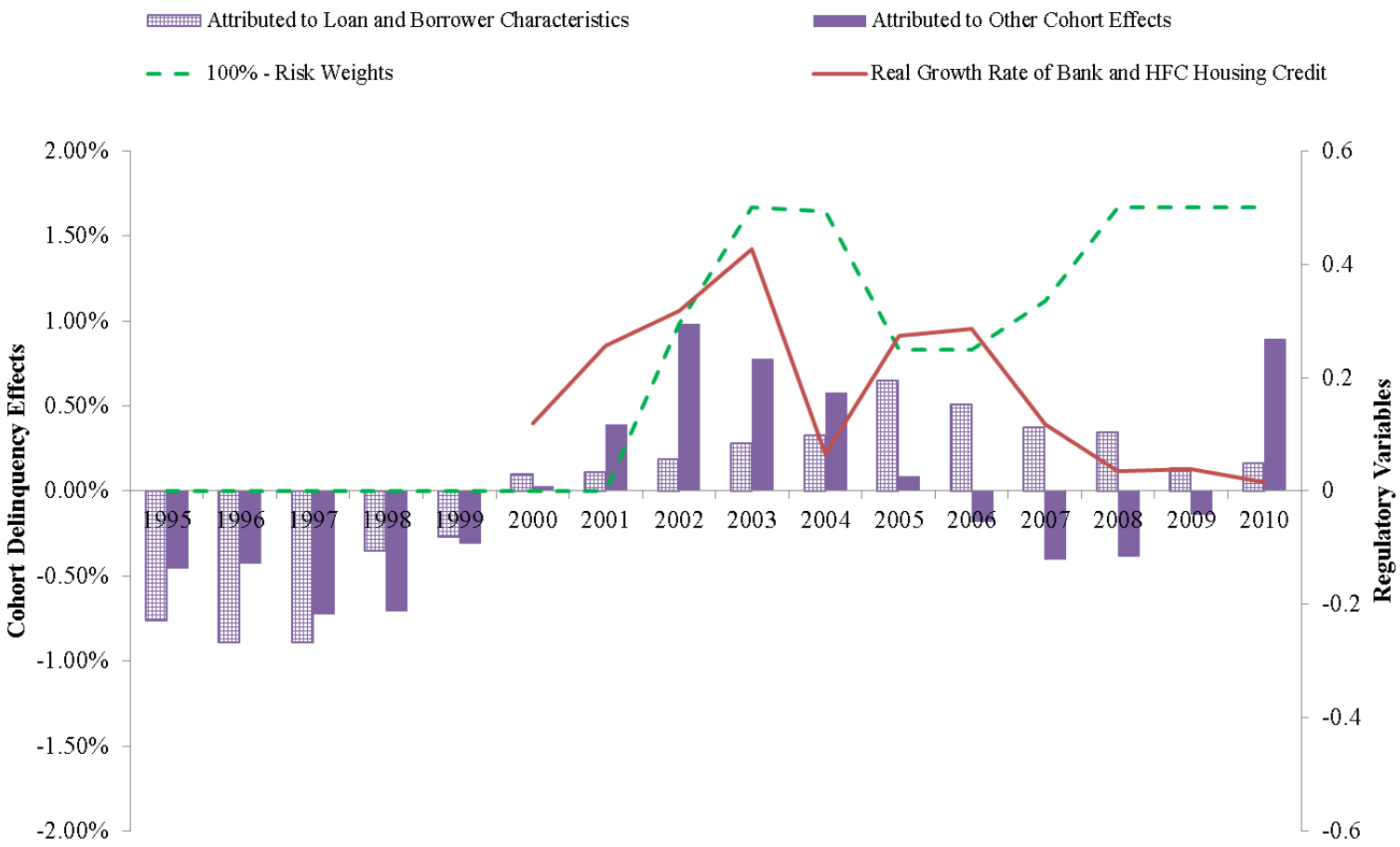
Figure A6: Cohort Effects by Size in Excess of Cohort Effects for Loans Above PSL Thresholds - Variable Rate Mortgages (Top) and Fixed Rate Mortgages (Bottom)





This plot is equivalent to Figure 8 constructed separately for variable and fixed rate mortgages.

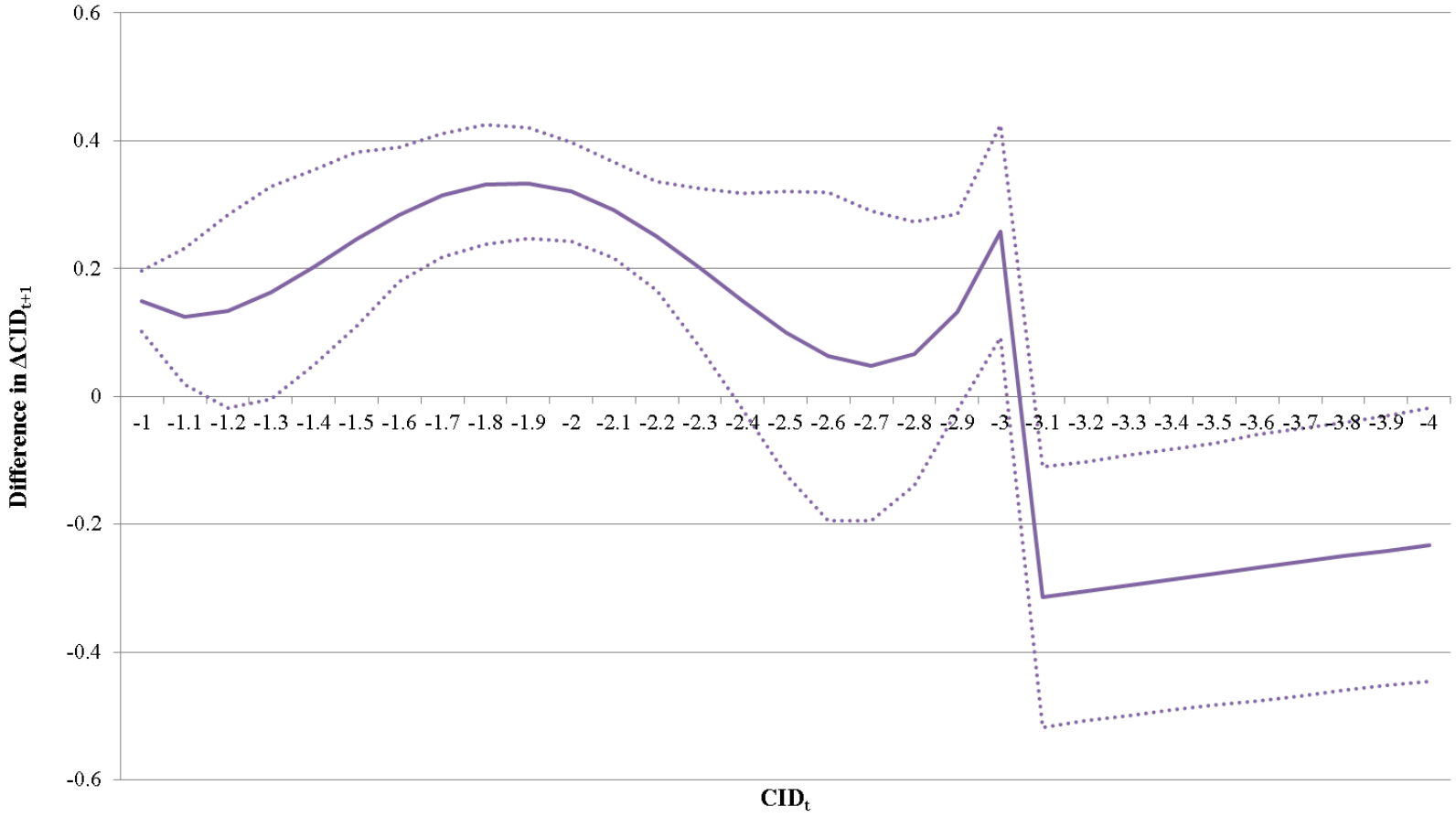
Figure A7: Abnormal Cohort Delinquencies Attributed to Loan and Borrower Characteristics (Hard Information) and Other Cohort Effects (Soft Information) - Issuance Weighted Average of Fixed and Variable Rate Mortgages



This is the equivalent to Figure 7, with a series representing the growth of housing credit plotted alongside and the interest rate ceiling series removed. The real growth of housing credit is computed using data from the National Housing Bank and Reserve Bank of India with use of the World Bank's GDP deflator.

Figure A8: 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} (After minus Before April 2004)



The solid line represents the difference in expected debt collection rates (ΔCID) around delinquencies before and after the April 2004 redefinition of non-performing assets. The expected debt collection rates are produced from regressions of the form described in Figure 10. The dotted lines represent a 90% confidence interval for the difference constructed by bootstrapping the month of the initial 30 day delinquency.