The Impact of Debt Relief Generosity and Liquid Wealth on Household Bankruptcy

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Consumer Bankruptcy in the US

- **Bankruptcy is a major source of debt relief**
  - 1 million households file each year
  - 1/10 Americans have filed at some point in their life
  - Transfers $3\times$ the resources to households as unemp. insurance

- **Trade-offs of generous bankruptcy**
  - Can create moral hazard $\Rightarrow$ discourages lending
  - Helps smooth consumption $\Rightarrow$ provides insurance

This Paper: What Drives Household Bankruptcy?

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- **Analysis II: impact of mortgage payment reductions**
  - **Approach:** IV strategy using variation in contract feature of adjustable-rate mortgages

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- **Analysis II: impact of mortgage payment reductions**
  - **Approach:** IV strategy using variation in contract feature of adjustable-rate mortgages
  - Fixes wealth gain from filing, varies wealth in and out of bankruptcy
  - Isolates a “cash-flow” default motive

Main Findings

- **Empirical Results**
  - $1,000 reduction in generosity leads to a 3% fall in filings
  - $1,000 reduction in payments leads to a 12% fall in filings

- **Model Implications**
  - Relatively stronger cash-flow motive $\Rightarrow$ strong desire to avoid bankruptcy
  - "Other" costs of bankruptcy are large (i.e., stigma, credit market exclusion)

- **Key Conclusions**
  - Moral hazard is a weak driver of bankruptcy
  - Incomplete insurance is a strong driver of bankruptcy
  - Suggests welfare-improving scope for generous bankruptcy

Related Literature & Contributions

Strategic Default: Elul et al. (2010); Guiso, Sapienza, and Zingales (2013); Mayer, Morrison, Piskorski, and Gupta (2014); Eberly and Krishnamurthy (2014); Gerardi, Herkenhoff, Ohanian, and Willen (2017); Bhutta, Dokko, and Shan (2017); Ganong and Noel (2018); Dobbie and Song (2018); Gupta and Hansman (2018); Hsu, Matsa, and Melzer (2018)

Trade-Offs of Generous Bankruptcy: Li and Sarte (2006); Livshits, MacGee, and Tertilt (2007); Chatterjee, Corbae, Ríos-Rull, and Nakajima (2007); Elul and Gottardi (2015); Mitman (2016); Dávila (2016); Auclert, Dobbie, and Goldsmith-Pinkham (2019); Gross, Kluender, Liu, Notowidigdo, and Wang (2019); Auclert and Mitman (2019)

Causes of Bankruptcy Fay, Hurst, and White (2002); Gross and Notowidigdo (2011); Gross, Notowidigdo, and Wang (2014); Mahoney (2015); Keys (2018); Kleiner, Stoffman, and Yonker (2019)

Effects of Mortgage Payment Reductions: Di Maggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao (2017); Fuster and Willen (2017); Campbell, Clara, and Cocco (2018); Gupta (2019)

Regression Kink Designs: Calonico, Cattaneo, and Titiunik (2014); Card, Lee, Pei, and Weber (2015); Pei and Yi (2017); Ganong and Jäger (2018)

Institutional Background & Data

Determination of Debt Relief Generosity in Bankruptcy

- **State asset exemption laws:**
  - Limit amount of assets filers can keep in bankruptcy
  - Homestead exemptions protect home equity

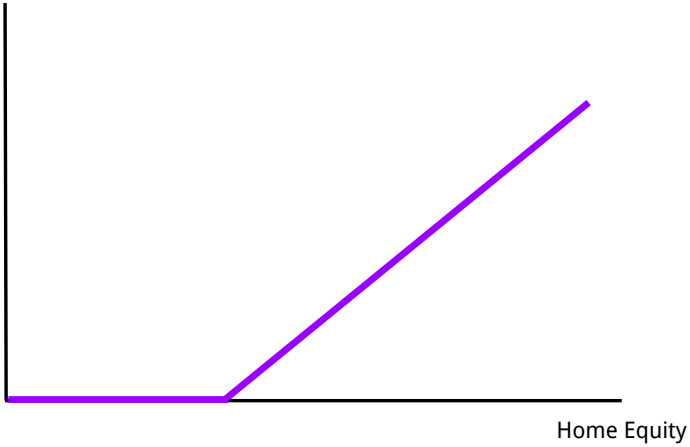
- In state s, household i's financial benefit from bankruptcy is:

$$\text{Benefit}_{i,s} = \text{Dischargeable Debt}_i - \text{Seizable Assets}_{i,s} - \text{Filing Costs}_{i,s}$$

The Homestead Exemption

Seizable home equity = max(home equity - exemption, 0)

equity distance



Main Data: CoreLogic's LLMA

- CoreLogic's Loan-Level Market Analytics (LLMA):
  - Panel of 45% of mortgages originated in the US over 2000-2016
  - Tracks mortgages and bankruptcy filings over time
- Measuring home equity
  - Project initial home value forward over time using Zillow's ZIP-level price index

▸ States Used ▸ Coverage

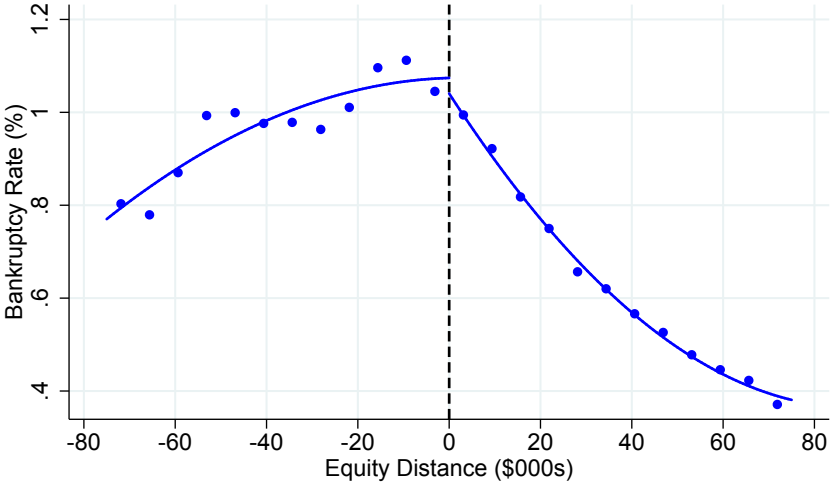
Empirical Analysis I: The Strategic Bankruptcy Motive

Empirical Strategy: Regression Kink Design (RKD)

- **Goal:** estimate impact of debt relief generosity in bankruptcy on filing
- **Identification Challenges:**
  - Unobserved factors affecting both wealth and filing
  - Exclusion restriction (unsecured credit)
- **Approach:** RKD exploiting kink in seizable home equity
  - **Intuition:** est. change in relationship between equity distance and filing at exemption limit
  - **Key Assumption:** unobs. factors are not kinked functions of equity distance

▸ Identification Intuition ▸ Identification Details ▸ Estimator Definition ▸ Smooth Density Tests

Kink in Bankruptcy Cost $\Rightarrow$ Kink in Filing Rate



▸ More Variability ▸ Wider Range

Measurement Error in RKDs

- Imputing home equity $\Rightarrow$ measurement error
- Measurement error creates non-standard problems for an RKD (sharp and fuzzy)
- **New approach:** assume curves *are* quadratic (instead of approx.) within bandwidth
  - Yields new characterization for bias due to classical measurement error
  - Implies attenuation bias – larger when more obs. assigned to wrong side of cutoff
- Implement bias correction using subsample of 200k home sales

▸ Details

Sensitivity of Filing to Financial Cost (RK Results)

Percent change in filings given $1,000 increase in seizable equity:

	(1) Benchmark	(2) ME-Corrected
RK estimate $\left(\widehat{\frac{\partial p}{\partial s}}\right)$	-1.64***	-3.42***
	(0.21)	(0.44)
Bandwidth	67.07	67.07
Observations	46,026,140	46,026,140

Notes: Coefficients are scaled to correspond to the annual % change in filings per $1,000 increase in seizable equity. RKD: Optimal bandwidth selection, approximation bias correction, and construction of the robust standard errors follows Calonico, Cattaneo, and Titiunik (2014). Estimation uses a uniform kernel. Statistical significance: 0.05*, 0.01**, 0.001***.

- Implies 0.025 percentage point fall in annual filing rate (sample avg: 0.72%)

▸ Various Bandwidths ▸ Ganong-Jäger Permutation Test ▸ Heterogeneity

Empirical Analysis II: The Cash-Flow Bankruptcy Motive

The Cash-Flow Bankruptcy Motive

- **Goal:** estimate impact of non-seizable cash-flows on bankruptcy filing
- **Challenge:** finding exogenous shocks to non-seizable resources
  - Non-seizability important for isolating cash-flow motive
- **Approach:** instrument for mortgage payment reductions
  - Variation comes from adjustable-rate mortgage (ARM) reset rules (similar to Gupta, 2019)
- **Mortgage payment reductions**
  - Payment reductions not generally seizable in bankruptcy
  - Mortgage debt is not discharged in bankruptcy

Identification: ARM Index

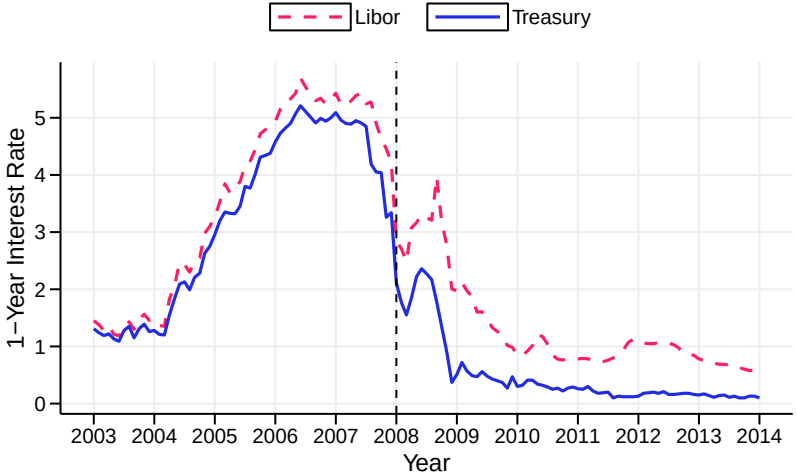
- **ARMs** (adjustable-rate mortgages)
  - Rate initially fixed (usually +5 years)
  - New Rate = Pre-Specified Margin + Index Rate

- Popular indexes: 1-year Libor and Treasury rates
  - Libor: daily average interbank loan rate
  - Rate often chosen to match denomination of MBS investors' cost of funds

- Libor and Treasury households have similar mortgage and regional characteristics

▸ Summary Statistics ▸ Testing for Differences

Identification: Libor-Treasury Divergence



- $\Rightarrow$ Treasury-indexed ARMs reset to much lower rates
- Payment difference for median loan peaked at $4,191 per year

Econometric Specification (IV)

- **Goal:** estimate β, instrumenting for MPay_i with IndexRate_i

$$B_{ict} = \beta \text{MPay}_i + \alpha_c + \tau_t + \gamma X_{ict} + \epsilon_{ict}$$

  - $B_{ict} = 1$ if household i in location c files bankruptcy in month t
  - $\text{MPay}_i =$ annual payment component determined by the index rate
  - $\text{IndexRate}_i =$ value of i's index rate upon reset

- **Expect negative OLS bias:** low-risk households can get bigger mortgages
- **Exclusion Restriction:** index rate only affects filing through payment
- **Sample:** restrict to 12 months following reset for non-delinquent ARMs

IV Estimation Results

Percent change in filings given $1,000 increase in mortgage payment:

	(1)	(2)	(3)	(4)
$MPay_i$	30.72***	27.49***	33.49***	29.98***
	(7.36)	(7.64)	(8.48)	(8.71)
Stage 1 F-Stat.	20.69	18.50	17.11	15.63
Observations	1,092,072	1,092,072	1,092,072	1,092,072
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓

Notes: All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. Statistical significance: 0.05*, 0.01**, 0.001***.

▸ 1st Stage ▸ IV vs. OLS ▸ Placebo Test

Comparing the Strategic and Cash Flow Motives

Estimate Comparison

- Steps to make cash-flow motive estimate comparable
  - Scale IV estimate to reflect response to change in NPV of mortgage payments
  - Re-weight ARM sample to match RKD on covariates (DiNardo, Fortin, and Lemieux, 1996)
  - Yields cash-flow motive estimate: 12.61*** (SE: 3.57)
- $1,000 reduction in generosity leads to a 3.42% fall in filings
- $1,000 reduction in payments leads to a 12.61% fall in filings

▸ Anticipatory Behavior ▸ NPV Estimation ▸ DFL Details ▸ Adjustment Results (More)

Theoretical Implications

- **Model Setting**
  - Household faces stochastic wealth shocks and incomplete markets
  - Has option to file for bankruptcy, decision follows a threshold rule
  - Strategic and cash-flow motive estimates corresponds to comparative statics

Model | Result | Proof | Robustness | "Other" Costs

Theoretical Implications

- **Model Setting**
  - Household faces stochastic wealth shocks and incomplete markets
  - Has option to file for bankruptcy, decision follows a threshold rule
  - Strategic and cash-flow motive estimates corresponds to comparative statics
- **Main Result**
  - $\frac{\text{cash-flow motive}}{\text{strategic motive}} \propto$ decrease in marginal utility when filing (for marginal filer)
  - Relatively stronger cash-flow motive $\Rightarrow$
    - Marginal filer expects larger consumption increase when filing
    - "Other" costs of bankruptcy are large (e.g., stigma or dynamic costs)
  - Note: full info benchmark assumes household observes variation in bankruptcy generosity

▸ Model ▸ Result ▸ Proof ▸ Robustness ▸ "Other" Costs

Conclusion

Conclusion

- Estimate strength of strategic and cash-flow bankruptcy motives
  - Use RKD and natural experiment
  - Find cash-flow motive is 4x stronger than the strategic bankruptcy motive
- Behavior consistent with "other" costs of bankruptcy being large
- Suggests welfare-improving scope for generous bankruptcy

Thanks!

Appendix

Smooth Density Tests

- **Test 1:** continuous equity distance distribution
  - Idea: manipulation around exemption limit $\Rightarrow$ discontinuous density
  - **Estimated discontinuity:** 1.21% (p-value = 0.24) ✓
- **Test 2:** smooth predetermined covariates
  - Estimate linear probability model using predetermined covariates
  - Household and mortgage info, ZIP HP growth, county-time FE
  - Test for jump or kink in predicted filing rate
  - **Estimated kink:** -0.04% per $1,000 (p-value = 0.28) ✓
  - **Estimated discontinuity:** -0.15% (p-value = 0.47) ✓

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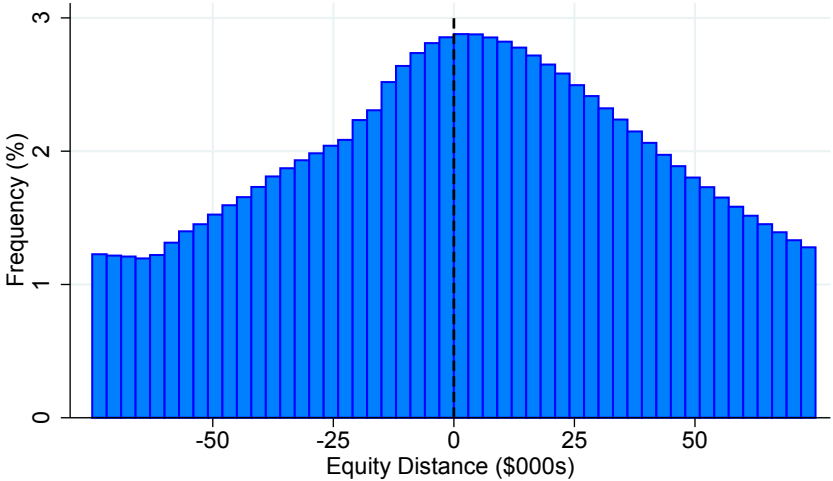
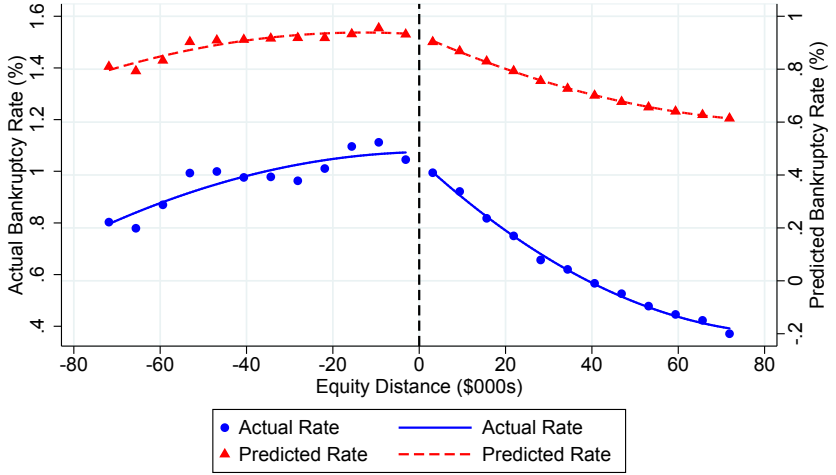
Smooth Density Tests: Equity Distance Distribution



Full Distribution | Go Back

Smooth Density Tests: Predicted Filing Rate



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RKD Measurement Error Correction

The measurement-error-corrected estimator is

$$\widehat{\tau}^{PRK-ME} = \frac{\widetilde{\beta}_1^+ - \widetilde{\beta}_1^-}{S'(D)^+ - S'(D)^-}$$

where

$$\widetilde{\beta}_1^+ - \widetilde{\beta}_1^- \equiv \left[\left(1 - \frac{\widehat{\sigma}_\mu^2}{\widehat{\sigma}^2}\right)(1 - \widehat{\pi^+} - \widehat{\pi^-})\right]^{-1} \left(\widehat{\beta}_1^+ - \widehat{\beta}_1^-\right) \xrightarrow{p} (\beta_1^+ - \beta_1^-)$$

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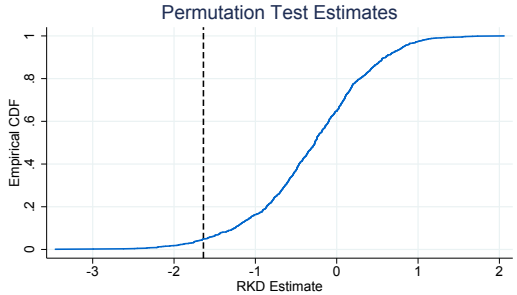
Permutation (Placebo) Test

- **Permutation test** (Ganong and Jäger, 2018)
  - Conservative, alternative approach to inference
  - Randomly reassign states' exemption histories and re-estimate RKD
  - Compare actual estimate to distribution of 1,000 placebo estimates



- Reject no effect (p-value 0.098)

Heterogeneity

Percent change in filings given $1,000 increase:

	Income (ZIP)		Unemp. Rate (County)		Yearly HP Growth (ZIP)	
	Low	High	Low	High	Low	High
RK Est. $\left(\widehat{\frac{\partial p}{\partial s}}\right)$	-2.74***	-2.68***	-1.82***	-1.51***	-2.26***	-0.78*
	(0.33)	(0.44)	(0.22)	(0.25)	(0.21)	(0.34)
Obs. (mil.)	16,586,486	20,063,488	24,898,146	22,740,920	18,672,092	18,737,706

	Orig. FICO		Orig. LTV		Predicted P(file)	
	Low	High	Low	High	Low	High
RK Est. $\left(\widehat{\frac{\partial p}{\partial s}}\right)$	-2.96***	-0.34^{+}	-1.46***	-2.47***	-0.30*	-1.51***
	(0.35)	(0.18)	(0.23)	(0.26)	(0.12)	(0.31)
Obs. (mil.)	19,507,407	18,221,361	23,135,018	24,751,526	12,843,168	11,846,132

Notes: For each covariate I split the sample into two subsets with below and above average values of a single covariate. The coefficients and standard errors are scaled by 1e-8 for readability. Optimal bandwidth selection, bias-correction, and construction of the robust standard errors follows Calonico, Cattaneo, and Titiunik (2014). Estimation uses a uniform kernel. Statistical significance: 0.1^{+}, 0.05*, 0.01**, 0.001***.

▸ Kink Graphs ▸ Yearly ▸ Time Period Splits ◂ Go Back

RKD: Time Period Splits

	(1)	(2)	(3)
	Pre-Reform	**Rush to File**	**Post-Reform**
RK Est.	-1.55***	-7.48***	-1.41***
	(0.37)	(1.53)	(0.20)
Bandwidth	72.64	56.76	70.07
Obs. (mil.)	11.12	1.64	34.51
	Pre-Recession	**Recession**	**Post-Recession**
RK Est.	-1.23***	-2.73***	-1.36***
	(0.28)	(0.46)	(0.28)
Bandwidth	72.64	56.760	70.07
Obs. (mil.)	11.12	1.64	34.51

Notes: Each column is the result of estimating the RKD on different sample periods. The pre-reform era is 2000 Q1 to 2005 Q2, the rush to file era includes 2005 Q3 and Q4, and the post-reform era includes 2006 Q1 to 2016 Q1. The pre-recession period is defined as 2006 Q1 to 2007 Q4, the recession era is 2008 Q1 to 2010 Q4, and the post-recession period is 2011 Q1 to 2016 Q1. All specification choices match those of the baseline specification. Statistical significance: 0.1+, 0.05*, 0.01**, and 0.01***.

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IV vs. OLS

Percent change in filings for Libor vs. Treasury-indexed ARMs:

	(1)	(2)	(3)	(4)
	IV			
$MPay_i$	30.72***	27.49***	33.49***	29.98***
	(7.36)	(7.64)	(8.48)	(8.71)
	OLS			
$MPay_i$	3.03	2.49	2.46	2.35
	(1.87)	(1.91)	(1.96)	(2.23)
Obs.	1,094,998	1,094,998	1,094,998	1,094,998
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓

Notes: All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. Statistical significance: 0.05*, 0.01**, 0.001***.

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ARM Placebo Test

Percent change in filings for Libor vs. Treasury-indexed ARMs:

	(1)	(2)	(3)	(4)
Libor_i	3.93	0.25	-0.53	3.70
	(10.93)	(10.68)	(10.83)	(11.34)
Obs.	1,094,998	1,094,998	1,094,998	1,094,998
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓

Notes: These regressions use data on bankruptcy filings *prior* to the interest rate reset. All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. Statistical significance: 0.05*, 0.01**, 0.001***.

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IV Estimation Results

Percent change in filings given $1,000 increase in mortgage payment:

	(1)	(2)	(3)	(4)
	2nd stage (outcome = filing increase per $1k)			
$MPay_i$	30.72***	27.49***	33.49***	29.98***
	(7.36)	(7.64)	(8.48)	(8.71)
	1st stage (outcome = annual mortgage payment)			
Index $Rate_{ict}$	1,275***	1,253***	1,384***	1,397***
	(105.97)	(110.08)	(126.52)	(133.54)
Stage 1 F-Stat.	20.69	18.50	17.11	15.63
Observations	1,092,072	1,092,072	1,092,072	1,092,072
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓

Notes: All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. Statistical significance: 0.05*, 0.01**, 0.001***.

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Cash-Flows vs. Expectations: Anticipatory Behavior

Regression using data in 12 months *prior* to reset:

$$B_{ict} = \beta_1 \text{IndexRate}_i + \beta_2 \left(\text{IndexRate}_i \times 2007_t\right) + \alpha_c + \alpha_t + \gamma X_{ict} + \epsilon_{ict}$$

	(1)	(2)	(3)	(4)
IndexRate_i	-0.04	-3.90	-5.90	-1.53
	(11.67)	(11.56)	(11.68)	(12.44)
IndexRate_i x 2007_t	-20.38	-19.69	-14.81	-11.56
	(12.01)	(12.24)	(12.05)	(14.37)
Observations	1,094,998	1,094,998	1,094,998	1,094,998
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓

Notes: I scale coefficient and standard errors on the IndexRate_{ict} covariates so that the coefficient corresponds to the relative (percent) change in the filing rate per 1% increase in the index rate. All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. Statistical significance: 0.05*, 0.01**, 0.001***.

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Estimating Expected Mortgage Payments

- Expected NPV of payments conditional on information in month τ:

$$M_\tau^{NPV} = \underbrace{s_\tau(1-\delta)M_\tau}_{\text{current payment}} + \underbrace{\sum_{j=1}^{360-\tau} s_{\tau+j}(1-\delta)\frac{\mathbb{E}_\tau(M_{\tau+j})]}{1+r}}_{\text{future payments}}$$

- If households believe payments are martingale ($\mathbb{E}_\tau(M_{\tau+j}) = M_\tau$) then

$$M_\tau^{NPV} = M_\tau \sum_{j=0}^{360-\tau} \frac{s_{\tau+j}(1-\delta)}{(1+r)^j} \equiv M_\tau\theta$$

Param.	Value	Meaning	Source
$\{s_t\}_{60\leqslant t\leqslant 360}$	Median: 7 yrs	Survival rate	Estimate using CoreLogic
δ	1.63%	Delinquency rate	Estimate using CoreLogic
r	4.39%	Discount rate	Avg. annual 30-yr FRM rate
$\theta/12$	6.22	Scaling factor	

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Composition Adjustment via Re-weighting

Step 1: Probit Regression

Using RKD and ARM samples, estimate $\widehat{p}_i \equiv P(i \in \text{RKD sample})$ as a function of characteristics of interest

Step 2: Construct Weights

$$w_i = \frac{\widehat{p}_i}{1-\widehat{p}_i} \times \left[\frac{\sum_i^N \mathbf{1}(i \in \text{RKD sample})/N}{1-\sum_i^N \mathbf{1}(i \in \text{high group})/N} \right]$$

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Strategic vs. Cash-Flow Motive: Results

		Composition-Adjusted	
		✗	✓
NPV-Adjusted	✗	29.98***	78.45***
		(8.71)	(22.22)
	✓	4.82***	12.61***
		(1.43)	(3.57)
Stage 1 F-Stat.		15.63	26.91

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Setting

- Representative household lives for two periods

Go Back

Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

$$c_t^B \quad , \quad t = 1, 2 \qquad\qquad c_1^N \qquad c_2^N$$

Go Back

Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

$$c_t^B = a \quad , \quad t = 1, 2$$

$$c_1^N = a$$
$$c_2^N = a$$

- a: non-seizable endowment

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Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

Go Back

$$c_t^B = a \quad , \quad t = 1, 2$$

$$c_1^N = a + y_1$$
$$c_2^N = a + y_2$$

- a: non-seizable endowment
- y_t: stochastic income

Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

Go Back

$$c_t^B = a + e, \quad t = 1, 2$$

$$c_1^N = a + y_1$$
$$c_2^N = a + y_2$$

- a: non-seizable endowment
- e: exempt assets
- y_t: stochastic income

Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

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$$c_t^B = a + e, \quad t = 1, 2$$

$$c_1^N = a + y_1 - R_1 d_1 + d_2$$
$$c_2^N = a + y_2 - R_2 d_2$$

- a: non-seizable endowment
- e: exempt assets
- y_t: stochastic income

- d_t: initial debt
- R_t: gross interest rate

Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

$$c_t^B = a + e, \quad t = 1, 2$$

$$c_1^N = a + y_1 - R_1 d_1 + d_2$$
$$c_2^N = a + y_2 - R_2 d_2$$

- Period 1 value functions:

$$V_1^B = u(c_1^B)$$

$$V_1^N(y_1, d_1) = \max_{d_2} \; u(c_1^N)$$

- a: non-seizable endowment
- e: exempt assets
- y_t: stochastic income
- d_t: initial debt
- R_t: gross interest rate

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Setting

- Representative household lives for two periods
- Consumption when filing for Bankruptcy and Not filing:

$$c_t^B = a + e, \quad t = 1, 2$$

$$c_1^N = a + y_1 - R_1 d_1 + d_2$$
$$c_2^N = a + y_2 - R_2 d_2$$

- Period 1 value functions:

$$V_1^B = u(c_1^B) - \sigma$$

$$V_1^N(y_1, d_1) = \max_{d_2} \; u(c_1^N)$$

- a: non-seizable endowment
- e: exempt assets
- y_t: stochastic income
- σ: utility penalty of bankruptcy
- d_t: initial debt
- R_t: gross interest rate

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Setting

- Representative household lives for two periods

Go Back

- Consumption when filing for Bankruptcy and Not filing:

$$c_t^B = a + e, \quad t = 1, 2$$

$$c_1^N = a + y_1 - R_1 d_1 + d_2$$
$$c_2^N = a + y_2 - R_2 d_2$$

- Period 1 value functions:

$$V_1^B = u(c_1^B) - \sigma + \mathbb{E}_1^B \left[V_2^N(y_2, 0) \right]$$

$$V_1^N(y_1, d_1) = \max_{d_2} \; u(c_1^N) + p_2 \mathbb{E}^N \left(V_2^B \right) + (1 - p_2) \mathbb{E}^N \left[V_2^N(y_2, d_2) \right]$$

- a: non-seizable endowment
- e: exempt assets
- y_t: stochastic income
- σ: utility penalty of bankruptcy
- d_t: initial debt
- R_t: gross interest rate
- p_t: bankruptcy probability

Cash-Flow vs. Strategic Motive

Result: Mapping to Preferences

The relative strength of the cash-flow vs. strategic motive is

$$\frac{-\partial p_1/\partial a_1}{\partial p_1/\partial e_1} = \frac{u'(c_1^{N\star}) - u'(c_1^B)}{u'(c_1^B)}.$$

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Cash-Flow vs. Strategic Motive

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$$\frac{-\partial p_1/\partial a_1}{\partial p_1/\partial e_1} = \frac{u'(c_1^{N\star}) - u'(c_1^B)}{u'(c_1^B)}.$$

- Implications a stronger cash-flow motive: $\left(-\frac{\partial p_1}{\partial a_1} >> \frac{\partial p_1}{\partial e_1}\right)$:
  - Marginal filer's consumption gain is large: $c_1^B >> c_1^{N\star}$
  - But other costs of filing (dynamic costs or stigma) must be large

$$u(c_t^B) - \sigma + \mathbb{E}^B(V_{t+1}) = \max_{d_{t+1}} \; u(c^{N\star}) + \mathbb{E}^N(V_{t+1})$$

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"Other" Costs of Bankruptcy

- **Stigma**
  - 82% of HHs say default is morally wrong when able to pay (Guiso, Sapienza, and Zingales, 2013)
  - Moral messages can reduce credit card delinquency (Bursztyn, Fiorin, Gottlieb, and Kanz, 2017)
- **Dynamic credit market costs**
  - Filers see significant increases in credit after flag removal (Musto, 2004; Dobbie et al., 2017; Gross et al., 2018)
  - But insolvent non-filers fare worse in terms of credit access (Albanesi and Nosal, 2018)
- **Dynamic labor market costs**
  - Bankruptcy flags can reduce employment, may signal bad type (Bos, Breza, and Liberman, 2018)
  - Chapter 13 protection can bolster earnings (Dobbie and Song, 2015)

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Bankruptcy Comparative Statics

- **Filing decision:**
  - Prefer to file when $V_t^B > V_t^N(d_t, y_t)$
  - Decision follows threshold rule: file if $y_t < y_t^\star$
  - Probability of filing: $p_t = P[y_t < y_t^\star(d_t)] = F[y_t^\star(d_t)]$

- Effect of a change to period 1's e or a:

$$\underbrace{\frac{\partial p_1}{\partial e_1} = f(y_1^\star)\frac{\partial y_1^\star}{\partial e_1}}_{\text{Strategic Motive}}, \qquad \underbrace{\frac{\partial p_1}{\partial a_1} = f(y_1^\star)\frac{\partial y_1^\star}{\partial a_1}}_{\text{Cash-Flow Motive}}$$

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Bankruptcy Comparative Statics: Shifts in the Threshold

- Threshold $y_1^\star$ characterized by indifference condition:

$$V_1^B = V_1^N(y_1^\star, d_1)$$

- Implicitly differentiating the indifference condition yields:

$$\frac{\partial y_1^\star}{\partial e_1} = \frac{u'(c_1^B)}{u'(c_1^{N\star})} > 0, \qquad \frac{\partial y_1^\star}{\partial a_1} = \frac{u'(c_1^B) - u'(c_1^{N\star})}{u'(c_1^{N\star})}$$

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Extensions

- **Dynamic model:** no change
- **Allowing filers to save:** no change
- **Heterogeneity:** recast in terms of average marginal filer
- **Asset adjustment costs or borrowing constraints**: no change if marginal changes in e and a don't switch constraints on/off
- **Institutional Features:**
  - Credit market exclusion for filers: unchanged
  - Delinquency (informal default): unchanged
    (non-filing MU may correspond to MU in delinquency)

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ARM Summary Statistics

Data: ARMs originated in 2003-2008 (CoreLogic)

	Libor			Treasury		
	Mean	SD	N	Mean	SD	N
Orig. Bal.	289.2	200.56	51,164	254.23	192.4	45,186
Orig. LTV	74.45	12.55	51,164	71.24	15.58	45,186
FICO	727.4	47.87	48,237	727.2	50.4	43,044
Own. Occ.	82.16		50,423	85.93		45,184
UR (county)	9.31	2.51	51,134	9.30	2.49	45,157
Med. Inc (county)	58.91	15.21	51,164	59.94	14.69	45,186

Notes: All values in thousands of 2010 dollars or %.

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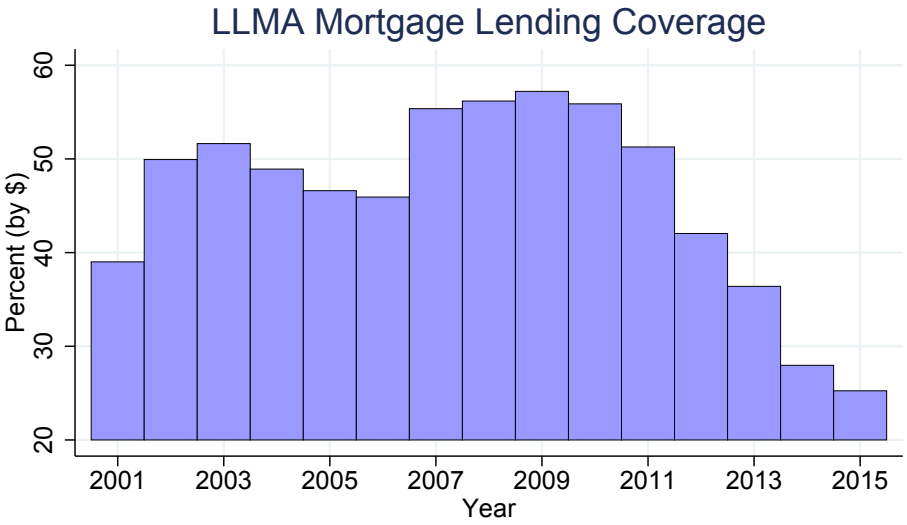
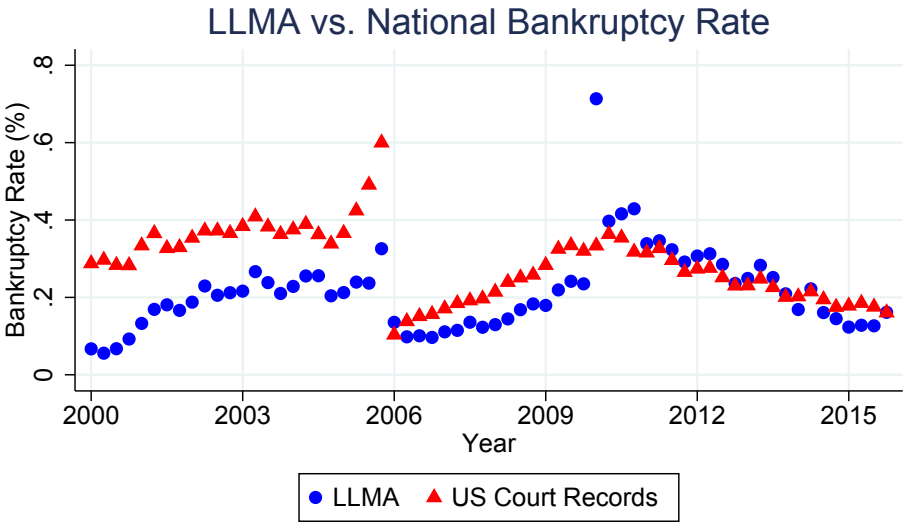
LHS: Libor Dummy

	(1)	(2)	(3)	(4)
Margin$_i$	-35.40***	-36.01***	-38.79***	-44.88***
	(1.71)	(1.74)	(2.02)	(3.30)
Old Pay.$_i$	0.04	0.05	0.08	0.03
	(0.05)	(0.05)	(0.05)	(0.06)
Orig. FICO$_i$	0.001	-0.01**	-0.01**	-0.01
	(4e-3)	(4e-3)	(4e-3)	(0.01)
Orig. LTV$_i$	0.27***	0.22***	0.20***	0.21***
	(0.02)	(0.02)	(0.02)	(0.02)
ln(Orig. Bal.)$_i$	0.03*	0.01	2e-3	0.02
	(0.01)	(0.01)	(0.01)	(0.02)
UR$_{ct}$ %	-0.29	-0.33	-0.46	
	(0.41)	(0.36)	(0.38)	
ln(Med. Inc.)$_{ct}$	0.18	0.23	0.24	
	(0.22)	(0.19)	(0.18)	
Δ ln(HP)$_{zt}$	-1e-4	3e-3	3e-3	3e-3
	(4e-3)	(4e-3)	(4e-3)	(0.01)
Observations	61,482	61,482	61,482	61,482
Loan Age FE		✓	✓	✓
Loan Age x Time FE			✓	✓
County x Time FE				✓


LLMA Mortgage Lending Coverage
Percent (by $)
20
30
40
50
60
2001
2003
2005
2007
2009
2011
2013
2015
Year

Go Back


LLMA vs. National Bankruptcy Rate
Bankruptcy Rate (%)
0
.2
.4
.6
.8
2000
2003
2006
2009
2012
2015
Year
LLMA
US Court Records

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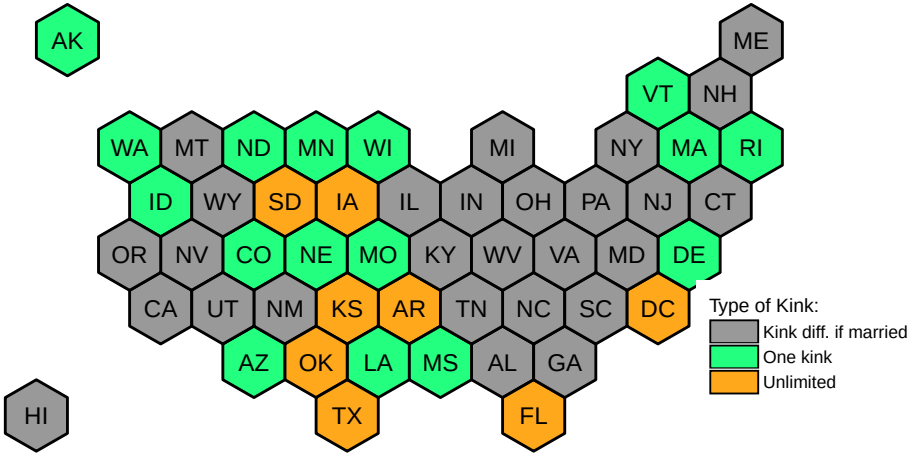
States Used



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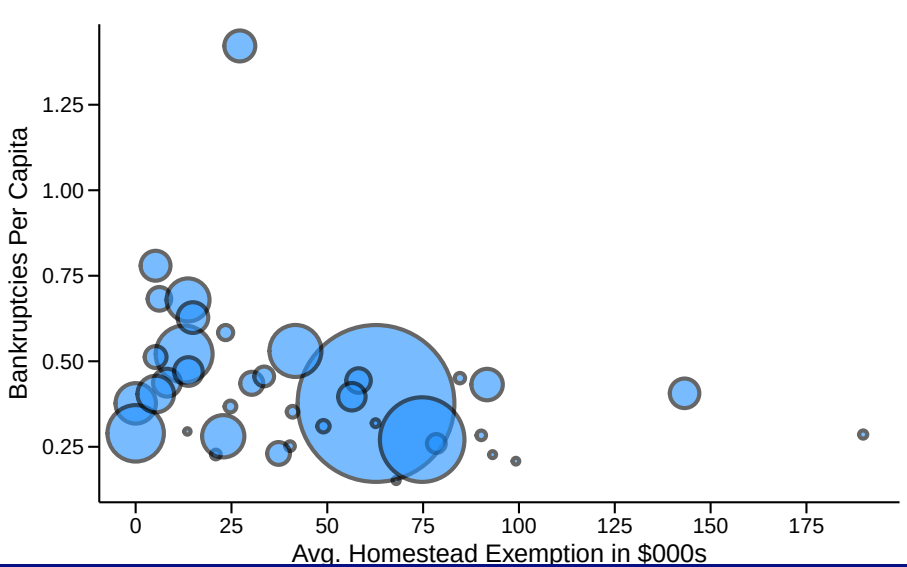
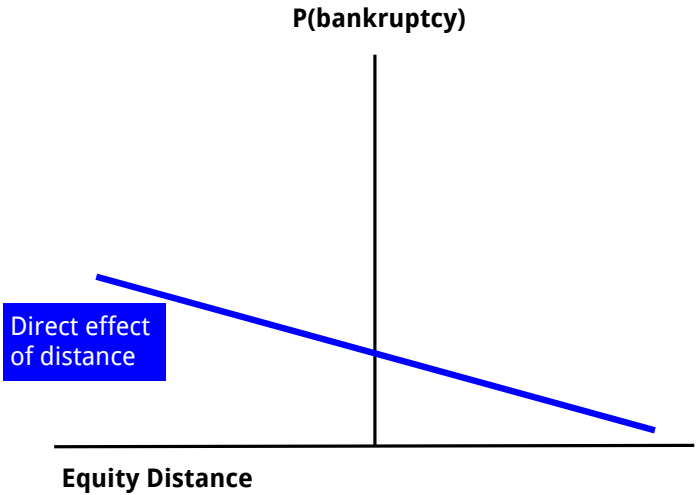
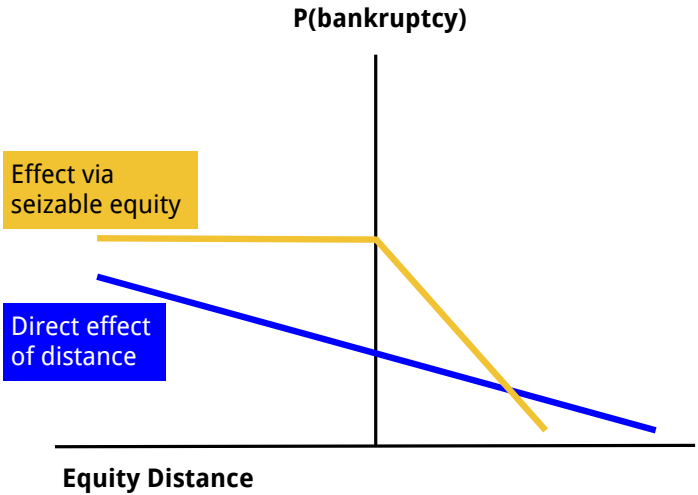
State Bankruptcy Rate vs. Homestead Exemption



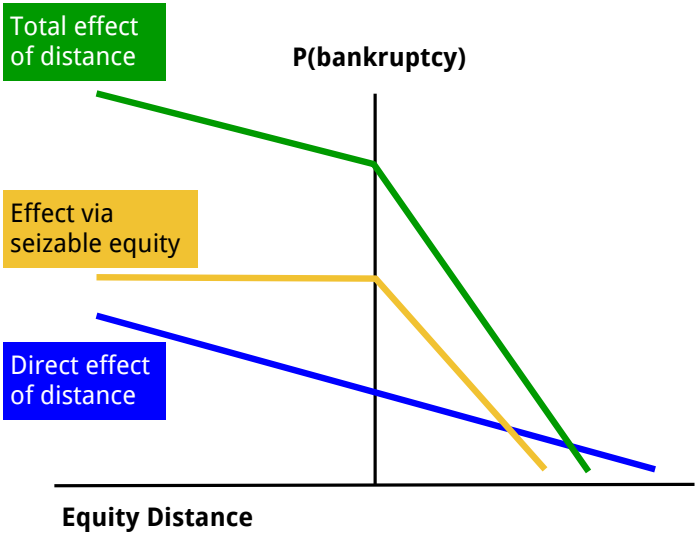
RK Identification Intuition



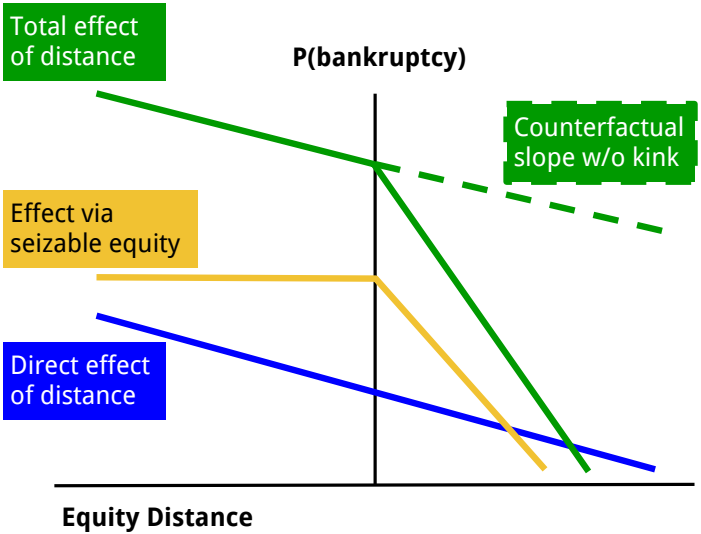
RK Identification Intuition



RK Identification Intuition



RK Identification Intuition



Estimand

The RK estimand is

$$\tau := \frac{\partial \mathbb{E}(B|D=0)}{\partial S} = \beta^+ - \beta^-$$

where β^+ and β^- are the RHS and LHS slopes of $\mathbb{E}(B|D)$ at the kink, specifically

$$\beta^+ = \lim_{D_0 \to 0^+} \beta(D_0), \quad \beta^- = \lim_{D_0 \to 0^-} \beta(D_0), \quad \beta(D_0) = \frac{d\mathbb{E}(B|D=\widetilde{D})}{d\widetilde{D}}\bigg|_{\widetilde{D}=D_0}$$

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Identification

- **Intuition:** Let $P \equiv \mathbb{E}[B(D, S(D), u)|D = 0]$. Distance D affects probability P through direct and indirect channels:

$$\frac{dP}{dD} = \frac{\partial P}{\partial D} + \frac{\partial P}{\partial S} S'(D) + \frac{\partial P}{\partial u} u'(D)$$

Differencing the RHS and LHS limits gives

$$\frac{dP}{dD}^{+} - \frac{dP}{dD}^{-} = \frac{\partial P}{\partial S} \underbrace{\left[S'(D)^{+} - S'(D)^{-}\right]}_{=1 \text{ (in my case)}}$$

if only $\lim_{D \to 0^{+}} S'(D) \neq \lim_{D \to 0^{-}} S'(D)$ at $D = 0$

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Estimation

- Nonparametric local polynomial estimation:

$$\{\widehat{\beta}_j^+\} = \underset{\{\widetilde{\beta}_j^+\}}{\arg\min} \sum_t \sum_i^{n_t^+} \left[B_{i,t}^+ - \sum_{j=0}^{p} \widetilde{\beta}_j^+ (D_{i,t}^+)^j \right]^2 K\left(\frac{D_i^+}{h}\right)$$

$$\{\widehat{\beta}_j^-\} = \underset{\{\widetilde{\beta}_j^-\}}{\arg\min} \sum_t \sum_i^{n_t^-} \left[B_{i,t}^- - \sum_{j=0}^{p} \widetilde{\beta}_j^- (D_{i,t}^-)^j \right]^2 K\left(\frac{D_i^-}{h}\right)$$

  - $B_{i,t} = 1$ if i files for bankruptcy in t
  - $D_{i,t}$ is i's distance at t from her exemption limit
  - $K(\cdot)$ is the kernel and h the bandwidth

- Estimate of interest: $\widehat{\tau} = \widehat{\beta}^+ - \widehat{\beta}^-$
- Choose bandwidth to min. MSE (Calonico, Cattaneo, and Titiunik; 2014)

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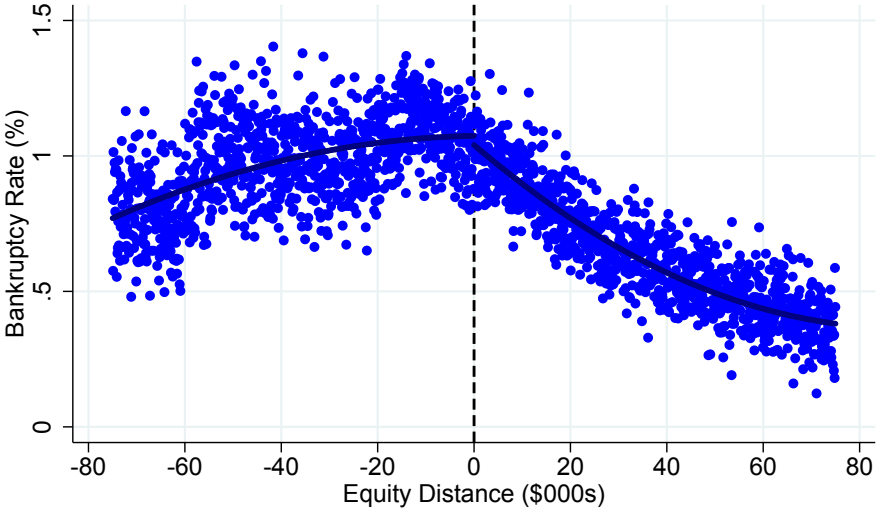
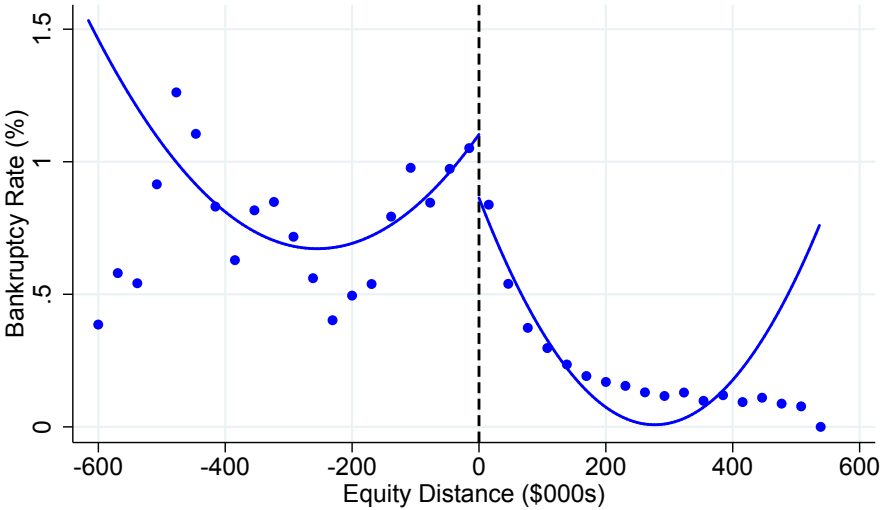
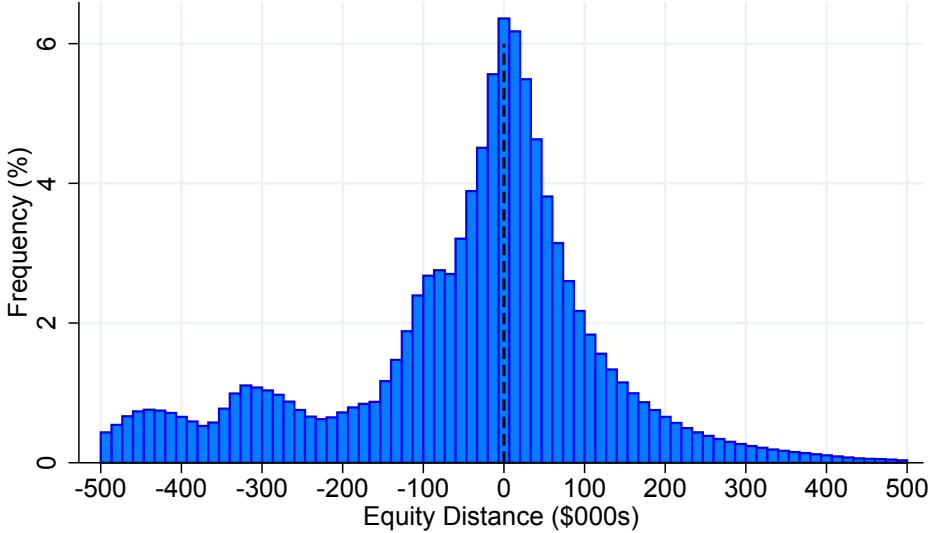
Filing Kink – More Variability



Filing Kink – Wider Range



Distribution of Equity Distance to Cutoff



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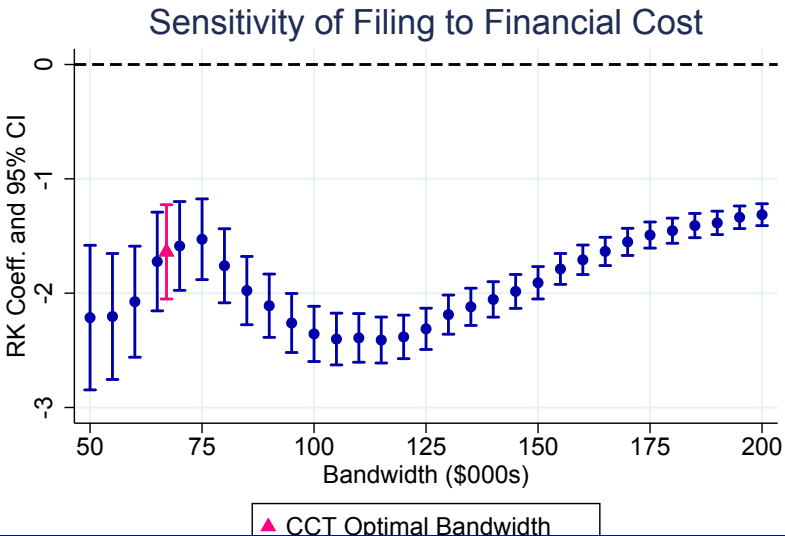
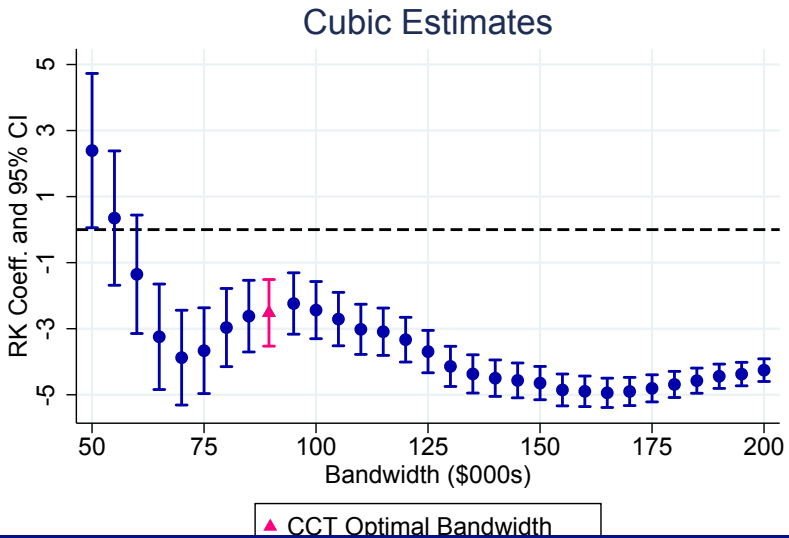
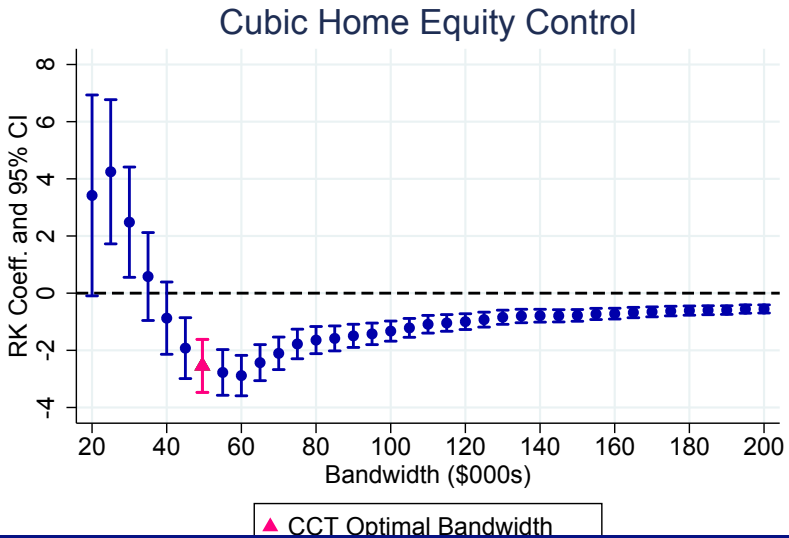
Various Bandwidths (Benchmark)



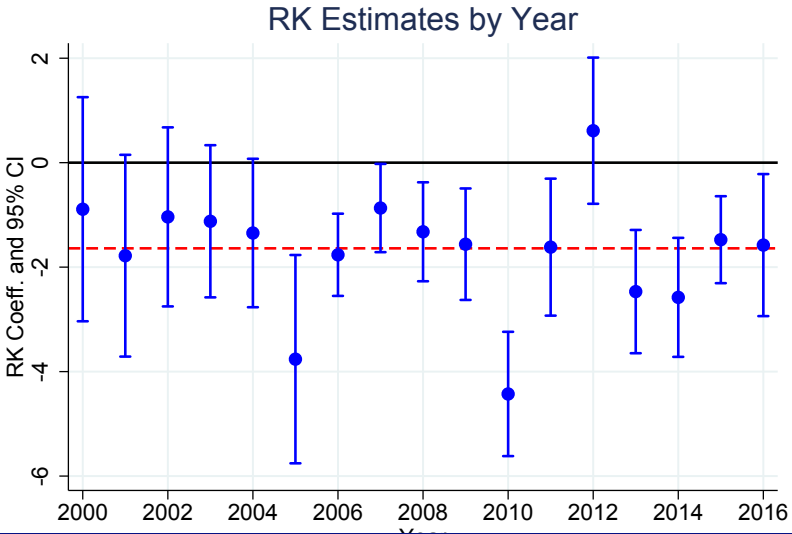
Various Bandwidths (Cubic Equity Distance)



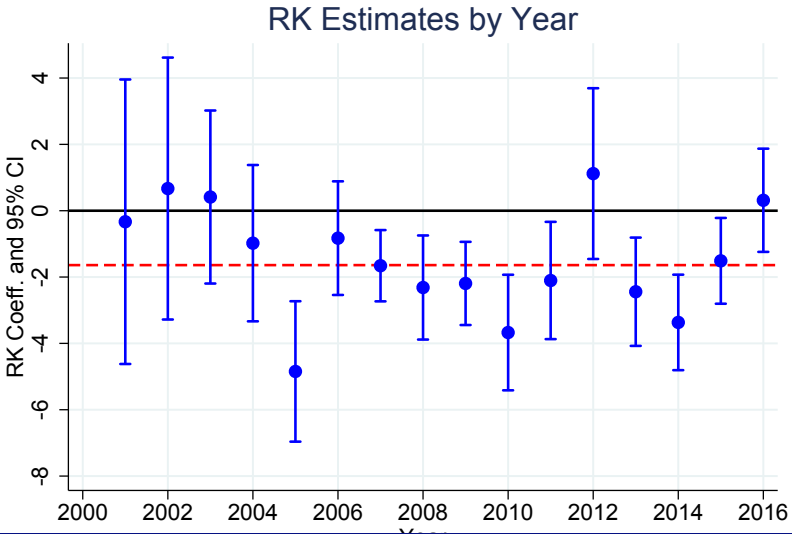
Various Bandwidths (Cubic Home Equity)



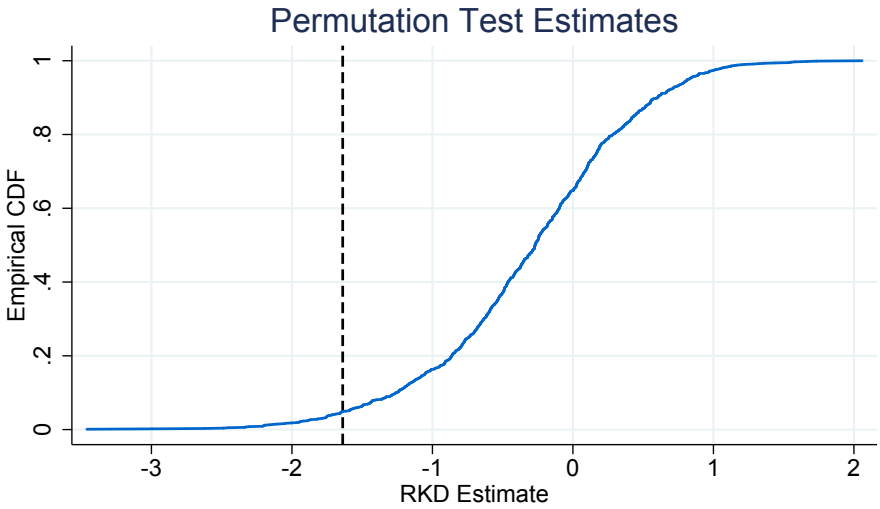
Year-By-Year Estimates



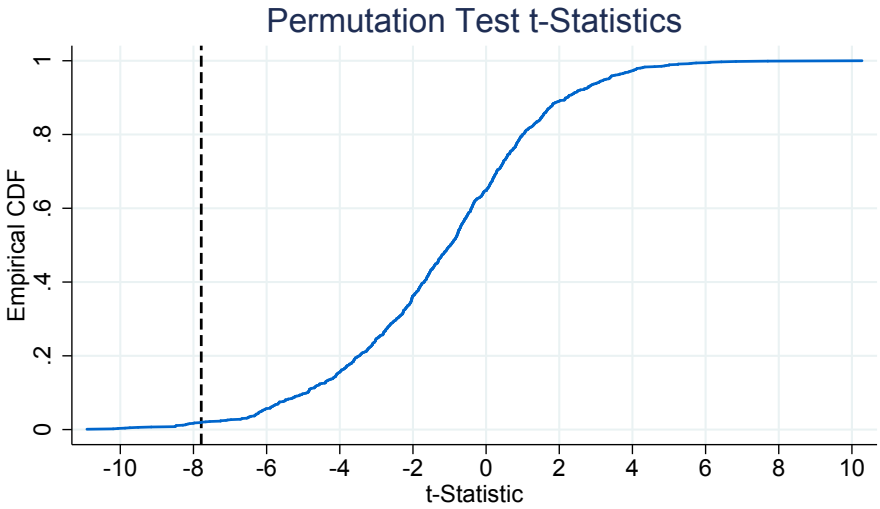
Year-By-Year Estimates (Constant Composition)



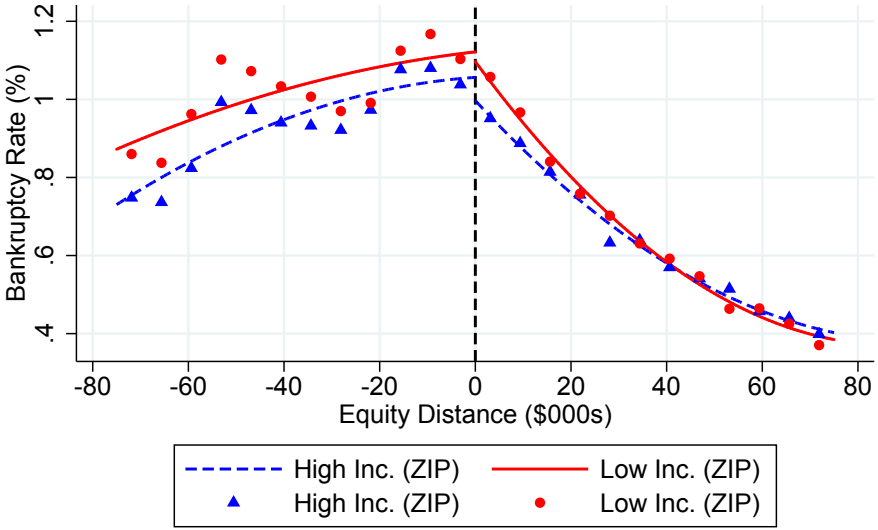
Permutation Test: Coefficient



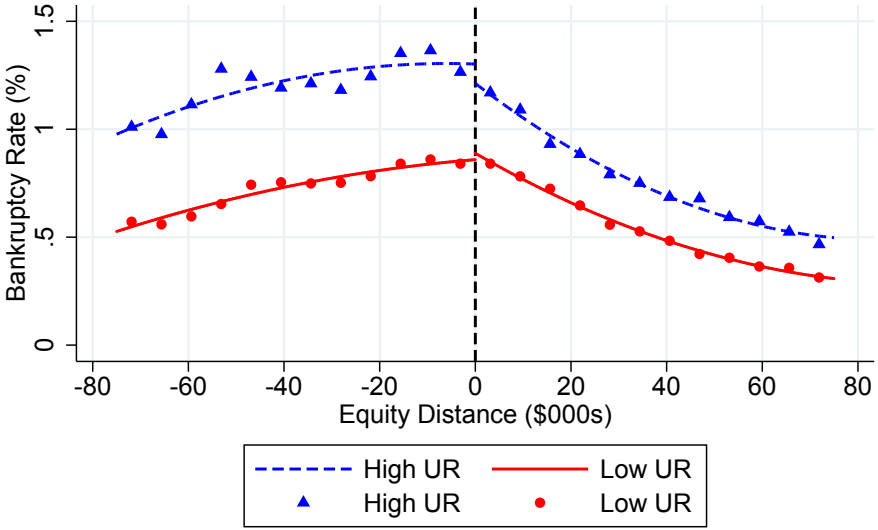
Permutation Test: t-Statistic



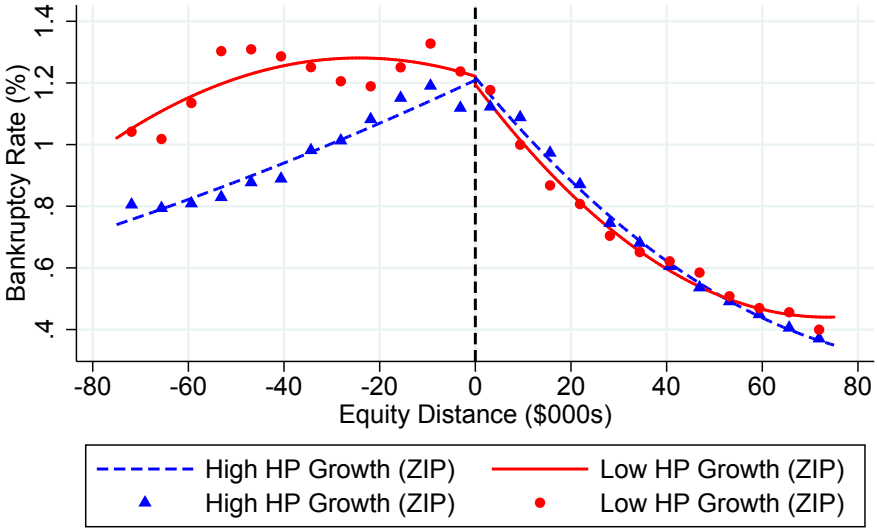
RKD: High vs. Low Income (ZIP)



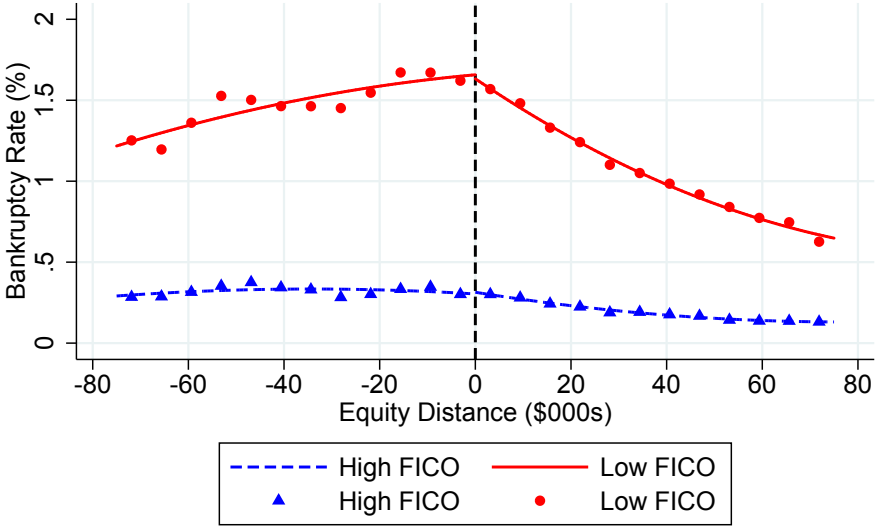
RKD: High vs. Low UR (County)



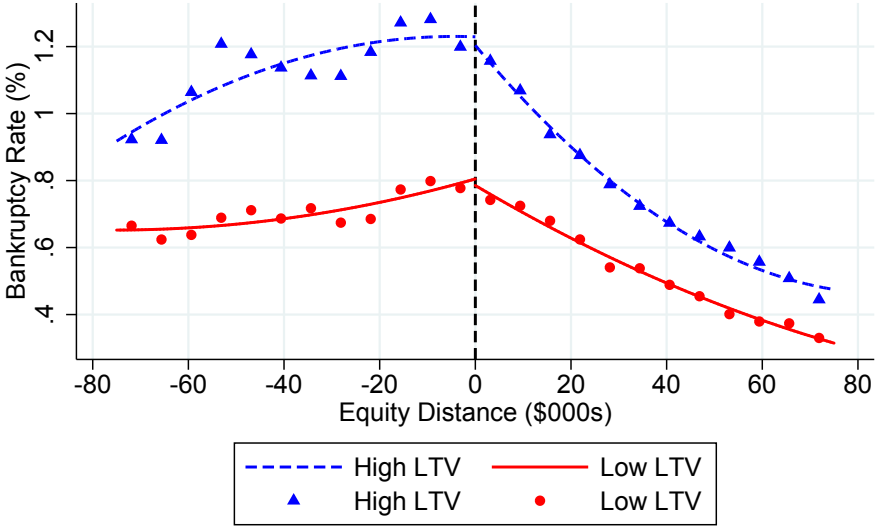
RKD: High vs. Low HP Growth (ZIP)



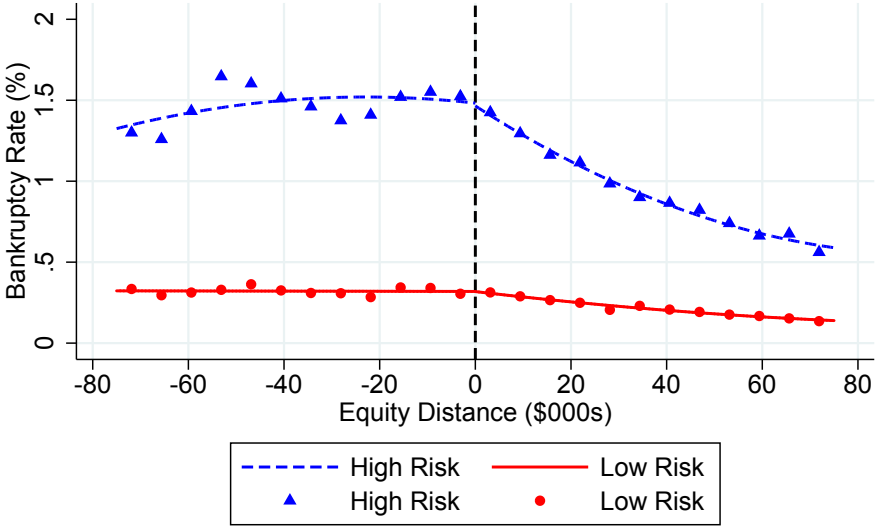
RKD: High vs. Low FICO



RKD: High vs. Low LTV



RKD: High vs. Low Predicted P(file)



RKD: Time Period Splits

	(1) Pre-Reform	(2) Rush to File	(3) Post-Reform	(4) Pre-Rec.	(5) Recession	(6) Post-Rec.
	Panel A: Unweighted					
Est.	-2.79***	-13.46***	-2.54***	-2.18***	-4.85***	-2.42***
Std. Err.	(0.67)	(2.75)	(0.36)	(0.50)	(0.81)	(0.49)
Bandwidth	72.64	56.76	70.07	86.86	66.30	77.13
Obs. (mil.)	11.12	1.64	34.51	8.63	9.12	18.71
	Panel B: Weighted for Constant Composition					
Est.	-5.52***	-22.57***	-3.83***	-3.29***	-4.23***	-2.92***
Std. Err.	(0.98)	(3.59)	(0.45)	(0.70)	(0.84)	(0.66)
Bandwidth	76.61	55.13	66.04	78.99	78.22	72.89
Obs. (mil.)	7.83	1.30	29.63	6.78	9.13	16.44

Notes: These regressions use data on bankruptcy filings *prior* to the interest rate reset. All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. I scale $MPay_{ict}$ and B_{ict} so that the 2nd stage is the effect on the quarterly bankruptcy rate (in percentage points) of a $10k increase in annual mortgage payments. The 1st stage captures the effect of Libor-indexing on annual mortgage payments. Statistical significance: 0.05*, 0.01**, 0.001***.

Liquidity Analysis: Restricting to Homeowners

	(1)	(2)	(3)	(4)	(5)
	2nd stage (outcome = bankruptcy prior to reset)				
$MPay_i$	0.36**	0.33**	0.35**	0.29*	0.20+
	(0.12)	(0.11)	(0.11)	(0.11)	(0.10)
	1st stage (outcome = annual mortgage payment)				
$Libor_i$	2,086***	2,272***	2,329***	2,390***	2,425***
	(142.80)	(153.21)	(154.59)	(166.87)	(172.84)
Stage 1 F	42.68	43.97	45.4	41.03	39.38
Observations	918,041	918,041	918,041	918,041	918,041
Loan Age FE		✓	✓	✓	✓
Loan Age x Time FE			✓	✓	✓
County x Time FE				✓	✓
ZIP FE					✓

Notes: These regressions use data on bankruptcy filings *prior* to the interest rate reset. All regressions contain county and time FE and household-level controls. Standard errors are clustered by county. I scale $MPay_{ict}$ and B_{ict} so that the 2nd stage is the effect on the quarterly

Baseline Model

- Period 1: ex ante identical households choose borrowing D

- In period 2, households:
  - Realize income $y \sim F_Y$
  - Receive annuity a, have uncertain illiquid wealth $H \sim F_H$
  - Can file for bankruptcy and keep e; filing cost φ

- Period 2 consumption with and without filing:

$$c^{NF} = a + y + H - D$$
$$c^{F} = a + e - \varphi$$

Two Bankruptcy Thresholds

- The household prefers to file if

$$c^{NF} < c^{F}$$
$$a + y + H - D < a + e - \varphi$$
$$y < e + D - \varphi - H \equiv y^{\star}_{MH}$$

- Household must file if

$$y + a < D$$
$$y < D - a \equiv y^{\star}_{L}$$

- Bankruptcy is driven by liquidity when

$$y^{\star}_{MH} < y^{\star}_{L}$$
$$e - \varphi - H < -a$$