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# Recovery on Defaulted Debt: Aggregation, Role of Debt Mix, and A Bit About Systematic Risk

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# How two groundhogs saw some light

- Are variations in recovery systematic? No *satisfactory* traction until we thought about:
- Where is the default boundary relative to the zero-net-worth point?
  - Usually, bank debtholders' decision dominates. And their choice depends on size of claim relative to firm value.  
**Enormous** empirical effect on recoveries in cross section.
- What are debt instruments of a bankrupt firm?
  - Contingent claims on the value of the firm at emergence.
  - Must understand ultimate recovery to all the firm's debt as a precursor to modeling value of individual claims.
- (Paper does not reflect our latest thinking)
- (Apologize toggle between “recovery”, “LGD” below)

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# Part 1 of our story: Think about the default (bankruptcy) boundary...

- Will managers and shareholders declare bankruptcy at the moment the firm is economically insolvent?  
Usually not...
  - They hold out-of-the-money options. They want to keep the game going, and want increased volatility.
- Will debtholders force bankruptcy at the moment of insolvency?
  - Which ones are most likely to have the legal power do so?
    - In the USA, banks and other private debt investors.
  - Given the right, how strong is the incentive?
    - Depends on seniority and size of position in debt structure.

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## ...and the impact of bank debt share

- If bank loans are most of the firm's debt, bankruptcy is forced when firm value is not far below the insolvency point.
  - Even if senior, banks will bear most of the losses as insolvency worsens, so they force filing sooner.
- If banks hold a small slice of the firm's debt, it is more likely to be deeply insolvent at filing.
  - Banks' recovery is protected by the layers of junior debt, so they will let the game go on longer.
- Bank debt most senior in USA; elsewhere?

# Sketch a first passage model of default

- Innovation: Default (bankruptcy) at  $V < V^*$ , but endogenous  $V^*$  chosen by senior claimant with covenants (“bank”), not the firm
  - Bank induces bankruptcy by accelerating loan but can only do so if a covenant is violated.
  - Bank may not induce at first covenant violation if benefits of waiting (fees, etc.) exceed expected losses from waiting.
  - Expected losses depend on size of bank’s position.
- $V^*$  depends on:
  - Total debt burden; “Mix” (share of bank debt in total debt); Borrower asset value volatility; Expected path of covenant violations; Expected benefits of waiting to accelerate the loan. Higher bank debt share implies higher  $V^*$  and “earlier” bankruptcy (firm value closer to solvency point).

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## Implication 1: Default probabilities should depend on debt mix

- Include debt mix in default prediction models (meaning share of total debt with covenants granting bankruptcy-decision control-rights).
- We recognize that other considerations are important too; relative importance is empirical question.
- We don't yet have empirical evidence on importance of mix for PD. Large-sample data for debt mix is hard to get.

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## Implication 2: **Firm-level** LGD related to bank loan share of firm's debt

- Presumes recovery is driven mainly by depth of firm's insolvency at default.
  - We recognize other things may matter too.
- Why would banks wait to pull the plug until the point their recovery begins to be threatened? They may benefit by waiting:
  - "Relationship" factors?
  - Receive covenant waiver fees, higher spreads on the way down; perhaps improve collateral.

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## Implication 3: We should not be surprised that firms are deeply insolvent at filing

- That bond recoveries are so poor has long been a puzzle.
  - It is one motivation for Duffie & Lando's accounting-quality paper (Econometrica 2001).
- Getting harder to blame it on losses during bankruptcy, e.g. Covitz Han Wilson (2006): time in bankruptcy does not affect recovery.
- In our data, mean bank debt share is 33%, mean firm-level recovery 45% (reasonable).

## Part 2 of our story: Firm-level LGD

- As with any debt instrument, view defaulted debt as a contingent claim on the value of the firm, but at emergence or liquidation.
  - Bankruptcy changes legalities and nature of option.
  - U.S. system of absolute priority implies collar options.
    - Upper and lower strike determined by place in queue.
  - Absolute priority violations due to bargaining process and court oversight are minor for our work.
- Suppose Loan=50 loses 0%; Bond=100 loses 50%; Subdebt=50 loses 100%.
  - Total recovery is \$100, total claims are \$200, so firm-level LGD=50%

# Debt instruments as collars

Whether claims are in-the-money....

Deeply subordinated

Contractually subordinated

General unsecured claims

Other secured

Well-secured

Lawyers

Depends on the value of the firm at emergence and debt structure.

Firm A at emergence

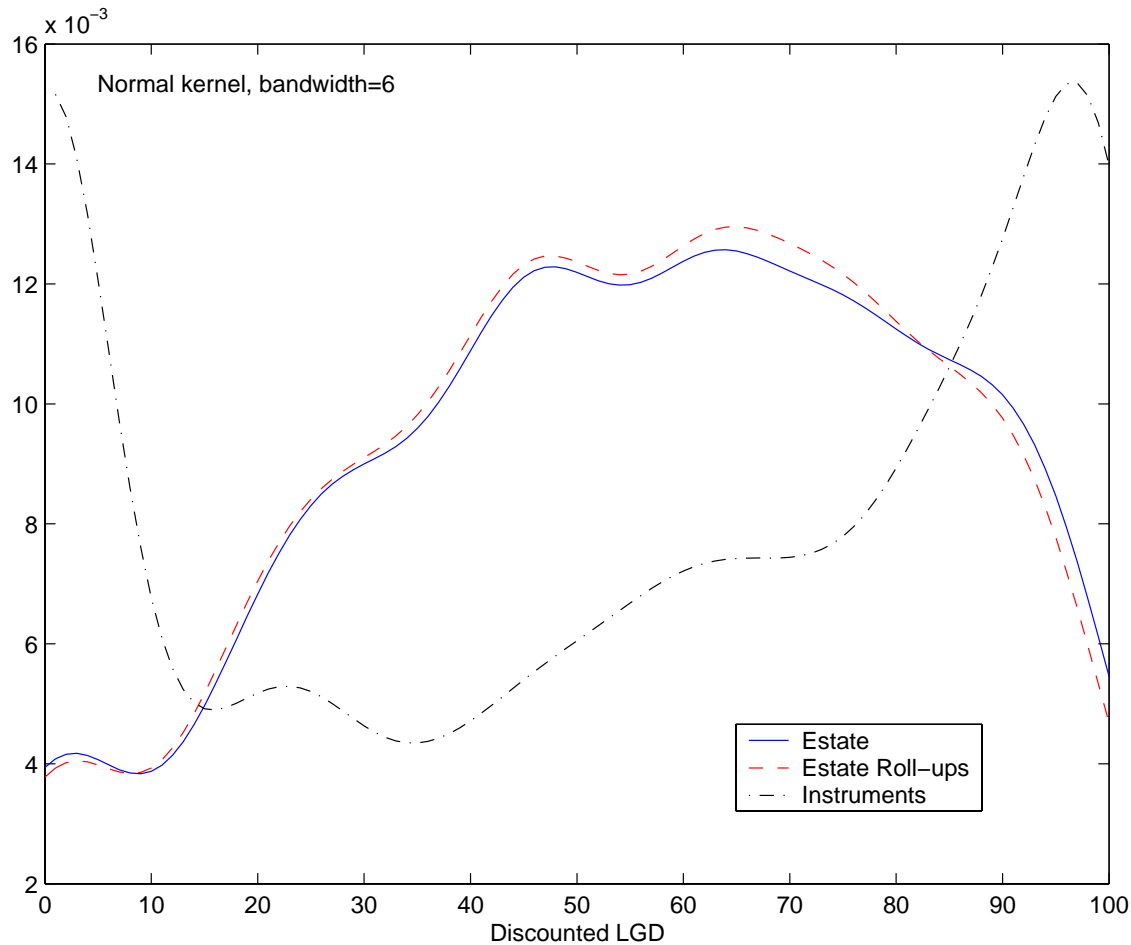
Firm B at emergence

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## Implication 1: Understanding debt structure is key to understanding instrument-level data

- Suppose every firm has many seniority classes of debt and firm-level recovery is uniformly distributed.
- Then expect recovery for most instruments to be 0% or 100%.
- In reality most U.S. firms have few classes, but instrument-level recovery is still strongly bimodal, whereas firm-level recovery is unimodal with mean near 50%.

# Actual LGD Distribution: Firm-level vs instrument-level analysis



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## Implication 2: First model the underlying, then model the option...

- Defaulted debt is a quite non-linear option, so Jensen's inequality rules, e.g.,  
$$E[\text{SeniorLGD}(\text{Firm-Recovery})] \neq \text{SeniorLGD}(E[\text{Firm-Recovery}])$$
  - Simple averages of instrument values and other linear approximations could easily steer us wrong.
- Modeling of the collar-type options will be messy, filled with irritating details. Not yet clear what devils are in these details.

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# What implications of our view for systematic variation in recovery rates?

- Not immediately obvious that using firm-level measures, and paying attention to bank debt share, should matter for measurement of systematic variation in recovery rates. Doesn't it all average out?
- NO. Most important: time variation in bank debt share affects annual averages.
- Many prior studies have pooled instrument-level data, omitting bank debt entirely.
- Bottom line: Extant evidence of systematic variation is less robust than it appears. 1989-91 drop in recoveries disappears entirely, 2000-2002 weaker.

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# Should we expect systematic variation in recovery?

- Bad macroeconomic times = worse recoveries seems so plausible, but...
- Wouldn't banks vary bankruptcy threshold ( $V^*$ ) with macroeconomic conditions?
- Effect could even be opposite of conventional wisdom, if regulators force banks to adopt more conservative thresholds in bad times.
- (No-bank-debt firms may be different.)

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# A taste of empirical work...

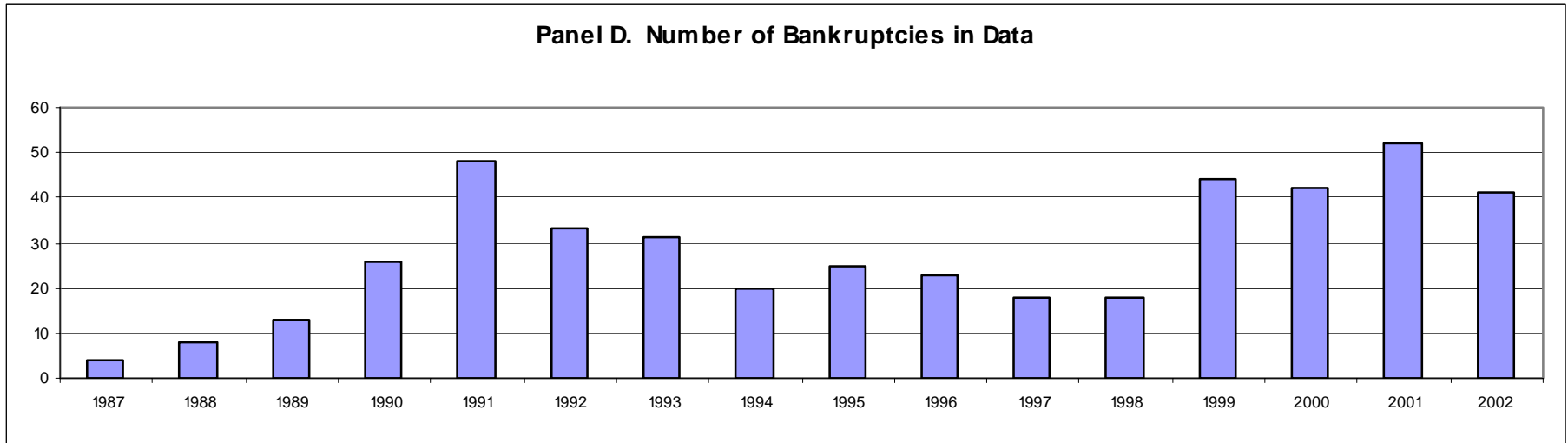
- Focus on:

- 1) Evidence that share of bank debt in total debt matters for firm-level recovery rates.
- 2) A little bit about systematic variation in recovery rates.

# Data (is for U.S. large corporate bankruptcies)

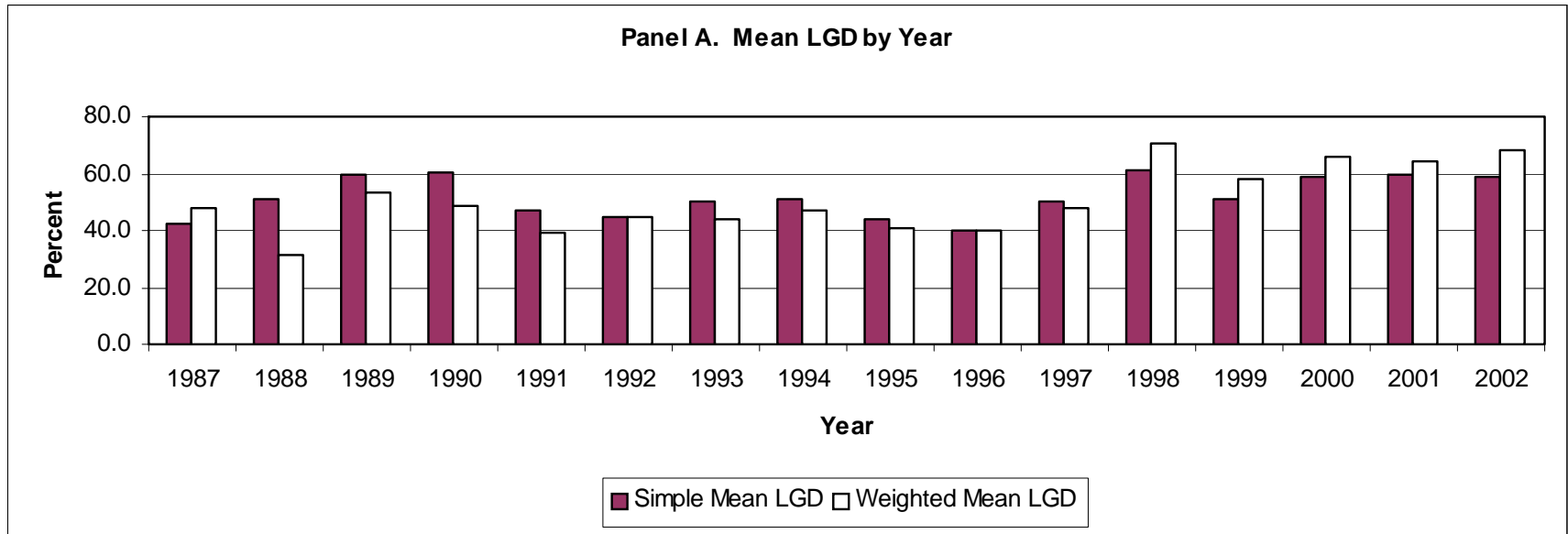
- S&P LossStat (*nee* PMD) database, 2004 release.
  - Limit to bankruptcies, 1987-2002 (drop 2003 filings), 446 of them.
  - S&P tries to include all bankrupt firms with total debt > \$50 million.
    - Subject to data availability. More complete in recent years. Court problem.
  - For each bankrupt firm, have all debt instruments.
    - We call it “firm” LGD but don’t have all claims, e.g. no LGD for trade credit. But we have all of what other studies have looked at, and usually more.
    - Firm-level LGD is dollar-weighted average of individual-debt LGDs
  - Focus on RFV measures of recoveries at emergence (not returns)
    - “Nominal” measure: Undiscounted dollars.
    - Discounted-back-to-default-date measure using Treasury term structure.
      - Maintained null hypothesis is no systematic risk.
      - **Choice of discount rate does not affect qualitative results.**
- We merge with Compustat for some exercises, sample size drops to 269 bankruptcies.

# We have few observations before 1990



And the number of observations is often less than 30 in individual “good” years. Perhaps we should not expect results to be robust across studies.

# Mean firm LGDs over time



- Red bars are simple mean (55% overall, range 42 to 61), white bars are dollar-weighted mean.
- 89-90 is worse, and 98-02. But U.S. recessions were 90-91 and 2001.
- Lot of noise in individual values, not clustered at mean.

# OLS regressions predicting firm LGD

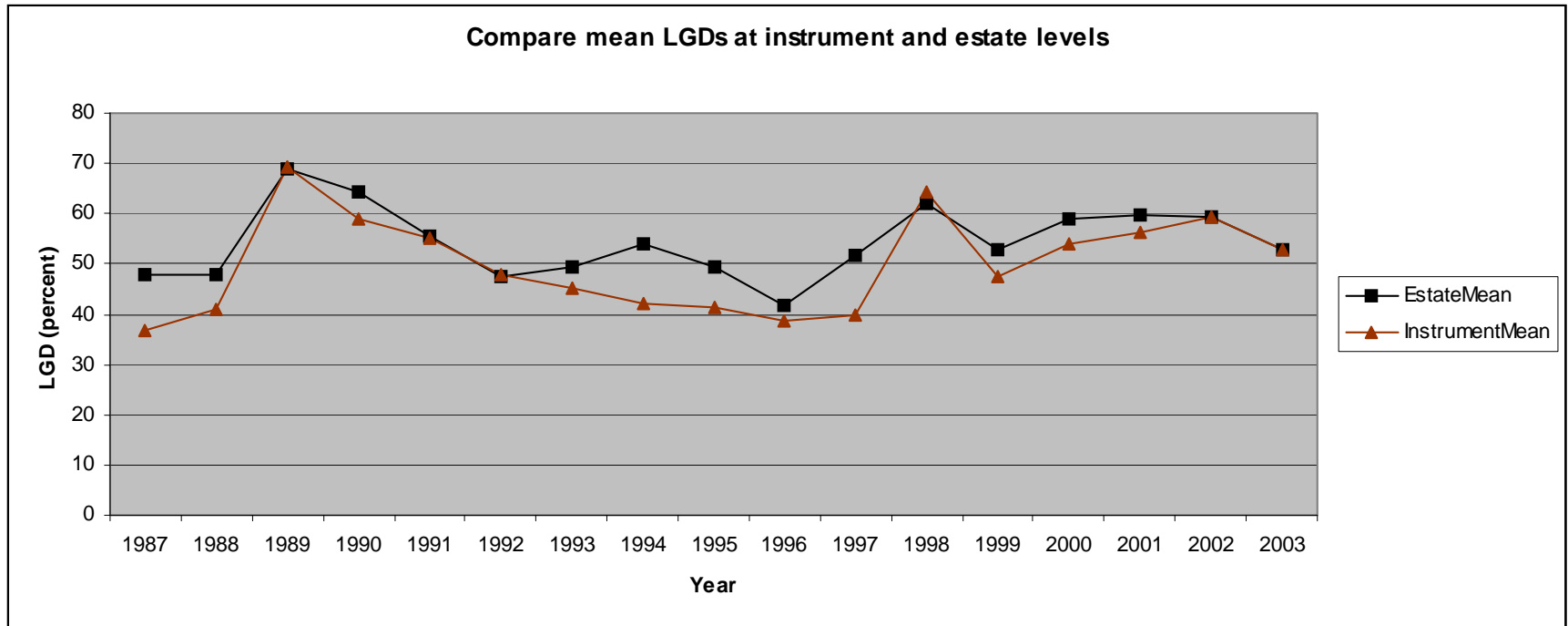
- Explanatory variables:
  - Dummies for **year of bankruptcy** or/and **emergence**
  - **Other state variables: default rate, GDP growth, stock returns**
  - **Industry:** Always include a public-utility dummy. Also try full set of industry dummies.
  - **Debt mix** (share of bank debt in total debt; subordinated, secured)
  - **Time in bankruptcy, identity of court, prepackaged.**
    - **Identity of court may control for selection bias in data, not sure.**
  - **Other variables investigated, not much useful so far. E.g. firm size, capital structure, asset structure (Compustat subsample)**

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# Debt structure of firm matters a lot!

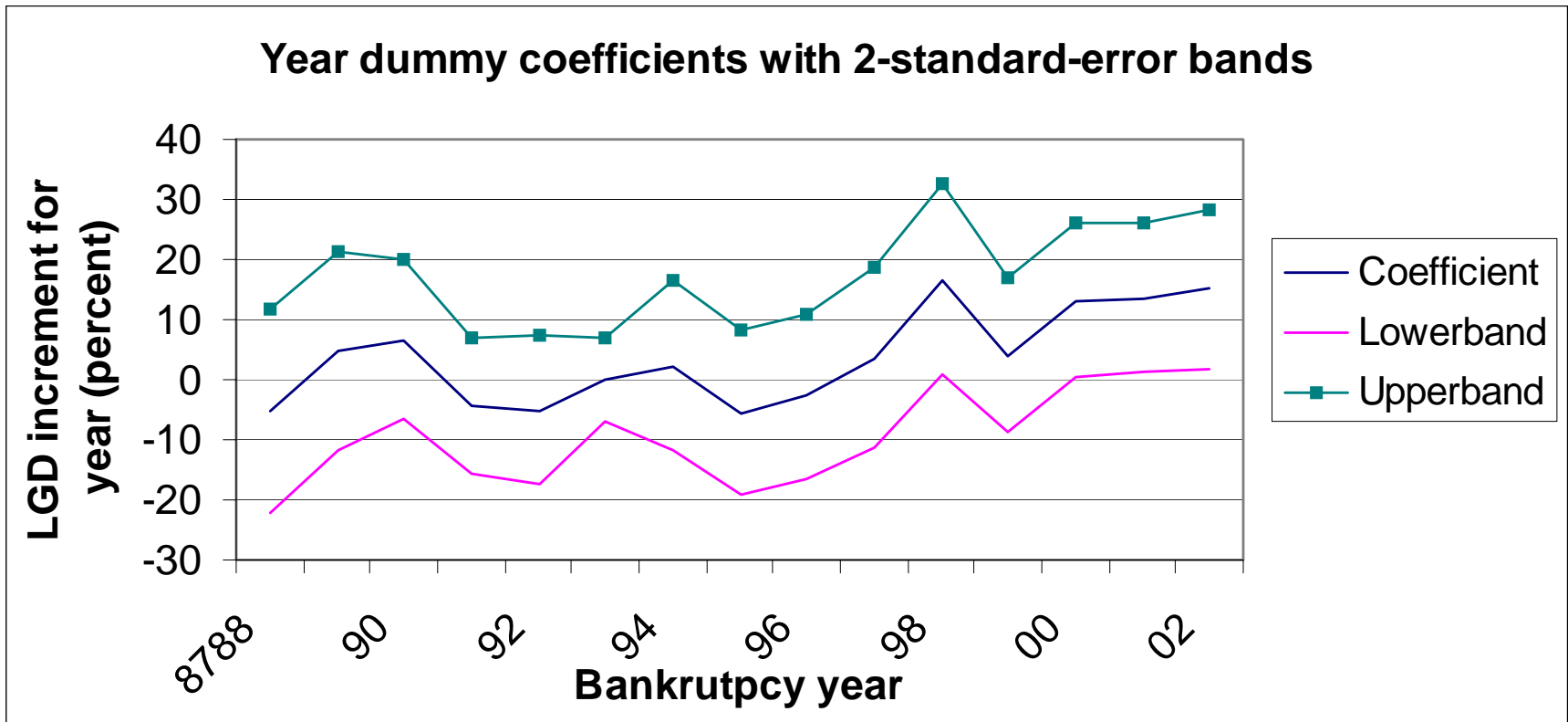
- An all-bank debt firm is predicted to have an LGD that is more than 30 percentage points better than a no-bank-debt firm!
  - This effect is not driven by outliers. Looks like fairly smooth relationship over 0% to 100% bank debt interval.
  - Does not appear to be driven by banks getting paid back before bankruptcy. Pre-bankruptcy debt change positively related to firm-level LGD, not negatively.
- An all-subordinated-debt firm does 10 percentage points worse than one with none, not linear, driven mainly by all-sub-debt firms. Not sure why.

# Mean LGD: Firm- vs instrument-level ( no controls)



- Peaks are similar, but instrument troughs are lower, so measured “cyclical” effects likely to be bigger with instrument-level measures.

# Bankruptcy-year dummies



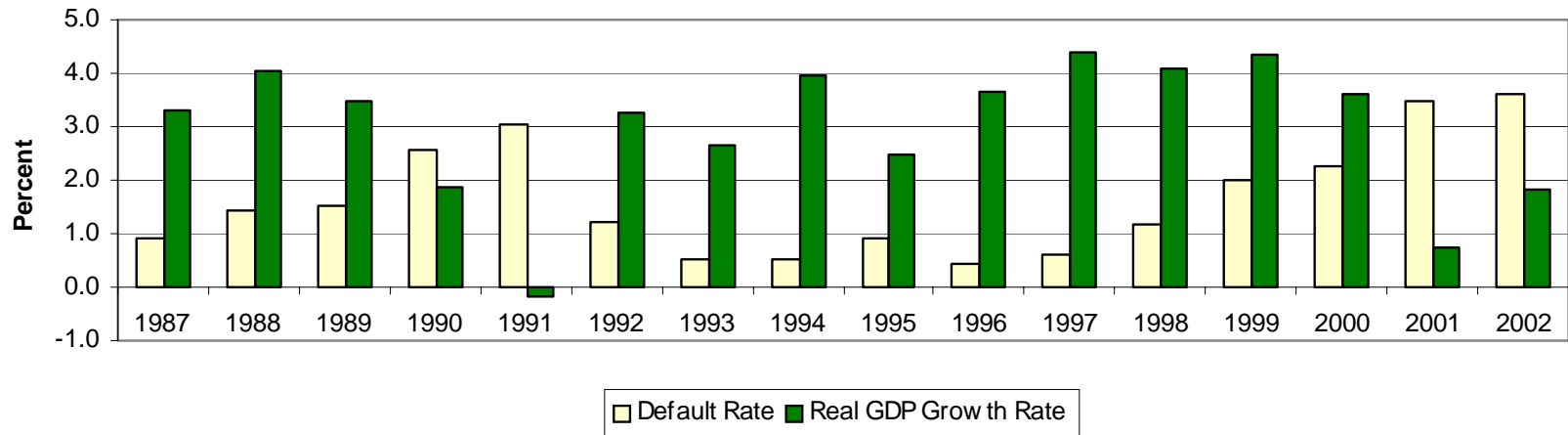
Generally not large until 1998, then +15, statistically significant 98, 00-02. 1998 effect appears to be due to a few observations with LGD>70%, recall <20 bankruptcies in 1998.

# Other measures of state of the world

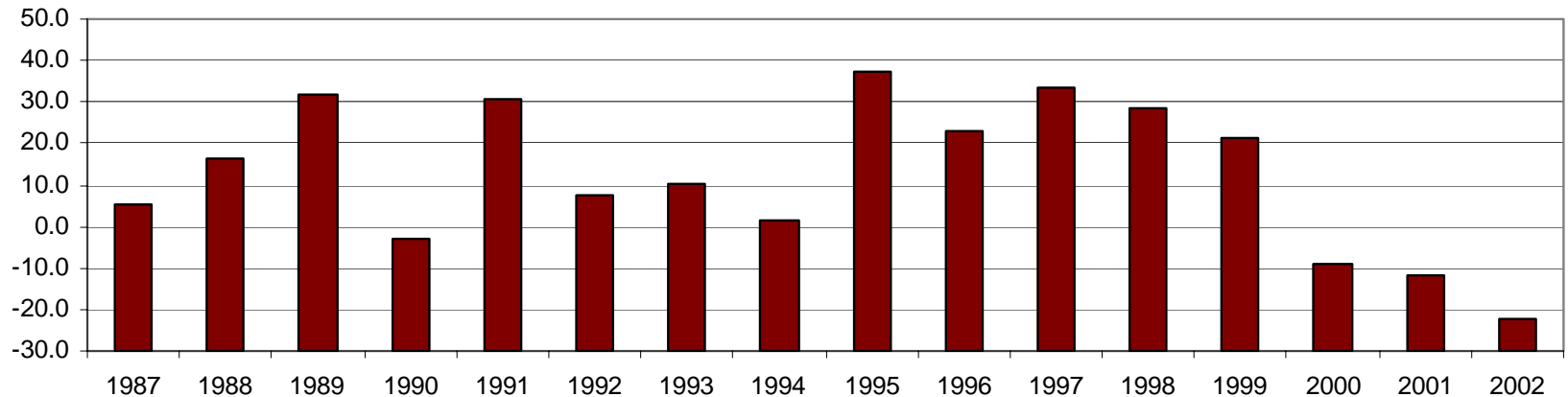
- Coefficient on S&P all-corporate default rate 2.5.
  - Sample mean 1.5, peak 3.5, implies +5% systematic effect?
- Coefficient on GDP growth small, insignificant
- Coefficient on S&P 500 total return -0.23
  - Sample mean about 12, trough about -22, implies +7% systematic effect

# Time pattern of other state variables

Panel B. S&P All-Corporate Default Rate and GDP Growth Rate



Panel C. S&P500 Total Return



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## But experience in 2000-2003 drives these results

- If we drop those years (both bankruptcies and emergencies), coefficients on all of GDP growth, default rate, and equity return are smaller, not statistically significant
- If we drop only bankruptcies of “bubble” firms (about 30 firms) results are also much weaker.
- Eye of beholder: How much should be bet on point estimates from one episode?

# Main things to take away

- *Really* important to model default and recovery together. No way are they independent at the individual-name level, even if recovery turns out to be uncorrelated with default rates at the aggregate level.
- Debt structure has a huge effect on default point and on recovery (and it may be material for default probability).
- Think of defaulted debt as options on firm value at emergence. First understand ultimate firm-level LGD.
- Reasonable people may differ about importance of systematic variation in LGD for U.S. corporate debt.
  - Point estimates imply systematic variation in ultimate-recovery LGD, but standard errors are wide, and robustness not great.
  - Noisy individual LGDs make moderate systematic variation hard to detect.
- Will hybrid loans, institutional investors change behavior?

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## Addendum: What about post-default prices...

- Post-default prices are weakly correlated with ultimate recoveries.
- Prices are often missing in extant datasets. Because they are zero? Is incidence of missing values related to time variation in averages? We don't know yet.
- Systematic variation might be due to supply-demand effects in market for distressed debt, rather than systematic risk in ultimate recoveries.
  - Different implications for buy-and-hold institutions.

# Market price vs discounted cashflows

