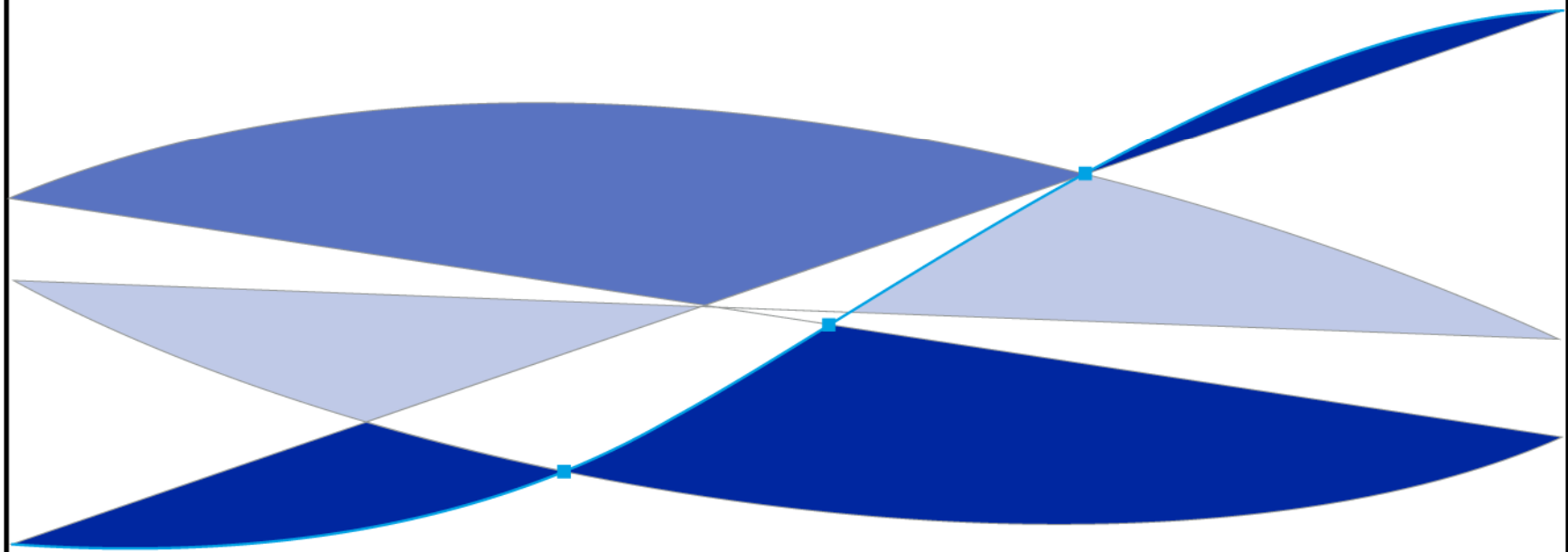
Moody's | K·M·V

Valuation of Corporate Loans: A Credit Migration Approach



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Agenda

1. Moody's KMV Loan Valuation Framework
2. EDF Implied Loan Values vs. CDS Implied Loan Values
3. EDF/CDS Implied Loan Values vs. LPC Quotes
4. Prepayment Options & Pricing Grids

Why compute fair market values of loans?

- Banks and Regulators
  - Achieve greater balance sheet transparency
  - Reduce the possibility that loan portfolios will generate big earnings surprises
  - Actively hedge or securitize the loan portfolios
  - Move towards hedge accounting
- Asset Managers
  - Participate in the fast growing secondary loan market

Challenges in determining the fair market value

- Limitations of secondary loan market
  - Dramatic growth but still low liquidity compared to bonds/CDS markets

- Loans are very different from bonds/CDS
  - Typically floating rate (bonds are typically fixed rate)
  - Have embedded options -- prepayment option, usage option etc.
  - Can be revolving credits with a complex fee structure
  - Can have performance based pricing and other contingent cash flows
  - Typically have a lower LGD

  - **Hence, it is difficult to infer a loan fair value directly by observing the price or spread on a comparable bond/CDS**

Empirical study of loan values

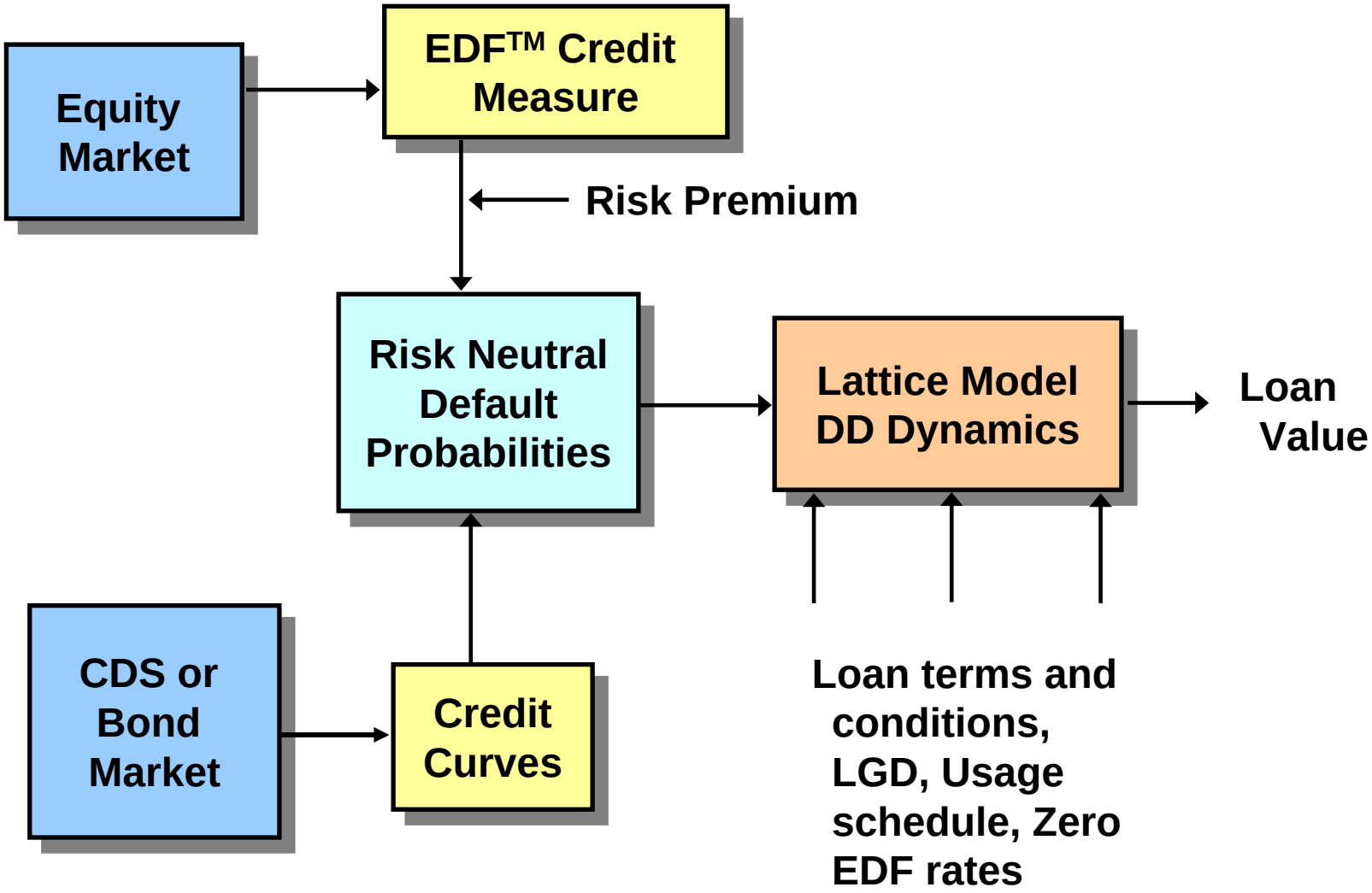
- Use Moody's KMV loan valuation framework to value a set of loans that are quoted in the secondary loan market.

- EDF-based fair values have very high correspondence with CDS implied loan values. However, using EDF measures gets you a much better coverage than using CDS, particularly in the leveraged market.

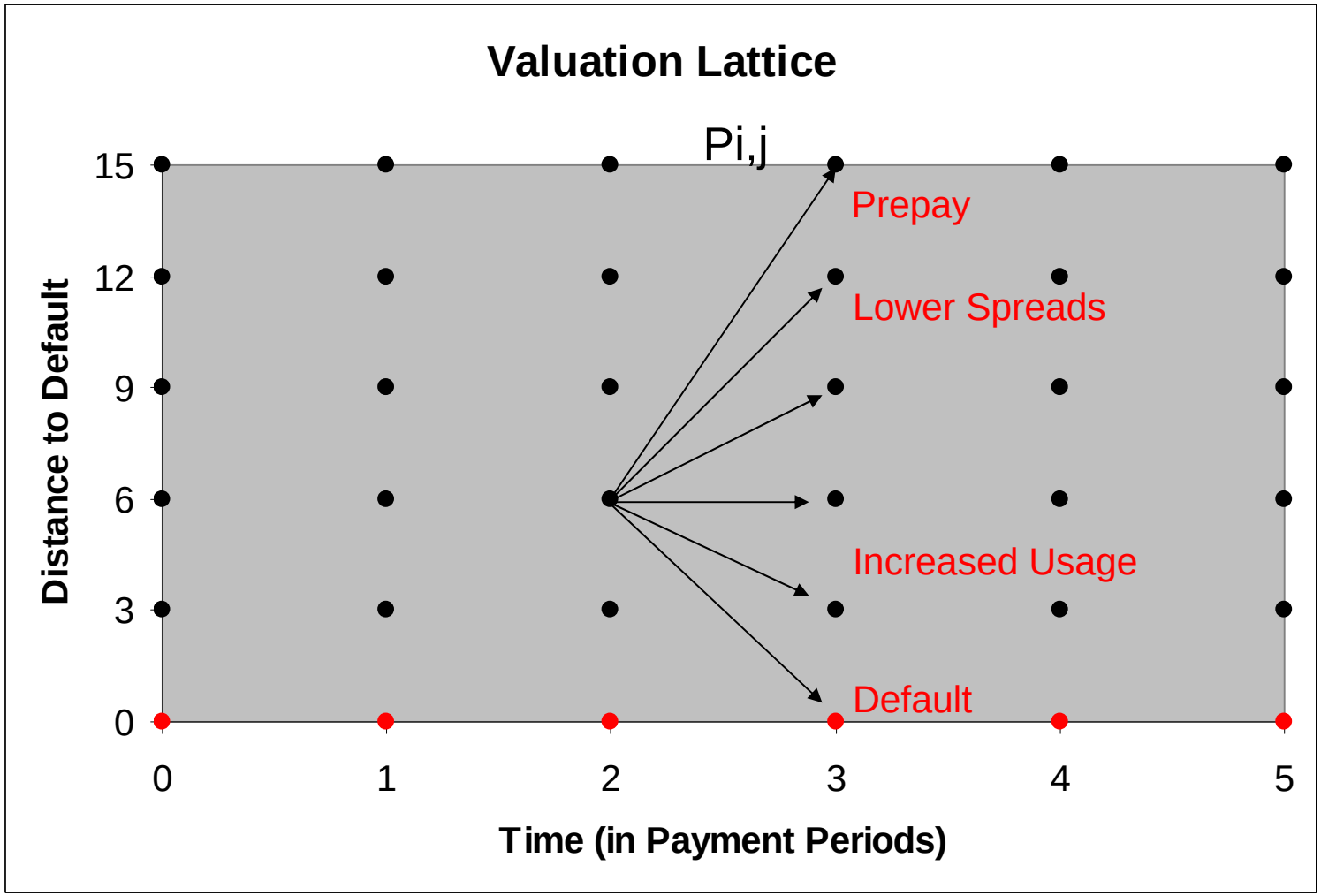
- Given the staleness and illiquidity in LPC quotes, EDF and CDS based values compare reasonably well to these quotes.

- Accounting for contingent cash flows – prepayment options and pricing grids is important.

Moody's KMV Loan Valuation Framework



Lattice approach can model complex fee structures and embedded options

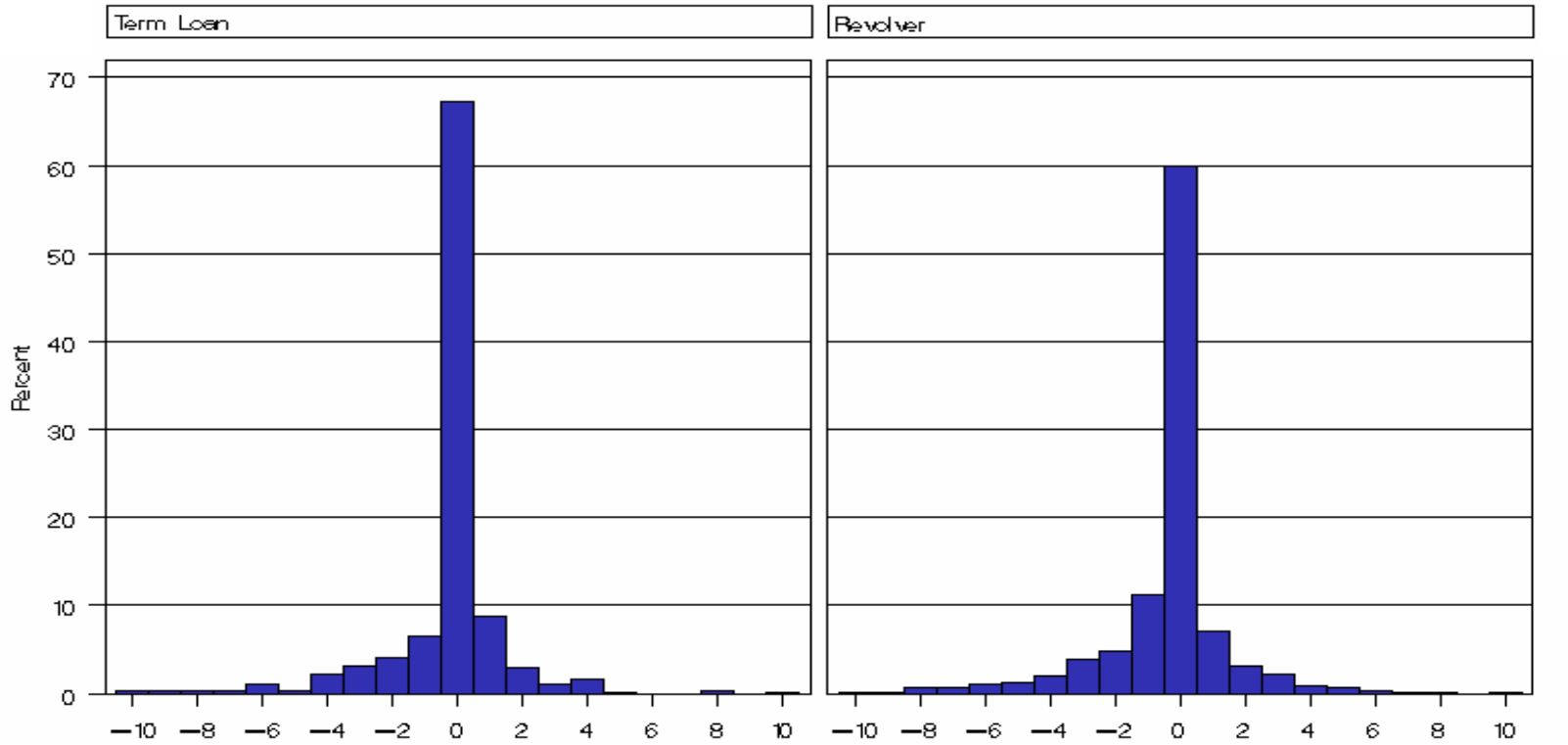


Data used in the study

(Loans that have been valued and have LPC quotes)

- Time period :
  - Jan 2002 through Dec 2004, monthly observations
- Number of loans
    - 1,798 unique loans (809 unique borrowers)
    - 1,246 Term Loans / 552 Revolvers
    - 744 Public / 1,054 Private
- Valued using CDS
    - 242 loans
- Most of the loans are sub-investment grade, about 75% are rated Ba or B.

Price Differences: EDF vs. CDS implied loan values



Differences within one dollar bucket (middle three buckets) – 83%

Within two dollars bucket (middle five buckets)- 91%

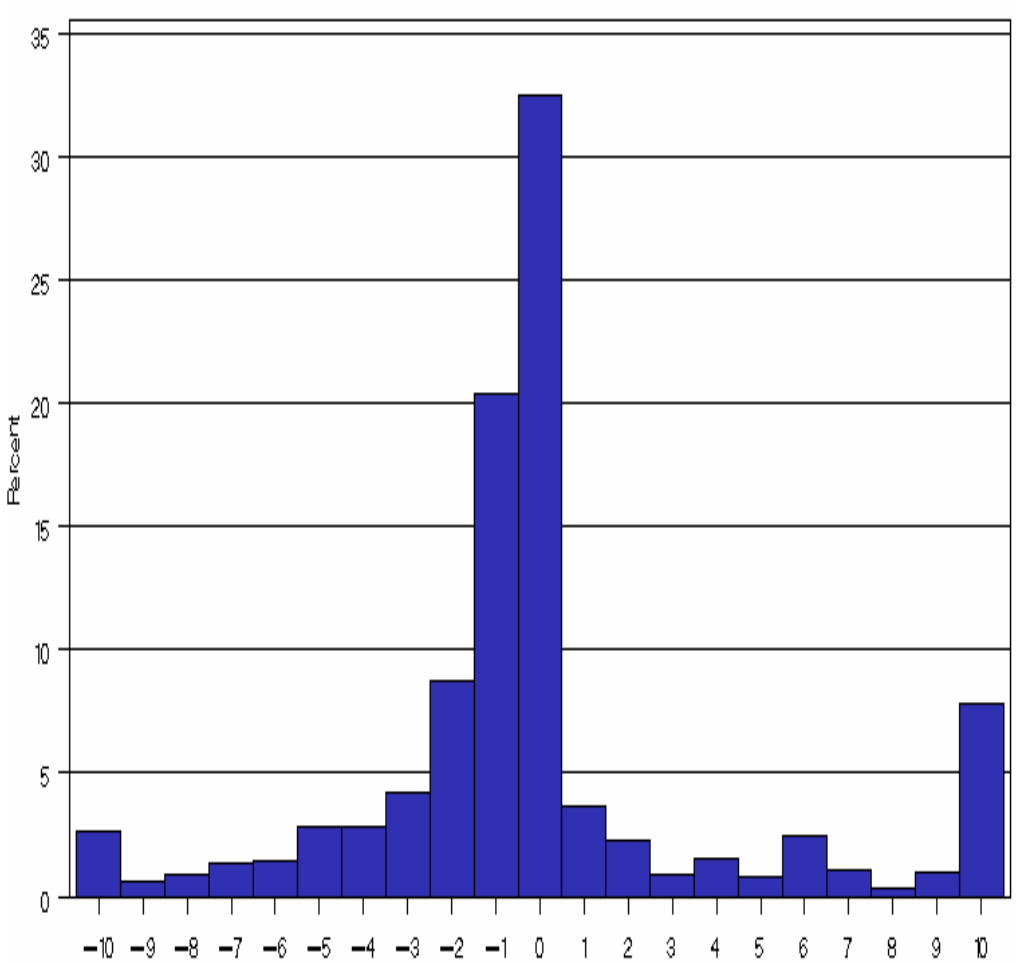
Differences within one dollar bucket (middle three buckets) – 78%

Within two dollars bucket (middle five buckets) – 86%

CDS and EDF based values are quite close to each other. However, coverage is about three times with EDF than with CDS. Valued 744 facilities with EDF, 242 with CDS. Common sample used to plot these graphs.

Price differences: LPC quotes vs. CDS implied loan value

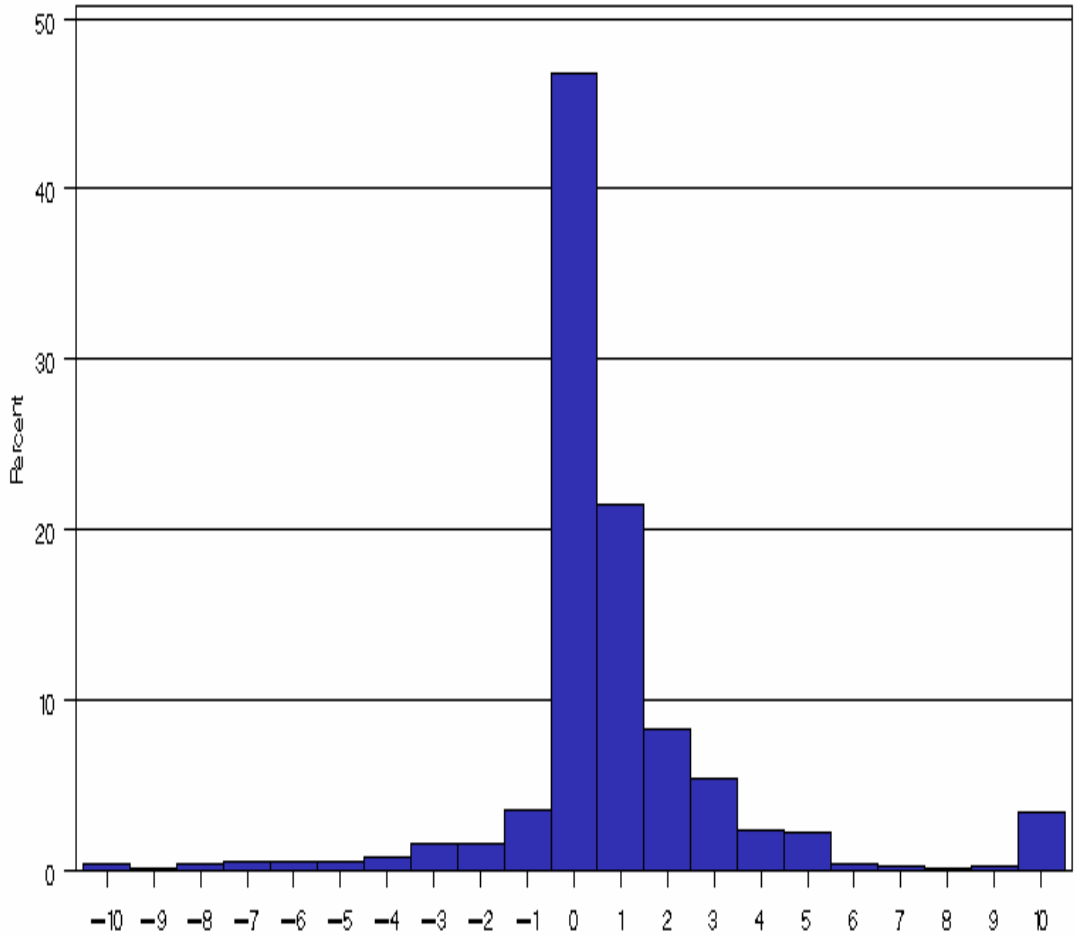
Term Loans, public firms



- **CDS Credit curves constructed from MarkIt data.**
- **Difference = Model value – Nearest LPC quote. Set to zero if model value is within quotes.**
- **Differences within one dollar bucket – 57%**
- **Differences within two dollars bucket – 68%**
- **We also observe some large differences.**

Price differences: LPC quotes vs. CDS implied loan values

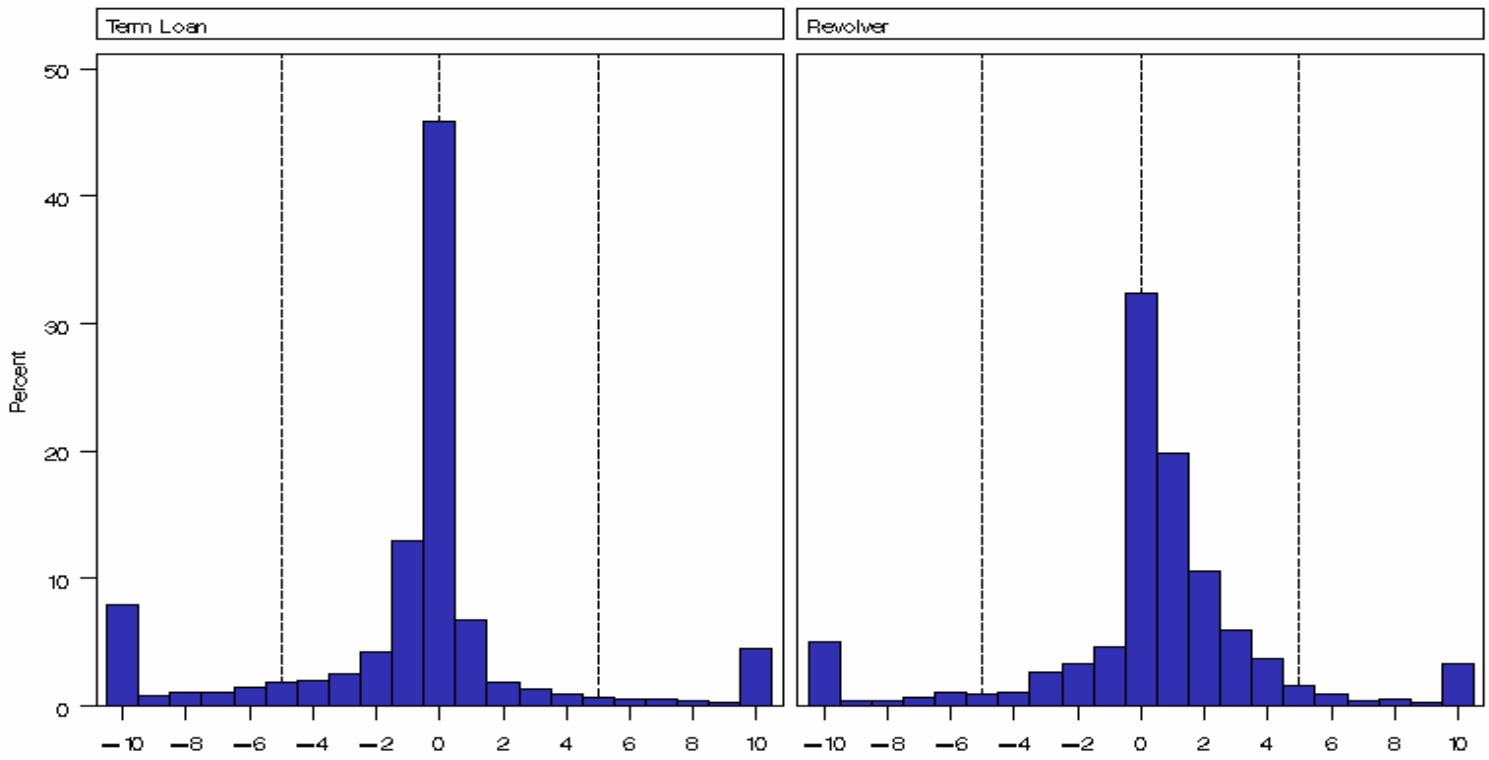
Revolvers, public firms



- **Difference within one dollar bucket – 70%**
- **Within two dollars bucket – 79%**

Price differences: LPC quotes vs. EDF implied loan value

Term Loans and Revolvers, Public Borrowers



Within one dollar bucket – 66% (57% with CDS)

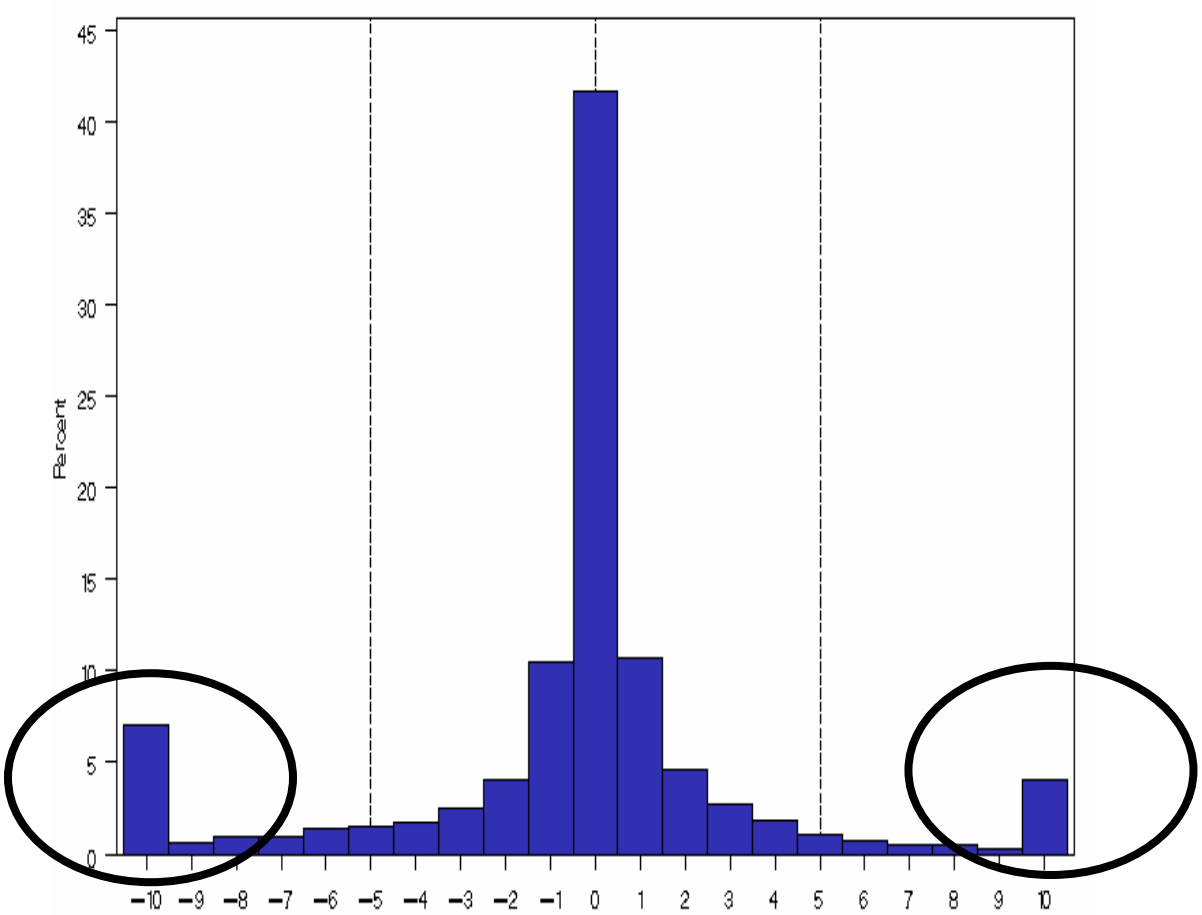
Within two dollars bucket – 73% (66% with CDS)

Within one dollar bucket – 57% (70% with CDS)

Within two dollars bucket – 71% (79% with CDS)

Samples are bigger with EDF than with CDS (744 borrowers with EDF, 242 with CDS)

What are the drivers for some large differences when comparing LPC quotes against EDF or CDS based values?

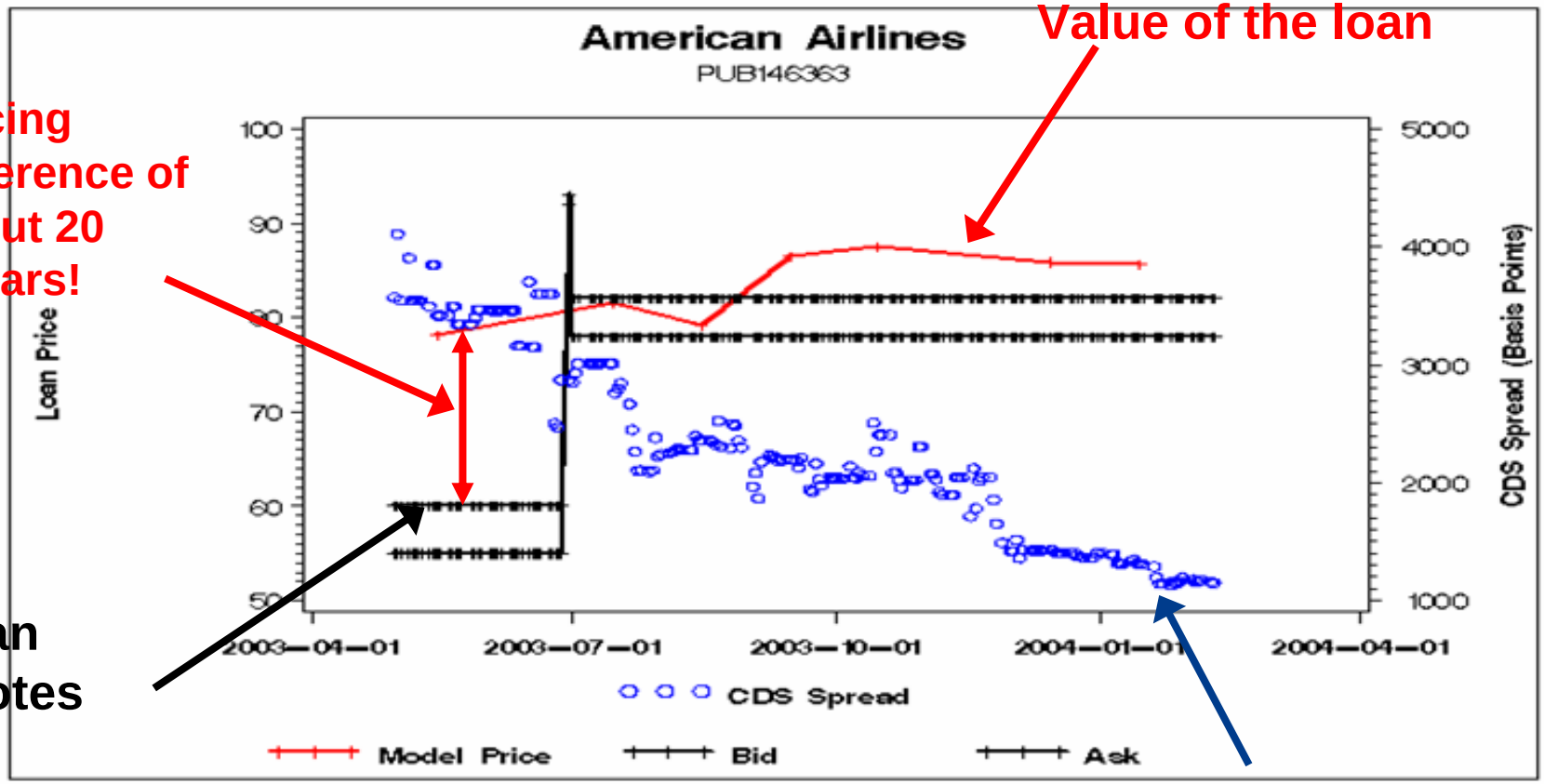


Model value << Market quote

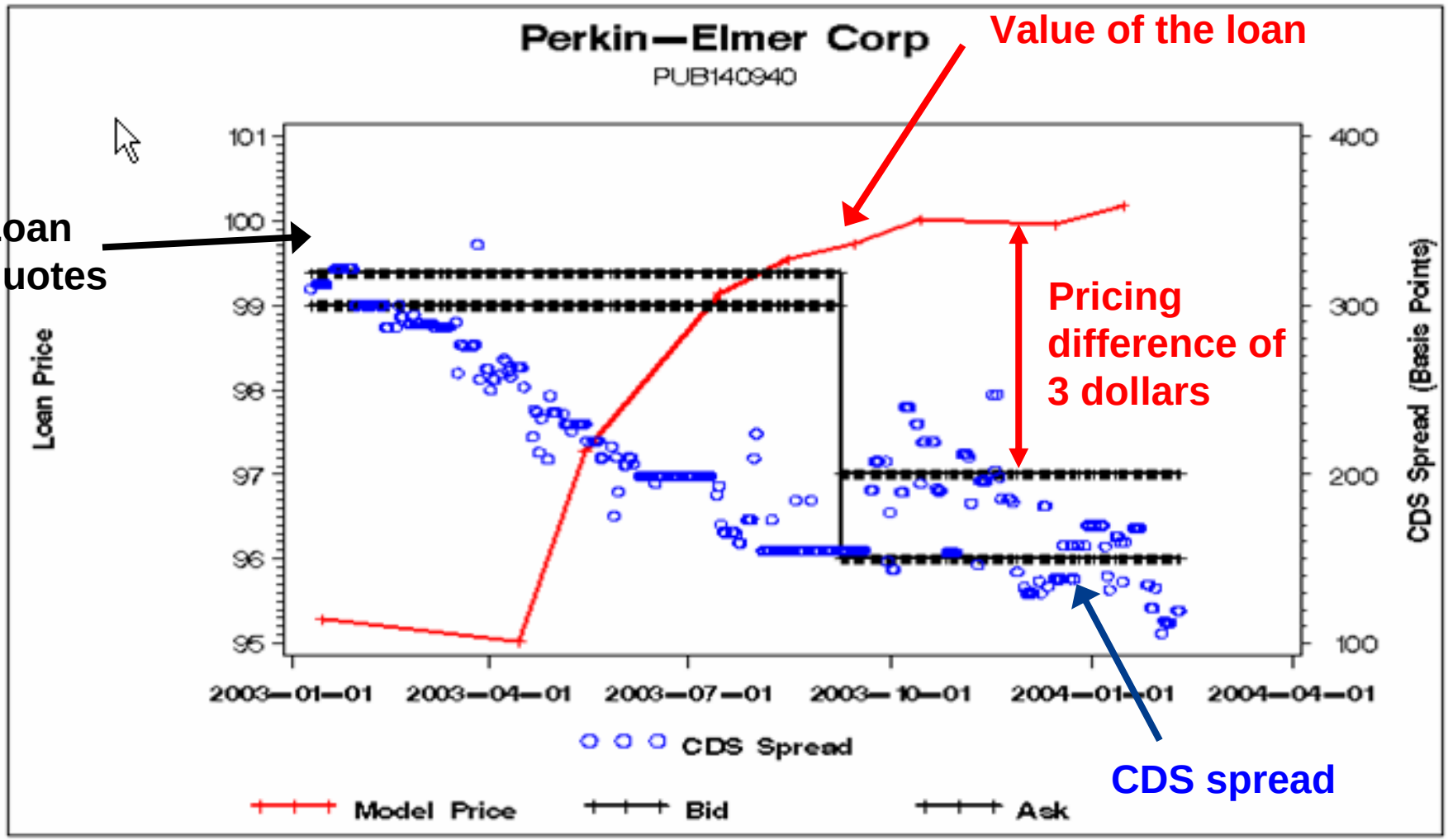
Model value >> Market quote

- **Large differences tend to be mostly idiosyncratic. Need to examine them on a case by case basis.**
- **Possible reasons: Stale loan prices, incorrect terms and conditions info, incorrect assumptions about usage or LGD levels, divergence between markets etc.**

Loan quotes are stale and may jump in response to new information



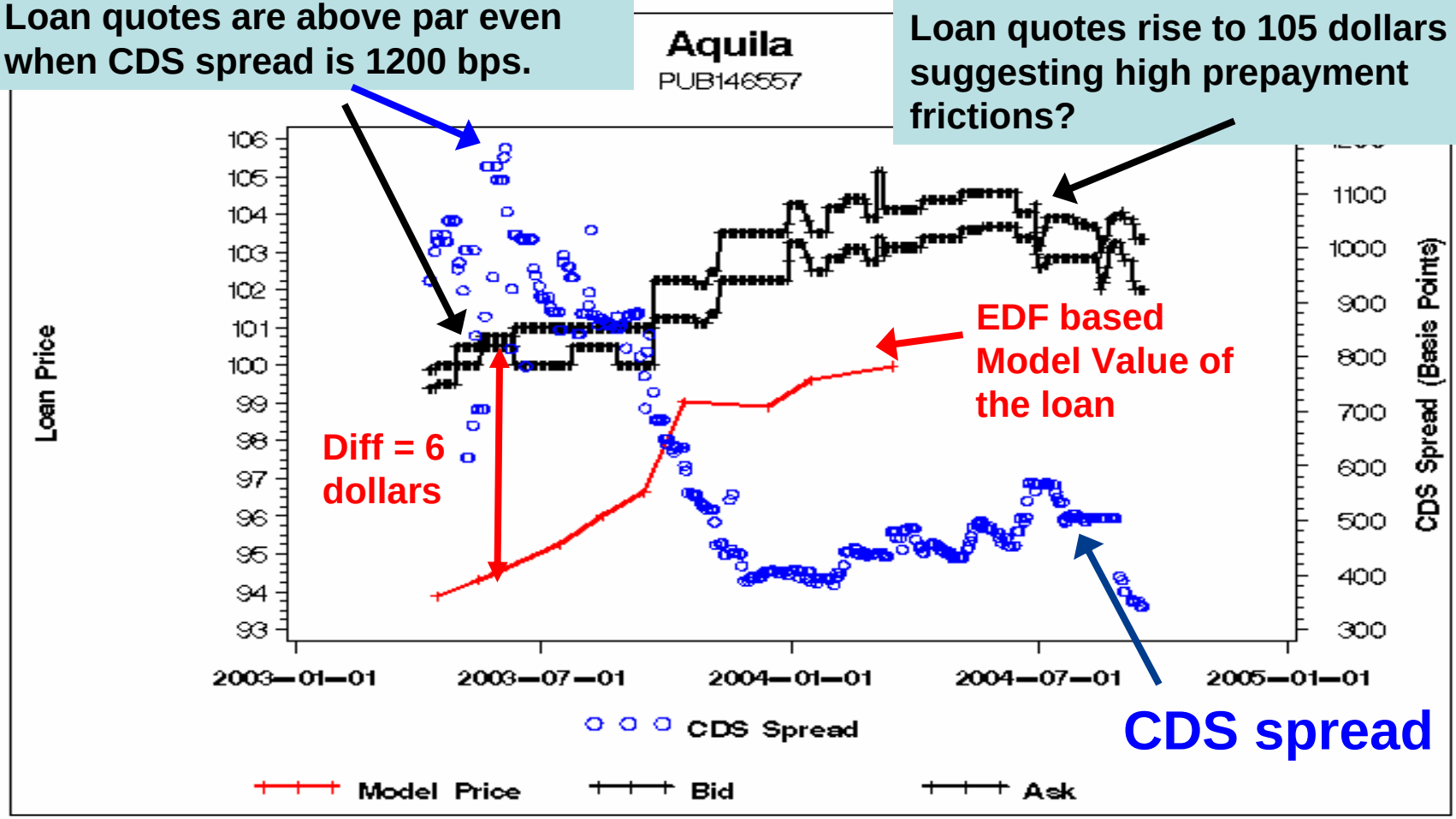
Loan prices are not only stale but also diverge from CDS and EDF



Generic assumptions about inputs like prepayment frictions and usage levels can cause large differences

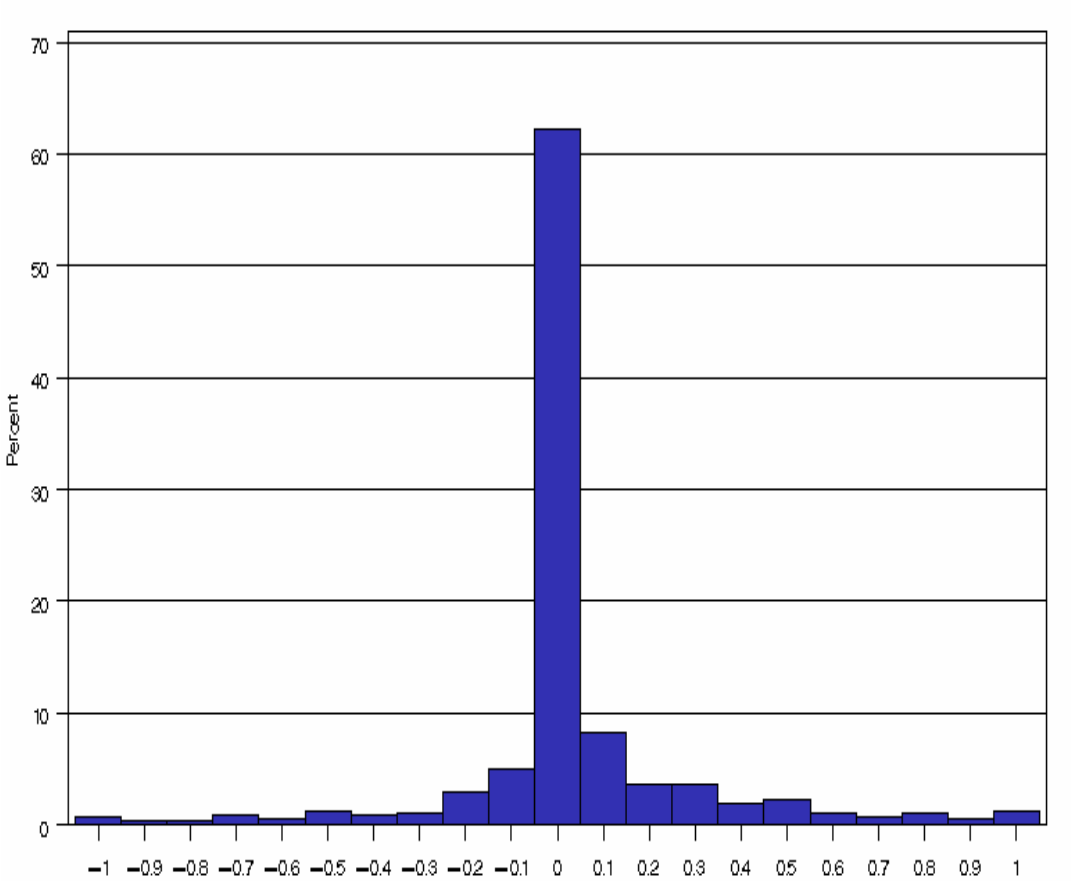
Loan quotes are above par even when CDS spread is 1200 bps.

Loan quotes rise to 105 dollars suggesting high prepayment frictions?



Loan quotes tend to be stale

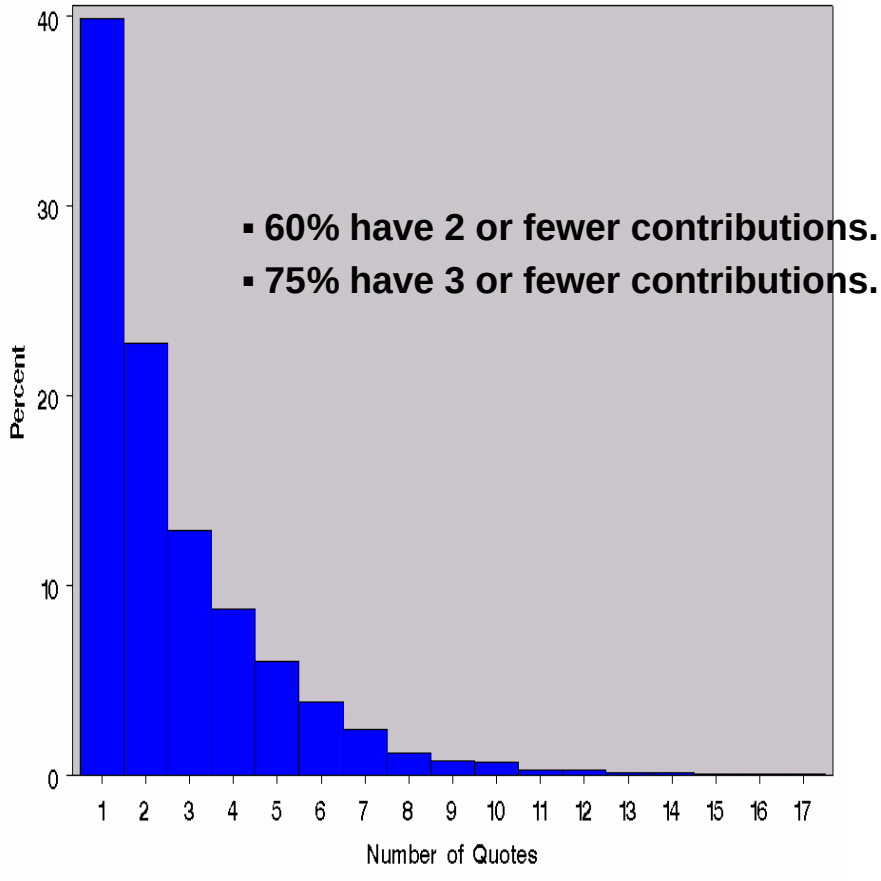
Distribution of Monthly changes in loan quotes.



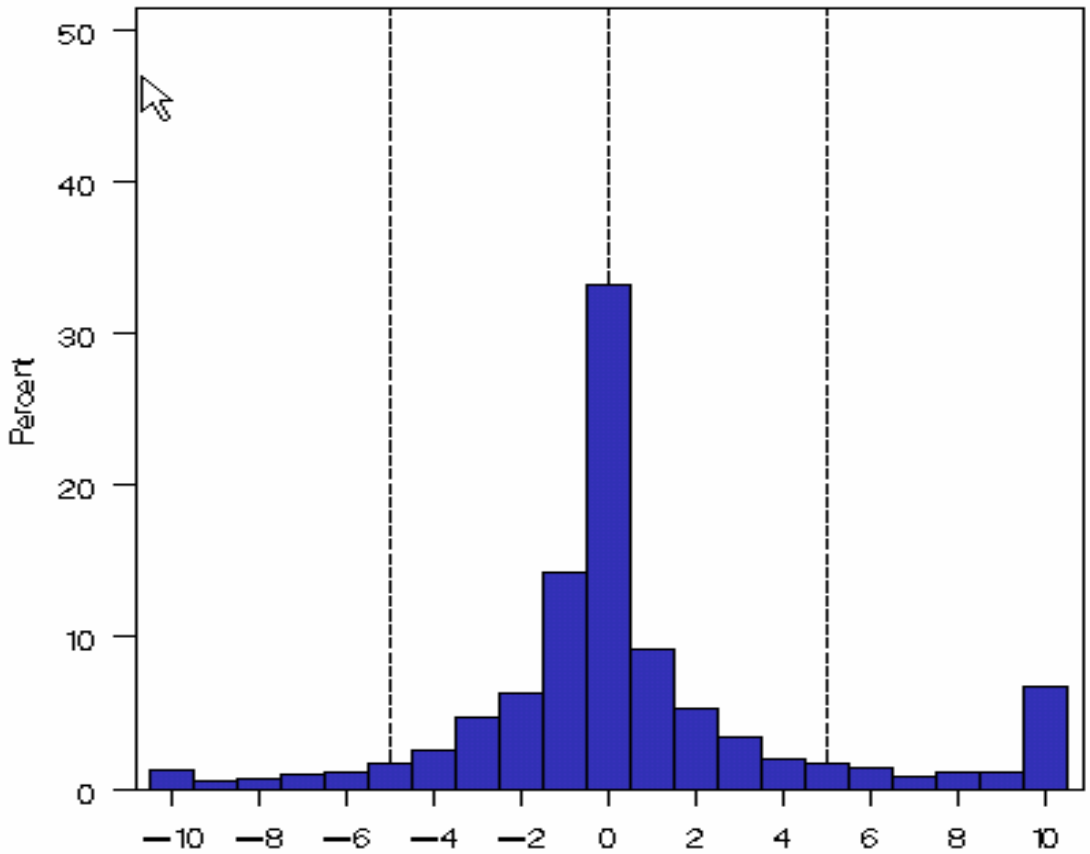
- **48% of monthly quote changes are *exactly* zero, suggesting high incidence of stale quotes** (caveat: loan values are expected to be somewhat more stable than, say, bond values – no Interest rate risk, lower LGD, prepayment option).
- **These quotes, by themselves, may be inadequate for mark-to-market purposes.**
- **Potential for better price discovery and MTM in loan market by bringing in information from more active markets.**

Most loans are quoted by just one or two dealers

- **About 60% of composite quotes are based on contributions of only 1 or 2 dealers.**
- **In the CDS world, such prices would be considered ineligible for inclusion in databases like the MarkIt data.**



Pricing differences: LPC quotes vs EDF based model values, Private Firms

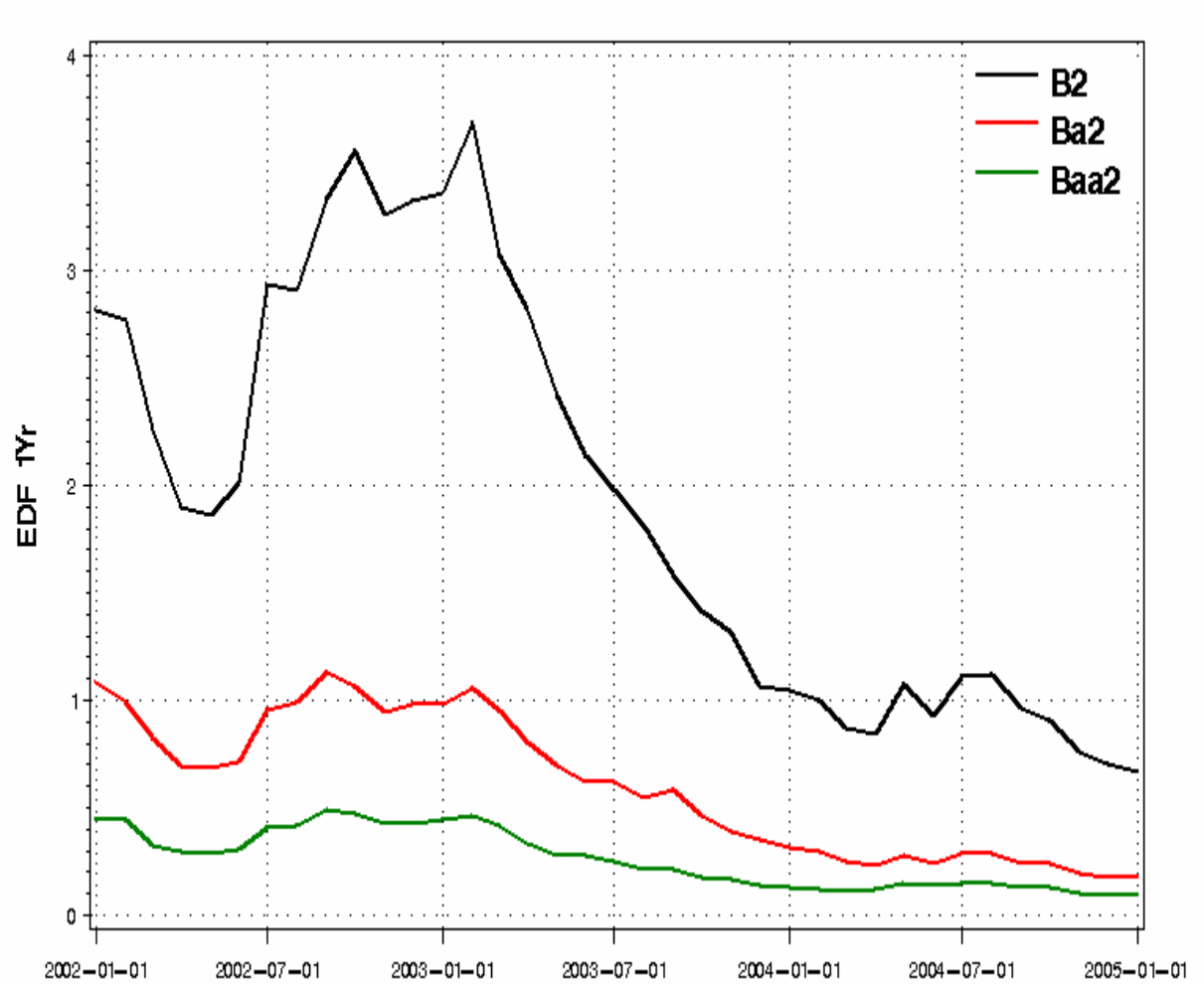


- Mapped ratings to EDF using spot EDF values.

Results

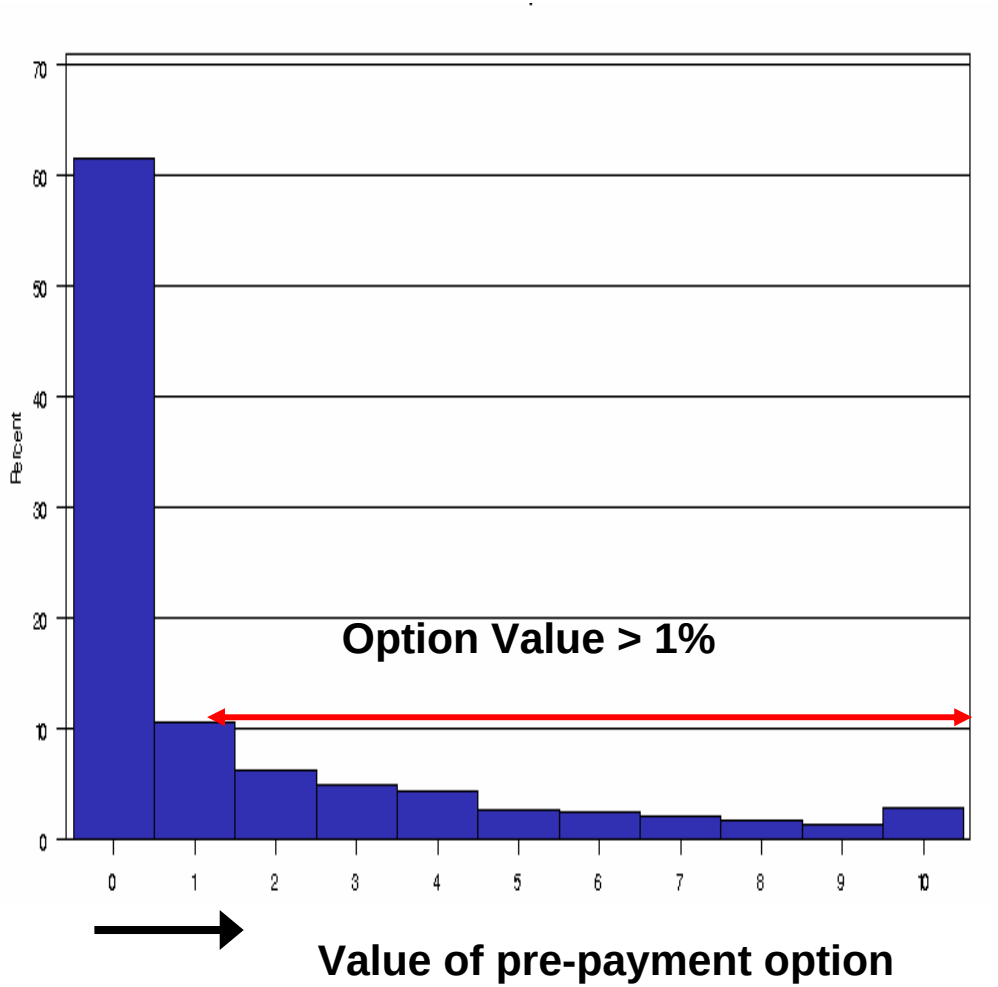
- Model values are within one dollar of nearest quote – 57% (65% for public firms)
- Within two dollars – 65% (75% for public firms).
- Some large differences.

Rating implied EDF values are dynamic measures of credit quality



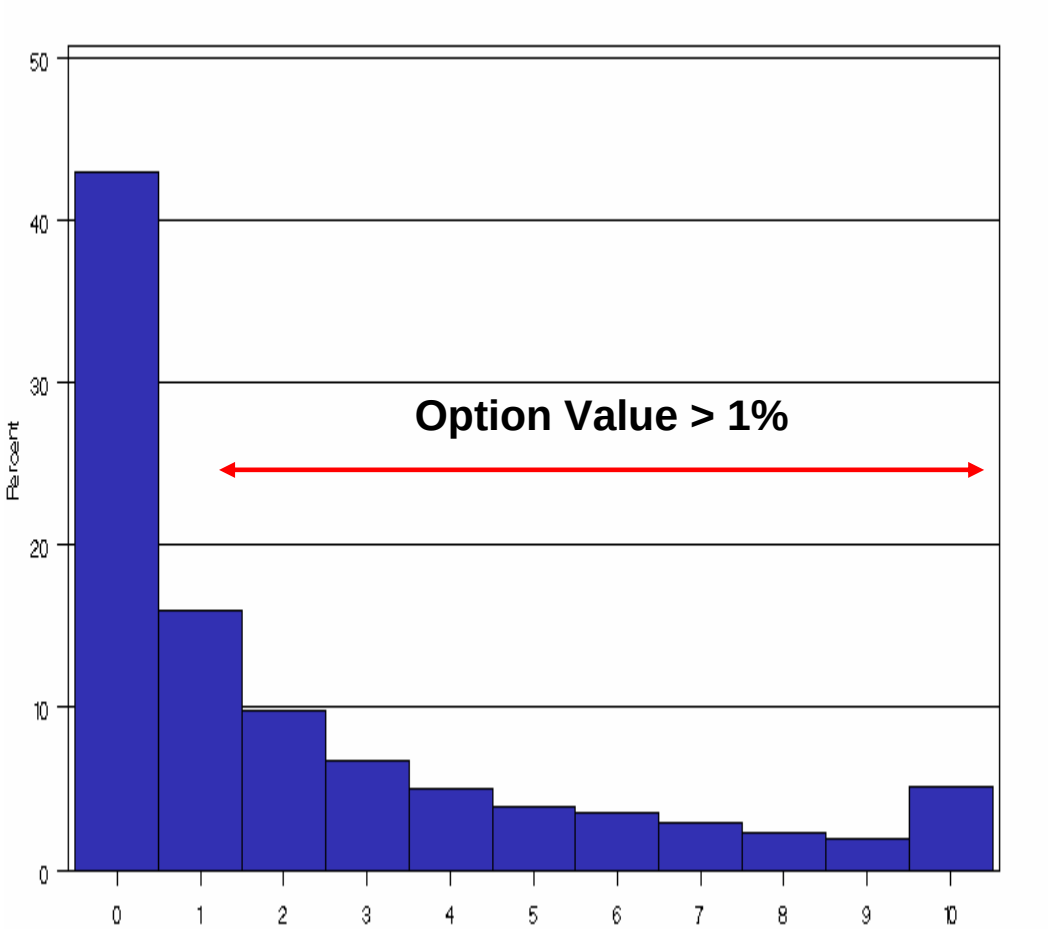
- **A given rating maps to varying levels of EDF depending on the state of the credit cycle.**
- **Rating may be a through the cycle measure of credit quality, but rating implied EDF behaves like a market based measure.**
- **Baa2 rated loans to private borrowers will, in general have lower model values in year 2002 than in year 2004.**
- **Model values will better reflect market behavior across the cycle.**

Value of the prepayment option can be substantial



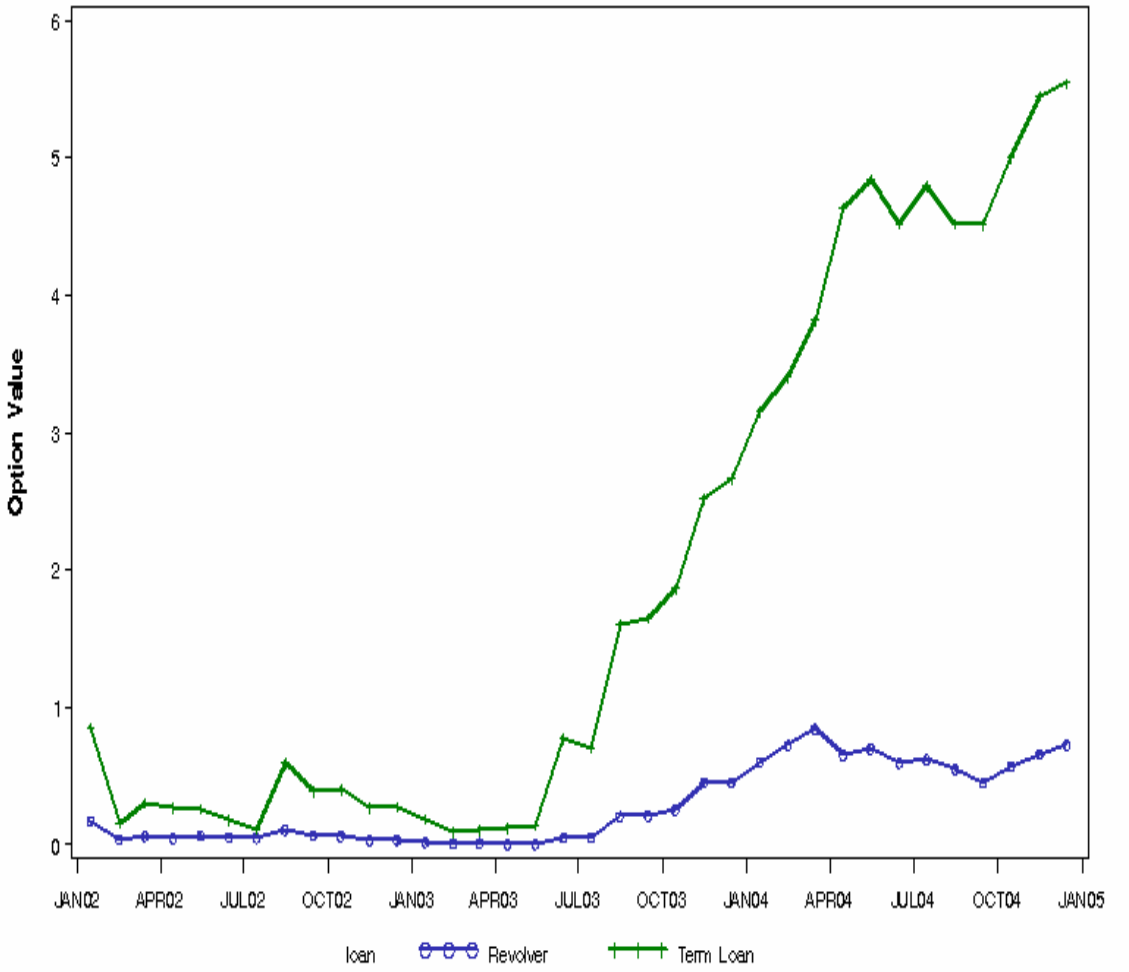
- **Value of PP option = Model value disallowing prepayments – model value allowing prepayments**
- **CDS implied model values used in calculations.**
- **28% of loans have prepayment option value of 1% of face value or more.**

Similar results using EDF based model



- **EDF (or rating implied EDF) based model values used to compute pre-payment option values here.**
- **Over 45% of loans have prepayment option value of 1% of face value or more.**
- **Assumed prepayment cost = 0.5% of face value.**
- **EDF sample has a much larger proportion of term loans than the CDS sample. Term loans are likely to have larger option values.**

Prepayment option is much more valuable in good credit environment

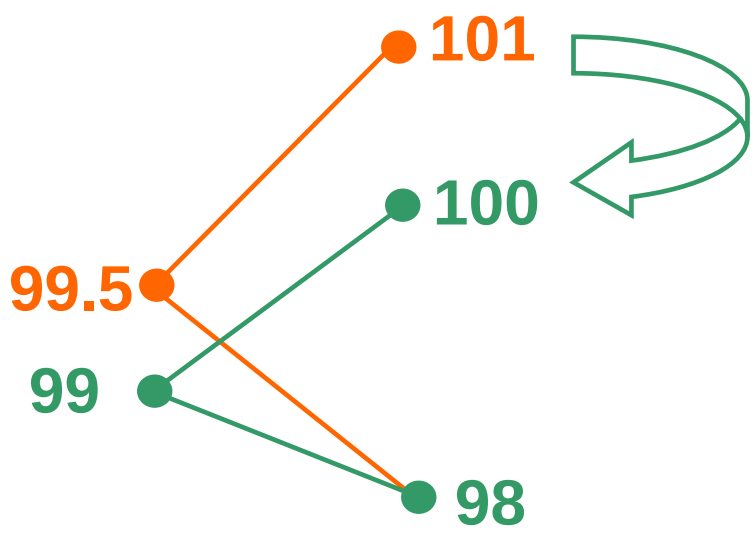


- **The chart shows median values of prepayment option for term loans and revolvers**
- **Option is much more valuable in a good credit environment than in a bad one. Loans still priced by ratings but EDF/CDS spreads have improved.**
- **Revolvers usage drops in good environment, hence option value does not rise as much.**

Can we account for prepayment option by simply putting a cap (at par) on model values derived from a model that ignores credit migration?

A Simple Two-Period Example

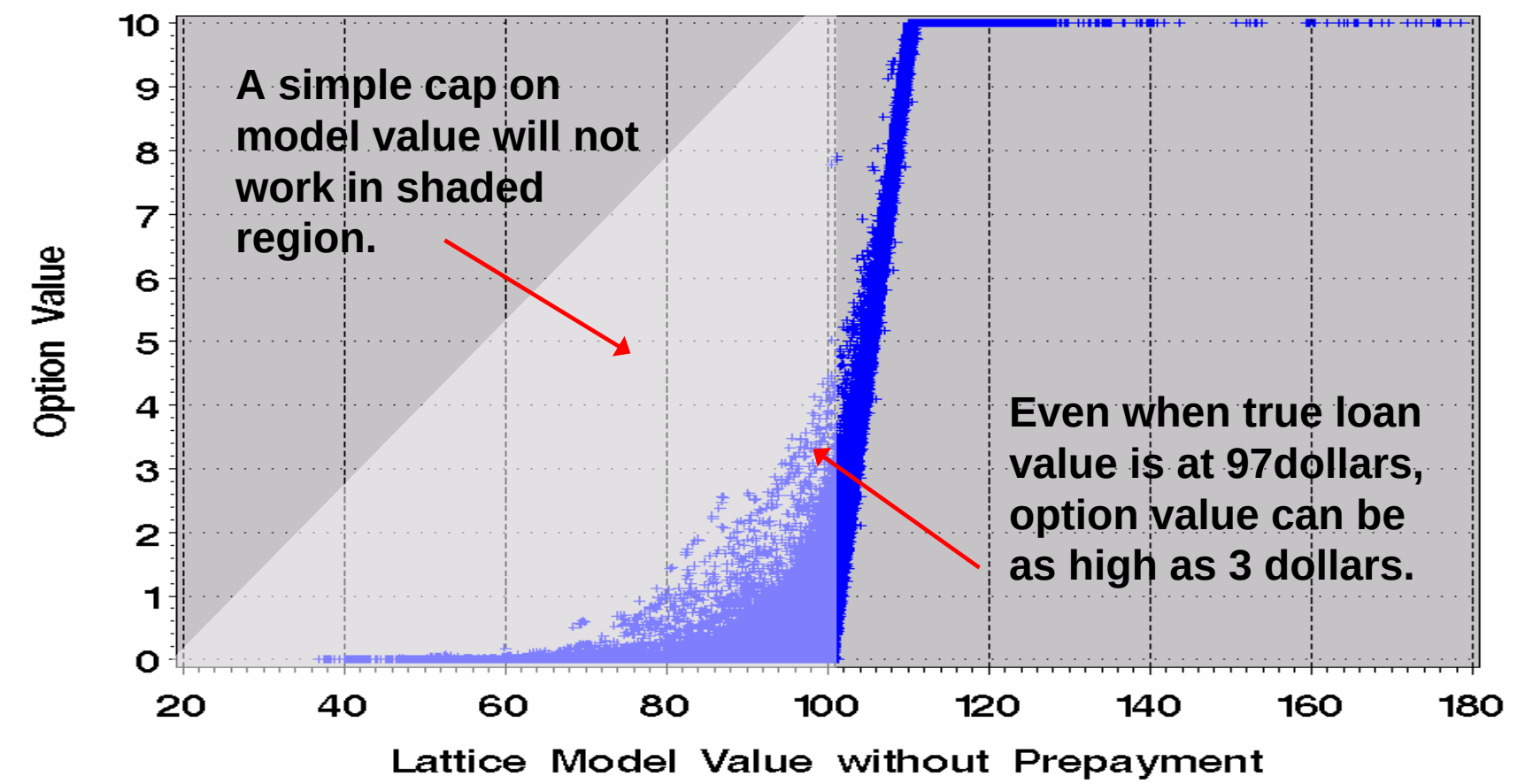
A model that ignores migration will value this loan at 99.5 because this value is still below par



Prepayment lower the value at this node. A credit migration model correctly captures this and will value the loan at 99, which is the correct value.

Prepayment Option Value = 99.5-99 = 0.5

Prepayment Option values can't be properly captured by simply putting a cap on model values derived from a model that ignores credit migration.



Do large values of pre-payment option predict actual prepayments?

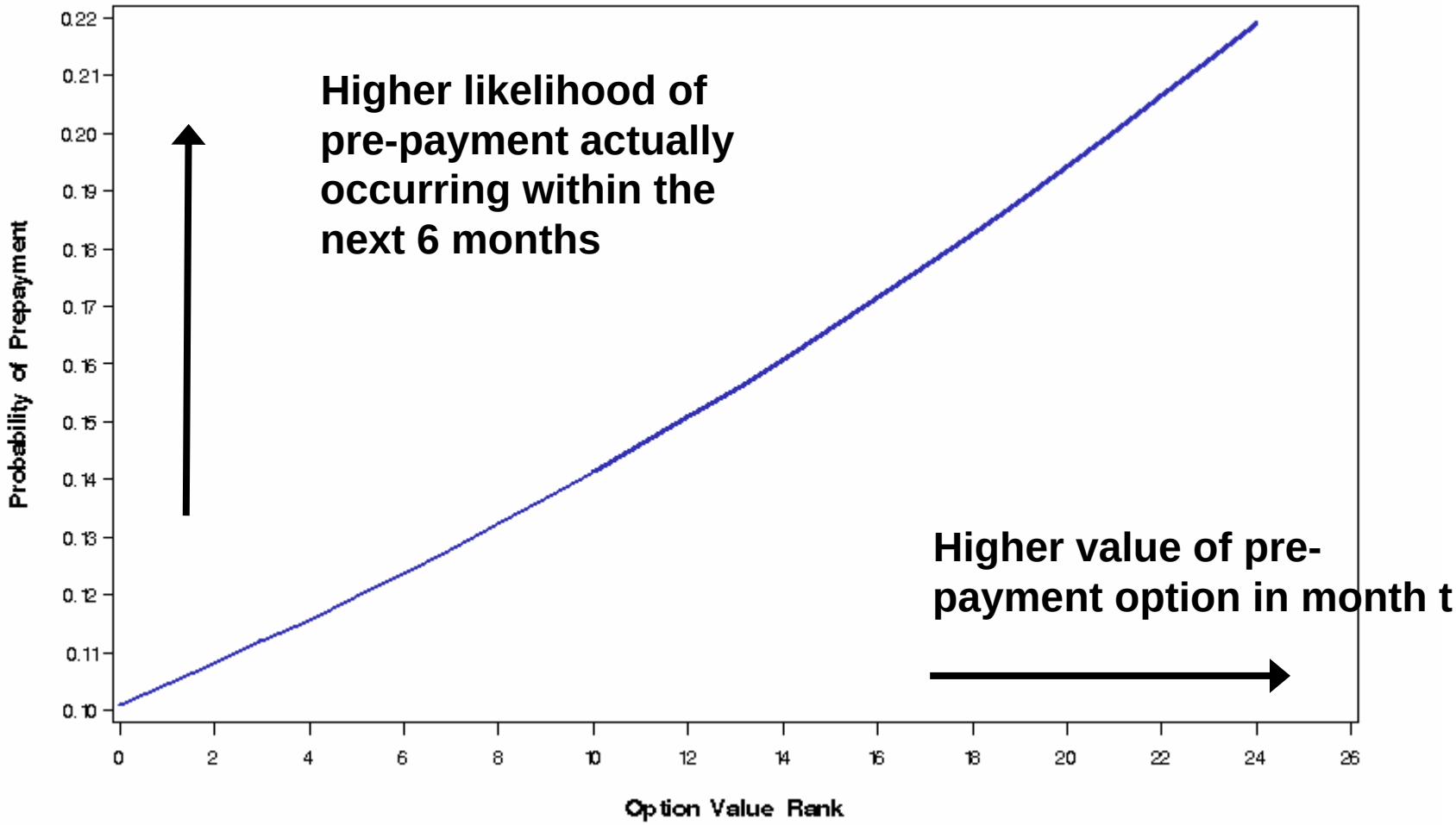
- Compute prepayment option value in month t.
- If this value is large for a given loan, is that loan more likely to be pre-paid in the next n=3 or 6 months?

- Estimate the probability of prepayment within t+n months.
- See if this is positively related to option value in month t.

Prepayment events

- Actual prepayment data in hard to obtain. Prepayment is assumed to have occurred if a loan ceases to be quoted when,
  - it is still at least 3 months away from its maturity date and,
  - its last quoted price is 95 dollars and above and,
  - it had at least 3 average daily quotes per day for a month prior to the cessation of its quotes

Higher values of prepayment option indeed predict higher incidence of prepayments

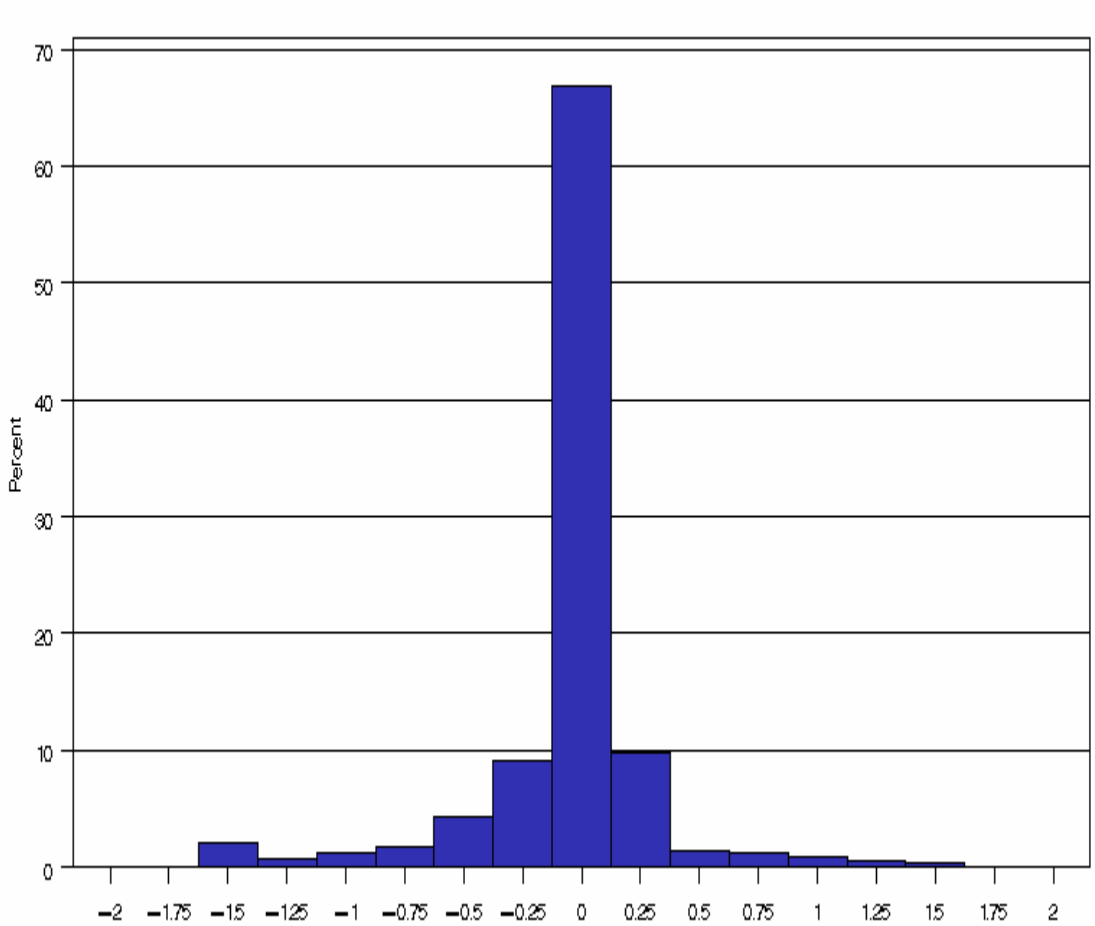


Pricing Grids

Rating	Drawn Spread (bp)	Facility Fee (bp)
Baa2	87.5	37.5
Baa3	112.5	37.5
Ba1	137.5	37.5
Ba2	175	37.5

In our sample, about 30% of loans had pricing grids. Usually based on financial ratios or ratings.

Value of pricing grids, term loans



- **Value of pricing grid = Value of loan with the grid – value of loan without the grid**
- **Grids can have positive or negative values and they can exceed 1% of the face value in some cases.**
- **Important to account for the grids in valuation.**

Summary

- Lattice model provides a versatile and rigorous framework for loan valuation.
  - EDF implied loan values closely match CDS implied loan values.
  - EDF/CDS implied loan values compare well against LPC quotes.
  - Large differences from LPC quotes can often be tracked idiosyncratic effects like stale quotes, incorrect terms and conditions, divergent behavior of different markets etc.
- Prepayment option and pricing grids can have significant values. Lattice model can identify these values and help pin down their source.
- Valuable tool for fair value calculation and understanding the various influences driving this value.