

# Risk Management Lessons from the Credit Crisis

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# Spain shows the way in better handling of risk management

## BANKS News analysis

A report calls for lenders to consider full-time expert non-execs, writes Peter Thal Larsen

Every Wednesday morning at 9.30am, five BBVA board members gather at the Spanish bank's head office in Madrid.

For the following three hours, they review new loans and discuss broader risks that might affect the bank's operations. When necessary, they reconvene the next day.

In 2007, they met a total of 74 times.

These meetings are similar to those that are held regularly in banks around the world. But in the case of the make-up of BBVA's risk committee there is one important difference: just one of its members, José Maldonado Ramos, is a full-time bank executive. The

other four are non-executive directors.

Other Spanish banks take a similar approach. Santander, BBVA's main domestic rival, has a five-member risk committee, including three non-executive directors, which met 102 times last year.

Managers believe that this intense board-level focus on risk is one reason why Spain's large banks have so far weathered the credit crunch in better shape than many of their European rivals.

This approach is now winning admirers elsewhere. Lord Turner, chairman of Britain's Financial Services Authority, recently argued that banks might benefit from non-executive board members who devoted most of their time to one institution.

Sir David Walker, the respected investment banker, is expected to consider this question in his review of banks' corporate governance.

The notion of full-time non-executive directors is

one of the main suggestions to emerge from a new report on European bank governance by Nestor Advisers.

"Banks will need people to come to their boards in a very dedicated fashion, and though they are non-executives, become more hands-on in terms of the way risk is run," says Stipon Nestor, the corporate governance consultancy's founder.

For some directors, many

of whom have full-time jobs elsewhere, the notion of a weekly meeting is unthinkable. Some bankers fear that a move in this direction would scare off potential board members who are already concerned by the workload and public scrutiny associated with being the director of a large financial institution.

Institutional investors fret that full-time directors

would have less independence than their part-time counterparts.

"We do not believe in a system of full-time independent directors: this could lead to a loss of independence and would rule out our being able to attract serving executives from other companies and sectors to become non-executive directors on our board," Marcus Agius, chairman of Barclays, told

shareholders of the British bank last month.

Given the current scrutiny of bankers' bonuses, there is also the thorny question of compensation: members of Santander's risk committee are paid more than twice as much as normal non-executive directors of the bank.

It would also be simplistic to suggest that introducing a full-time risk committee, or appointing more bank execu-

tives to the board, could have prevented the problems some banks have experienced.

The board of UBS, for example, delegated many of its risk-management decisions to a small committee of former executives who failed to spot that the bank was piling highly rated but risky loans onto its balance sheet.

Mr Nestor points out that

all eight of the European banks that have outperformed in the crisis have an experienced banker as chairman. But so did half the banks that have underperformed.

The performance of Spanish banks is also due to the tight controls imposed by the country's central bank, which banned off-balance sheet vehicles and forced banks to build up extra reserves during the boom.

Even so, as policymakers and politicians attempt to improve corporate governance and risk management at banks in an attempt to prevent a repeat of the crisis, the Spanish approach is worth debating.

Emilio Botín, Santander's chairman, recalls a visit from a former chairman of the US Federal Reserve who expressed surprise at the amount of time the bank devotes to risk management.

"It's true, it consumes a lot of our directors' time," Mr Botín said in a speech last year. "But we find it essential. And it is never too much."

## Boards urged to develop more commitment from independent directors

Banks should cultivate a cadre of experienced former executives who can serve as non-executive directors while taking a closer interest in risk management than most boards are able to, an in-depth study of the corporate governance of European banks has recommended, writes Peter Thal Larsen.

The report by Nestor Advisers, the corporate governance consultancy, argues that bank boards will in future need non-executive

directors with more banking experience spending more time on their duties than many board members are currently willing to commit.

The recommendation comes amid a growing debate about the structure and composition of banks' boards of directors in the wake of the credit crunch.

"To achieve proper board dynamics, bank boards will probably need to enlist more financial industry expertise, have their non-executive directors work

significantly more, and require them to limit their other commitments," Nestor Advisers recommends.

The Nestor report finds that while broad comparisons are difficult, banks with boards of directors led by financial industry experts in general performed better during the crisis than boards led by non-bankers.

Stipon Nestor, founder of Nestor Advisers, said the main priority for bank boards after the credit crisis

was to ensure that they could look at the broader picture, ask difficult questions, and challenge the biases of executives.

However, this runs contrary to many of the demands that have been placed on directors through rules such as the Sarbanes-Oxley Act.

"What we should ask for boards is to be able to take the long view, and we have been constantly pushing them in the opposite direction for the past 10 years," said Mr Nestor.



BBVA has a board-level focus on risk

# Risk Mismanagement...

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“The best Wall Street minds and their best risk-management tools failed to see the crash coming.”

# Risk Management Failures?

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“A large loss is not evidence of a risk management failure because a large loss can happen even if risk management is flawless.”

» René Stulz (2008), “Risk Management Failures”

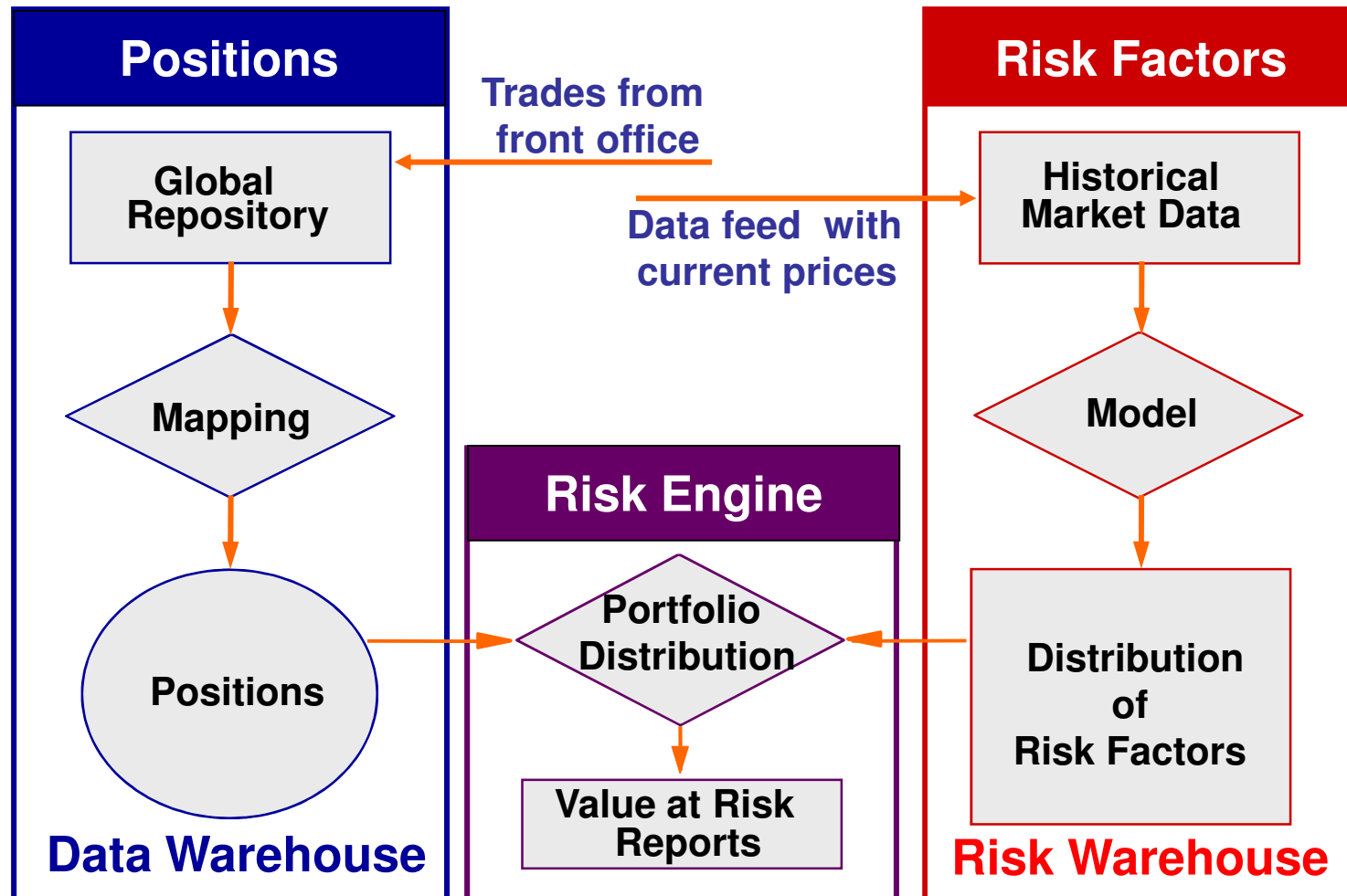
# Risk Management Lessons

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(1)

## Risk Measurement Systems

# Components of a Risk Measurement System



# Market Risk Measurement: Returns-Based

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- Advantages:
  - » easy and cheap to implement
  - » account for dynamic trading
- Drawbacks:
  - » no data for new markets and managers
  - » will not capture style drift (e.g. Amaranth)
  - » may not reveal hidden risks, e.g. short options
  - » give no structural insight into risk drivers

*Reference:* Lo, 2001, “Risk management for hedge funds: Introduction and overview,” FAJ

# Market Risk Measurement: Positions-Based

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- Advantages:
  - » use the most current position information
  - » can be applied to new products and managers
  - » can be used for stress tests, with factor scenarios
- Drawbacks:
  - » expensive to implement: several million positions for large bank or full transparency for fund of funds
  - » assume that the portfolio is frozen over the horizon and do not account for dynamic trading
  - » susceptible to errors in data and models

*References:* Jorion, 2008, "Risk management for event-driven funds," FAJ

Jorion, 2007, "Risk management for hedge funds with position information," JPM

# Conclusions:

## Returns- vs. Positions-Based

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- Modern risk measurement systems are based on position information
- Positions-based risk measures are more informative than returns-based risk measures and can be used for forward-looking VAR reports and stress tests
- Returns information should be used to calibrate risk models: “backtesting” counts the number of exceptions, or losses worse than VAR

# Risk Management Lessons

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(2)

## Taxonomy of Risks

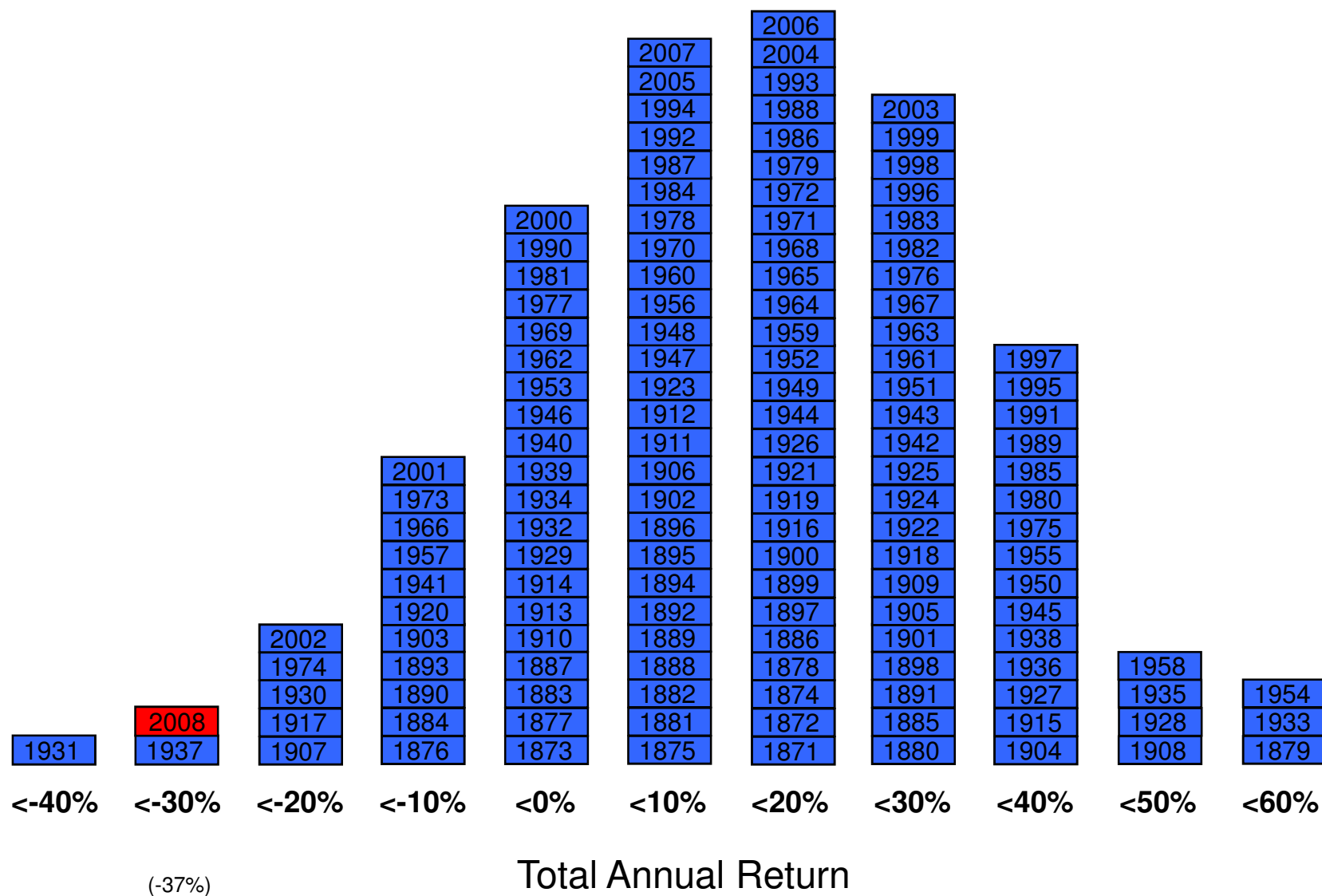
- Known knowns
- Known unknowns
- Unknown unknowns

# Known Knowns

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- Flawless risk measurement:
  - (1) The risk manager correctly identifies and measures the distribution for the risk factors
  - (2) All the positions are correctly mapped
  - (3) The distribution of P&L is correct
- Top Management and the Board decide on a risk/return profile for the business
- Big losses can still occur:
  - (1) Bad luck
  - (2) Management took too much risk

# Distribution of S&P Returns: 1871-2008



# Example

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- Suppose a long/short equity portfolio has a beta of 0.5; the distribution of equity returns is based on 1871-2007 data
  - » in 2008, the S&P lost 38%
  - » the portfolio should have lost around 19%
- VAR is not a worst-loss measure, however: it should be exceeded with some regularity
- VAR does not describe the distribution of losses beyond the quantile (conditional VAR)

# Known Unknowns: Model Risk

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- (1) The risk manager ignores important known risk factors
- Example: many banks lost money on “basis” trades, which involve buying corporate bond and buying CDS protection
    - » arbitrage trade if can be held to maturity
    - » in the meantime, there is mark-to-market risk
    - » typical risk systems map both positions on the same yield curve, and do not capture this risk

# Known Unknowns: Model Risk

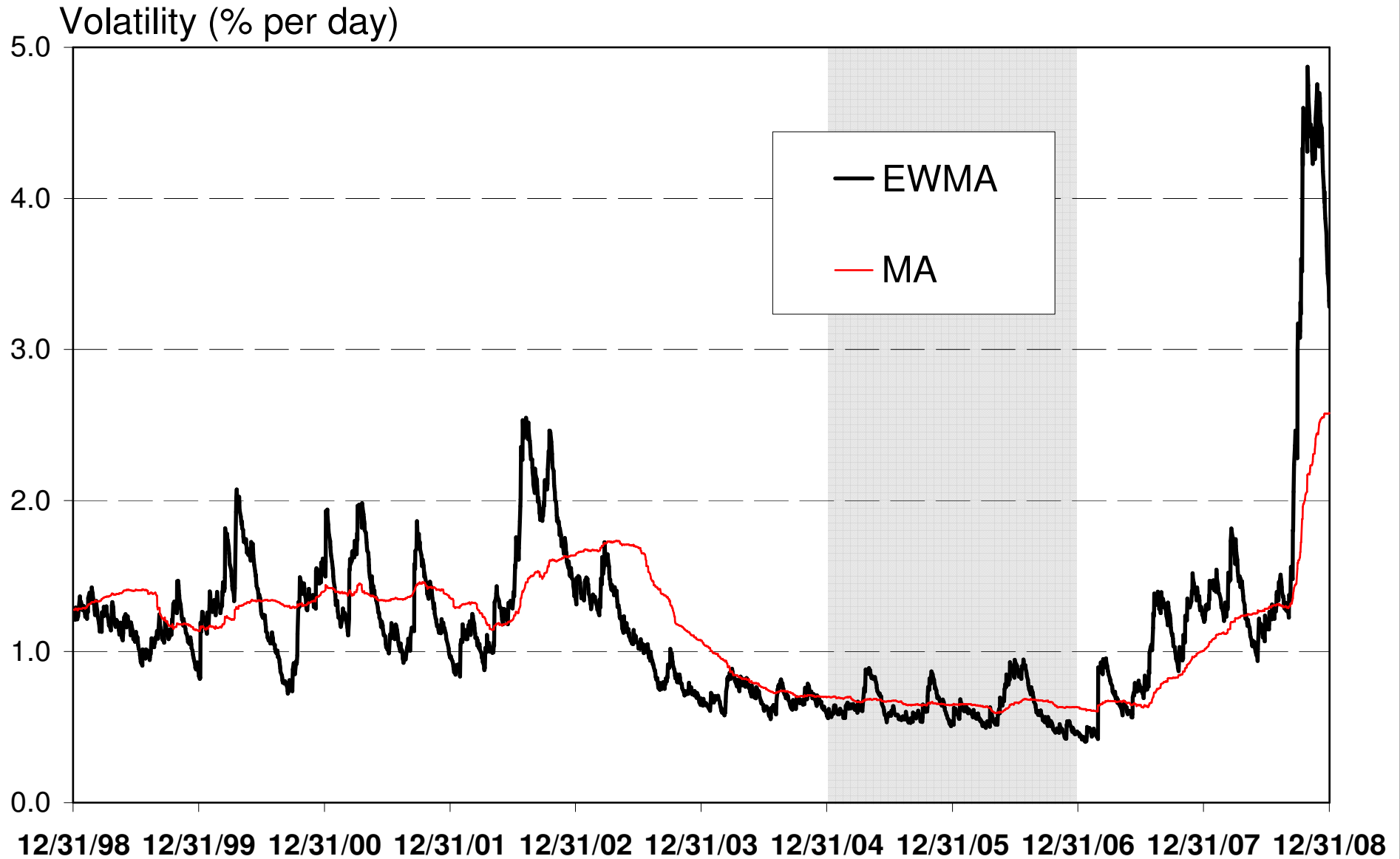
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- (2) The distribution of risk factors is incorrect, e.g. volatilities and/or correlations
  - Example: volatility is measured over a recent window, not representative (“euphoria”)
    - » risk models experienced many exceptions in 2007
  - Example: credit risk model used to build tranches of CDOs is inappropriate
    - » credit rating agencies underestimated default correlations, calibrated to rising home prices
    - » normal copula cannot explain default clustering

*Reference:* Das et al. “Common failings: How corporate defaults are correlated,” JF, 2007

Jorion and Zhang, “Credit contagion from counterparty risk,” JF, 2009

# Daily Volatility Forecast for the S&P Index



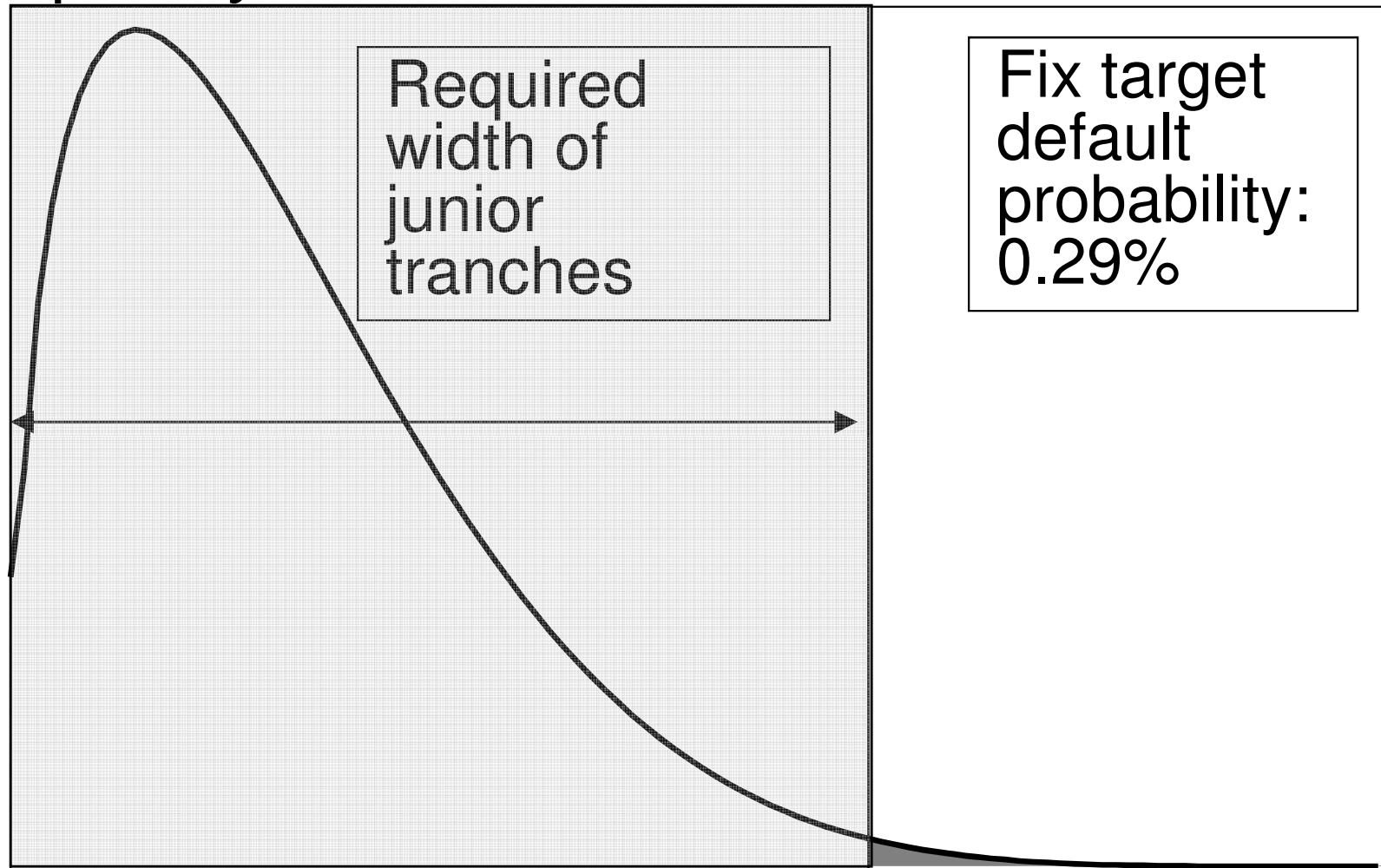
# Structured Credit Models: Default Probabilities

## Standard & Poor's Cumulative Default Rates (%) Global Corporates, 1981 to 2006

Rating	Y1	Y2	Y3	Y4	Y5
AAA	0.00	0.00	0.09	0.19	0.29
AA	0.01	0.05	0.10	0.20	0.32
A	0.06	0.17	0.31	0.47	0.68
BBB	0.24	0.71	1.23	1.92	2.61
BB	1.07	3.14	5.61	7.97	10.10
B	4.99	10.92	15.90	19.76	22.55
CCC/C	26.29	34.73	39.96	43.19	46.22

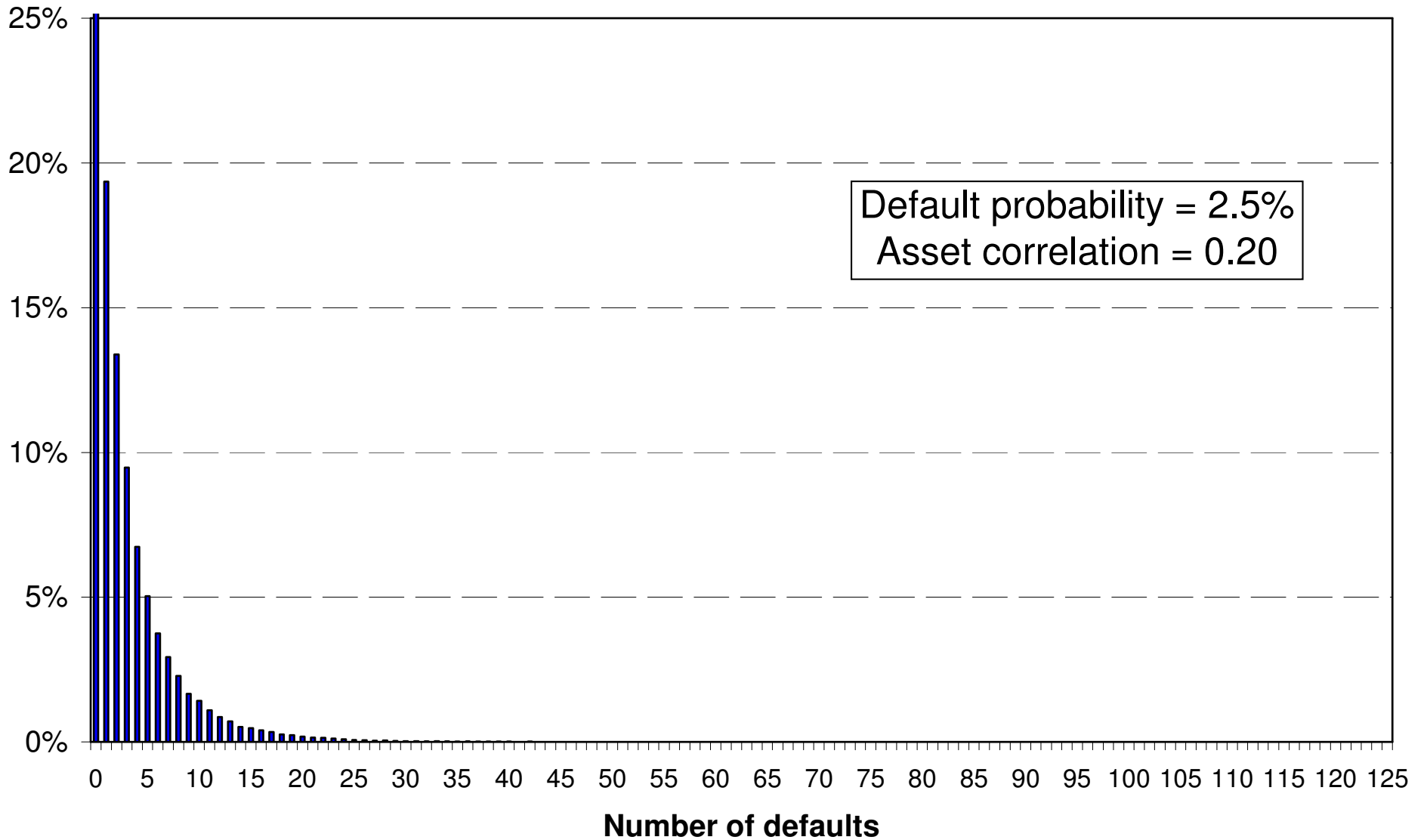
# Building the Tranche

Frequency

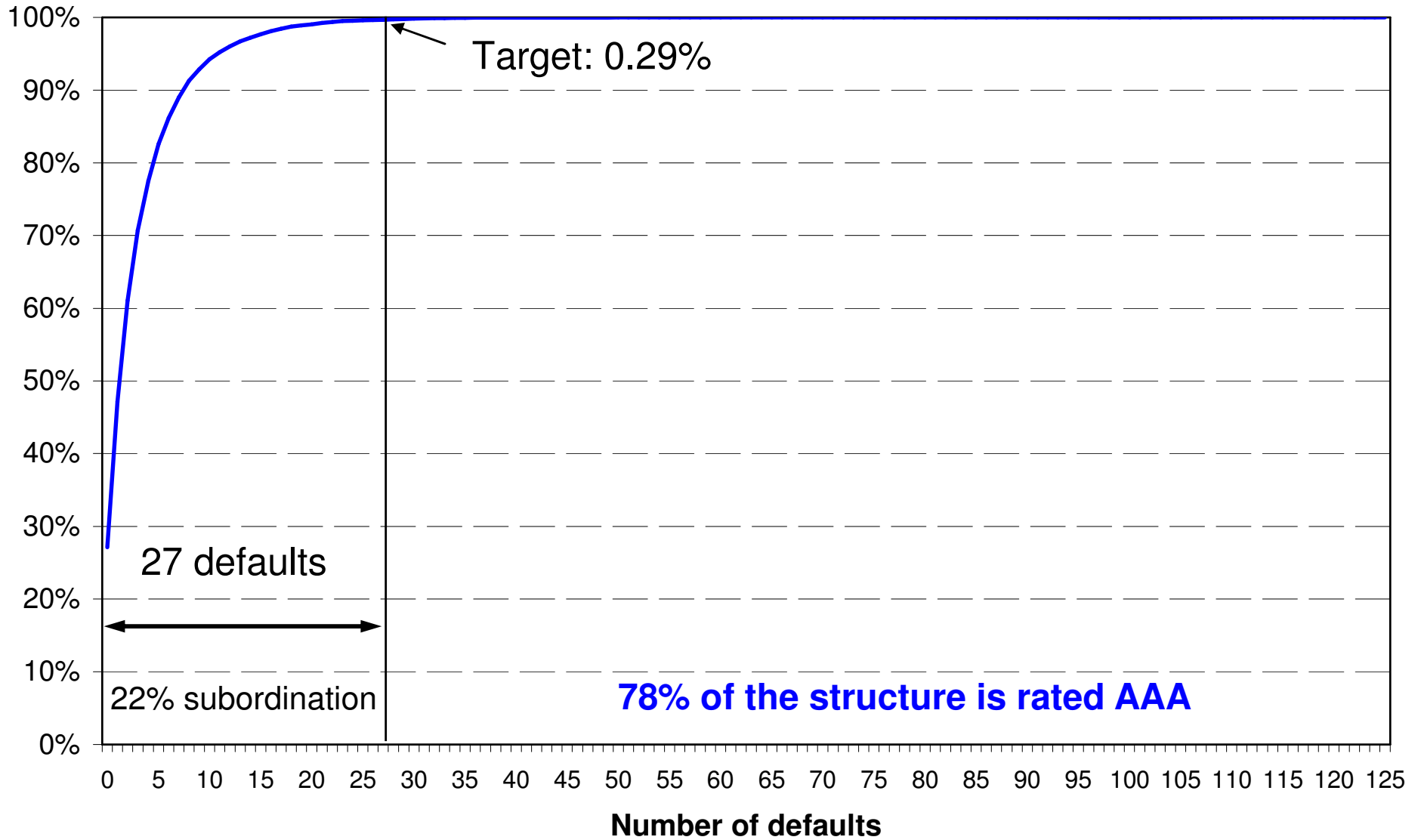


Number of defaults

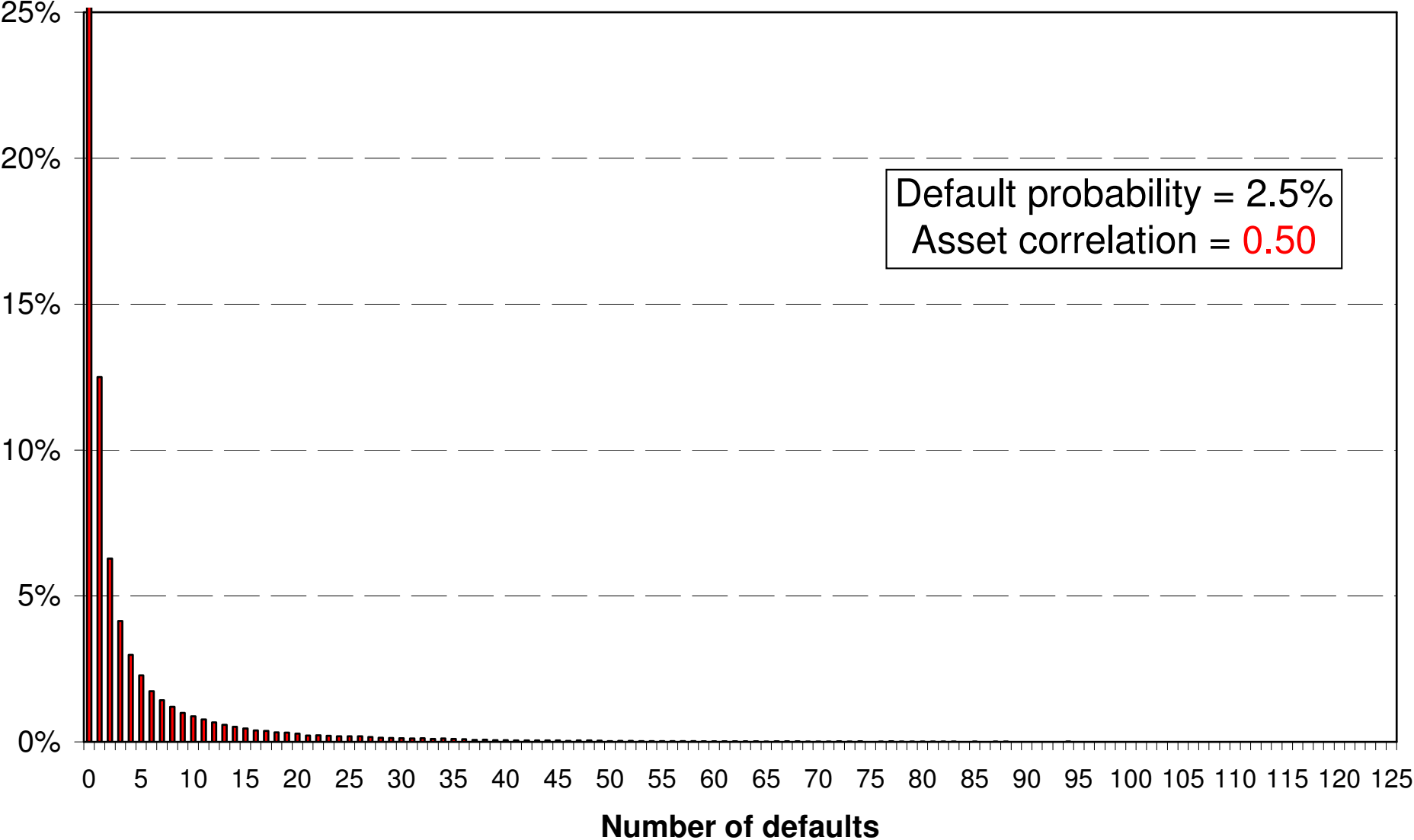
# Distribution of Defaults: 125 BBB Credits



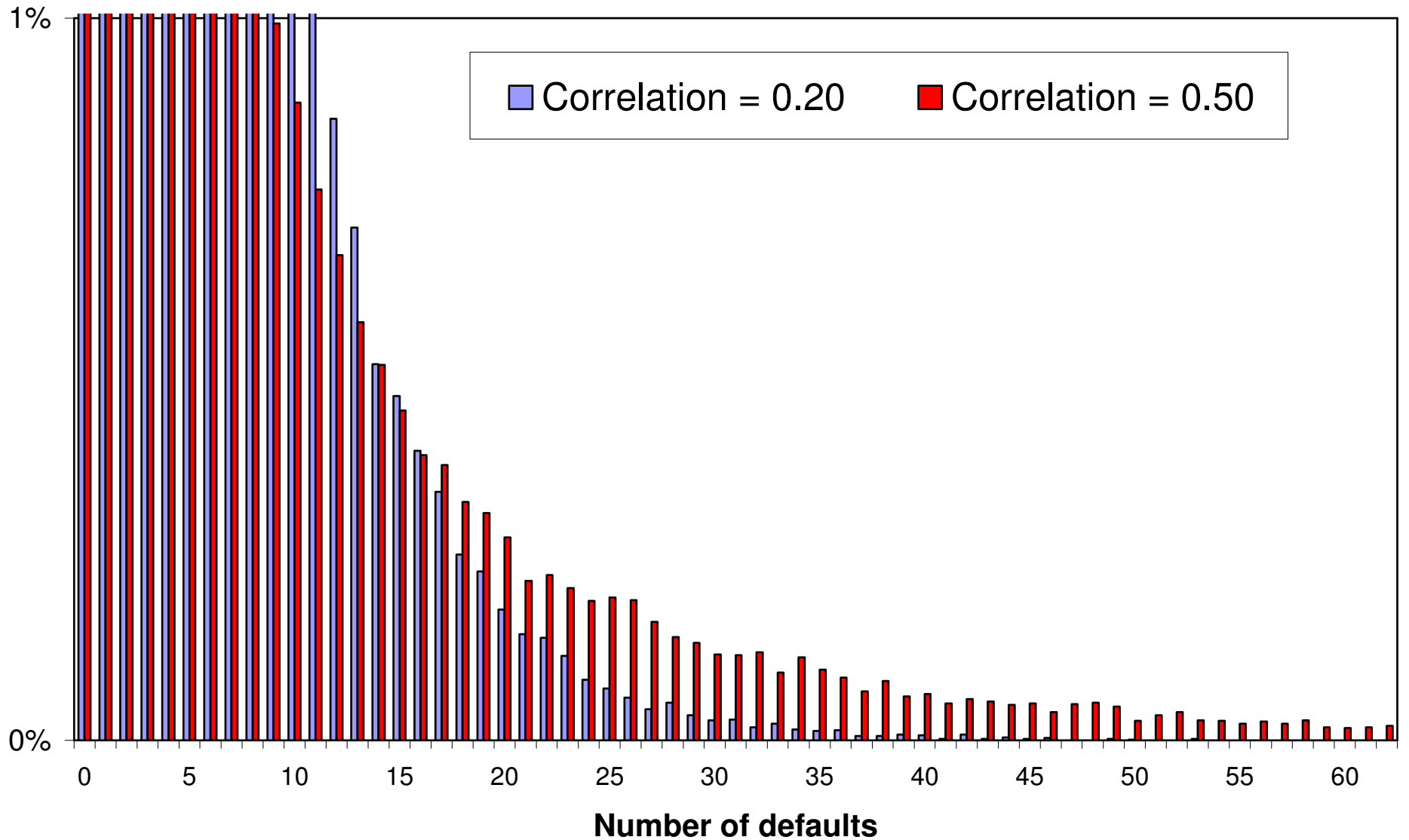
# Cumulative Distribution of Defaults



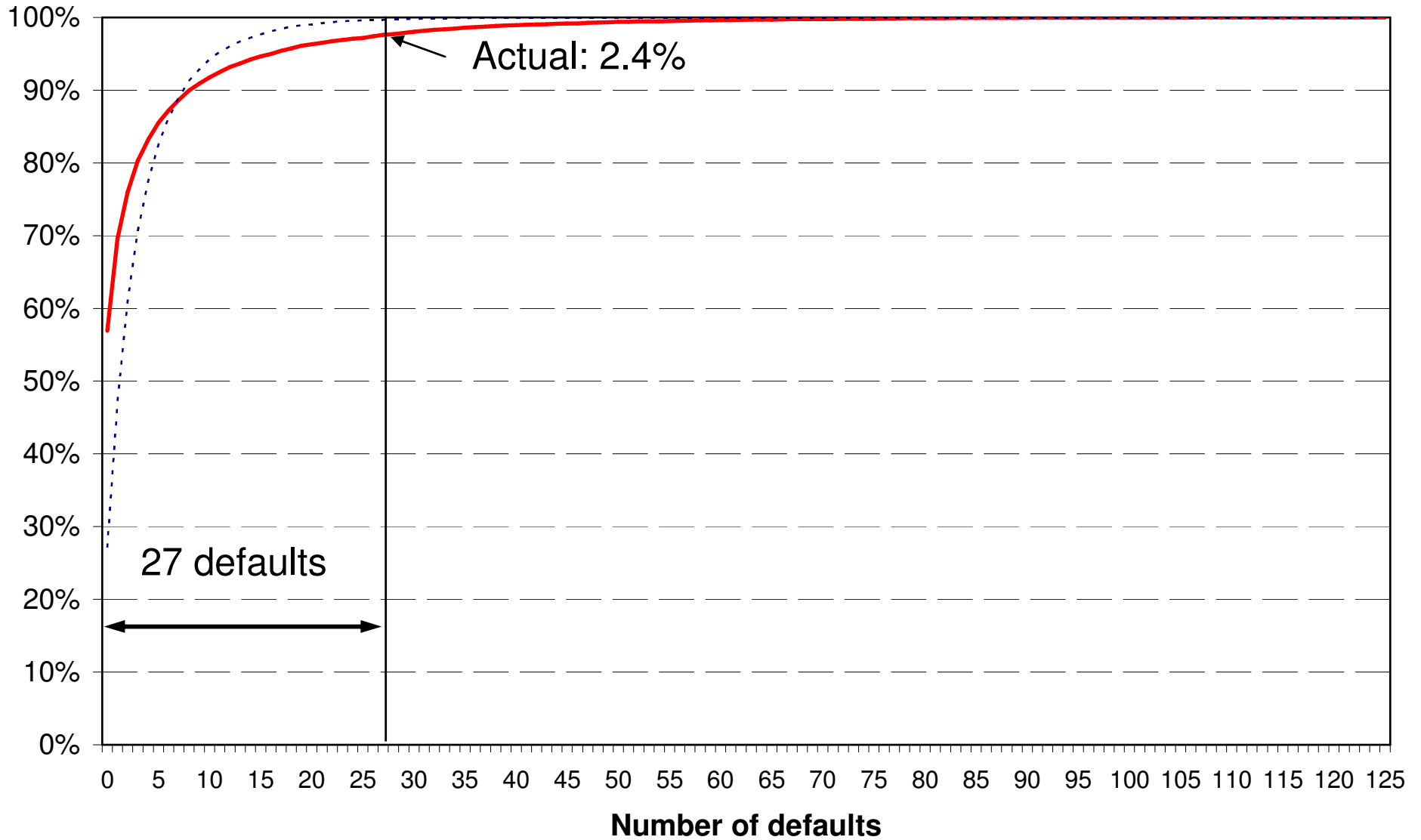
# Distribution of Defaults: 125 BBB Credits



# Distribution of Defaults: Effect of Correlation



# Cumulative Distribution of Defaults



# Known Unknowns: Model Risk

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- (3) The mapping process is incorrect
- Example: UBS mapped AAA-rated ABS tranches on AAA corporate yield curves
    - » this ignored nonlinearities in super senior tranches, which are similar to out-of-the-money short positions in options
    - » credit tranches are not comparable to corporate credits because they result from an optimization
    - » because they were viewed as riskless, these structures found their way in all business units
  - This is particularly an issue for new products

# Known Unknowns: Liquidity Risk

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- Asset liquidity risk, or price impact of large asset sales
- Funding liquidity risk, when the firm cannot meet cash flow or collateral needs
- BCBS: “Liquidity is crucial to the ongoing viability of any banking organization”
- However, this risk is complex and difficult to reduce to simple quantitative rules

# Unknown Unknowns (Knightian Uncertainty)

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- Regulatory risk, such as sudden restriction on short sales
- Structural changes, such as conversion of investment banks to commercial banks and deleveraging
- Counterparty risk with contagion: it is not enough to know your counterparty--you need to know your counterparty's counterparties too
- Difficult to handle
- No solution: need higher capital cushion

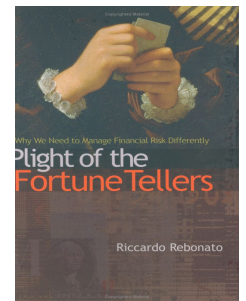
# Unknown Unknowns

## Implications for Economic Capital

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- Many institutions have developed “economic capital” analysis, which is a measure of the worst loss from all risk factors at a high confidence level over a long horizon
- Example: DB reports an EC of €13,611 for 2008 at the 99.98% confidence level
- Such numbers are unreliable: unlike typical applications of VAR, (1) the horizon is long, (2) confidence level is very high, and (3) economic cycles are over 5-10 years

*Reference:* Rebonato, Riccardo, *Plight of the Fortune Tellers*, 2007



# Risk Management Lessons

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(3)

- Lessons for risk managers
- Lessons from regulators

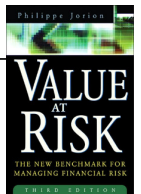
# (Known) Pitfalls in Risk Management

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- Traditional risk measures are backward-looking and assume stable distributions that are relevant for the future
- Historical risk measures rely on market-clearing prices, which requires trading activity
- Institution is assumed to be a price taker
- With VAR limits, traders could try to game the risk measure, deliberately moving into positions that appear to have low risk but big losses when they occur

## CHAPTER 21

### Risk Management Guidelines and Pitfalls



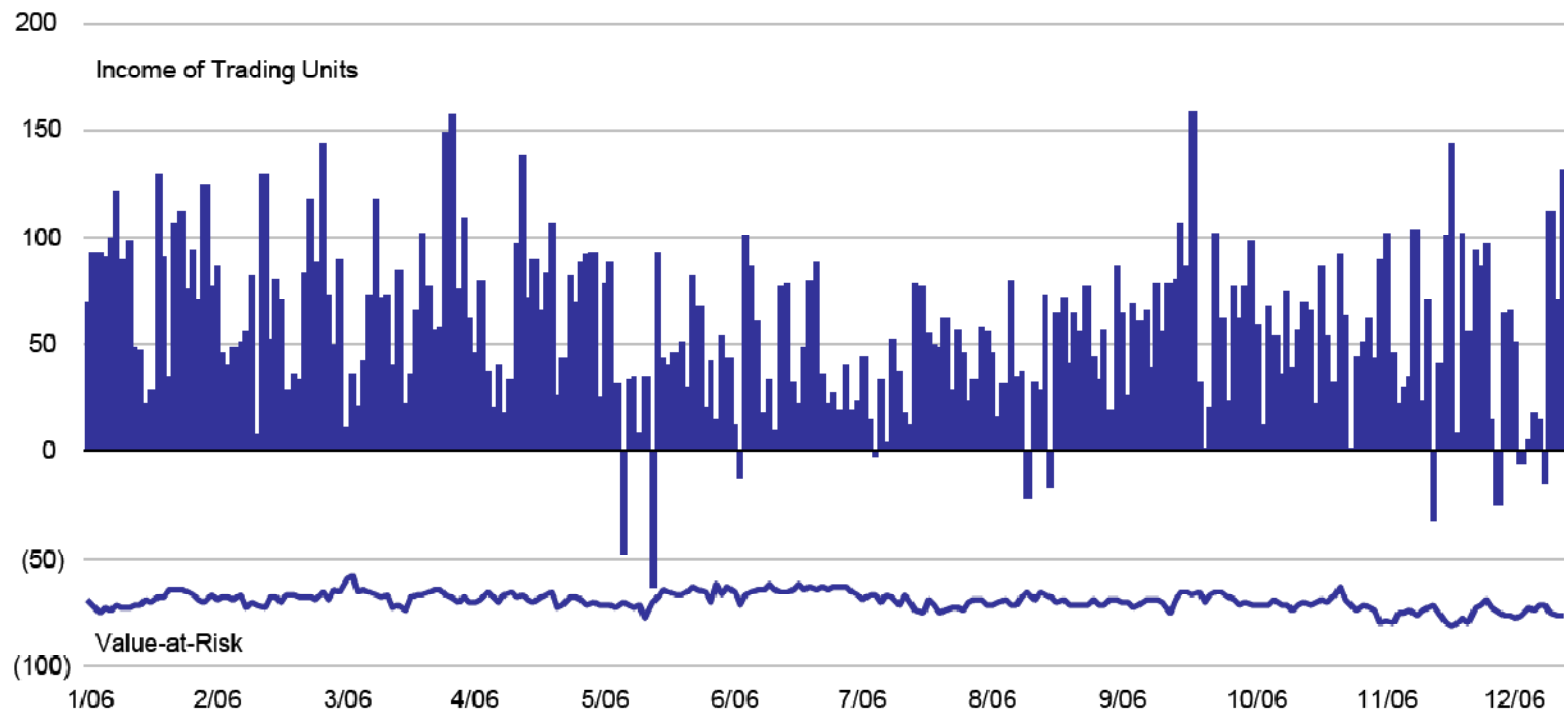
# How to Detect Flaws in Risk Measurement System

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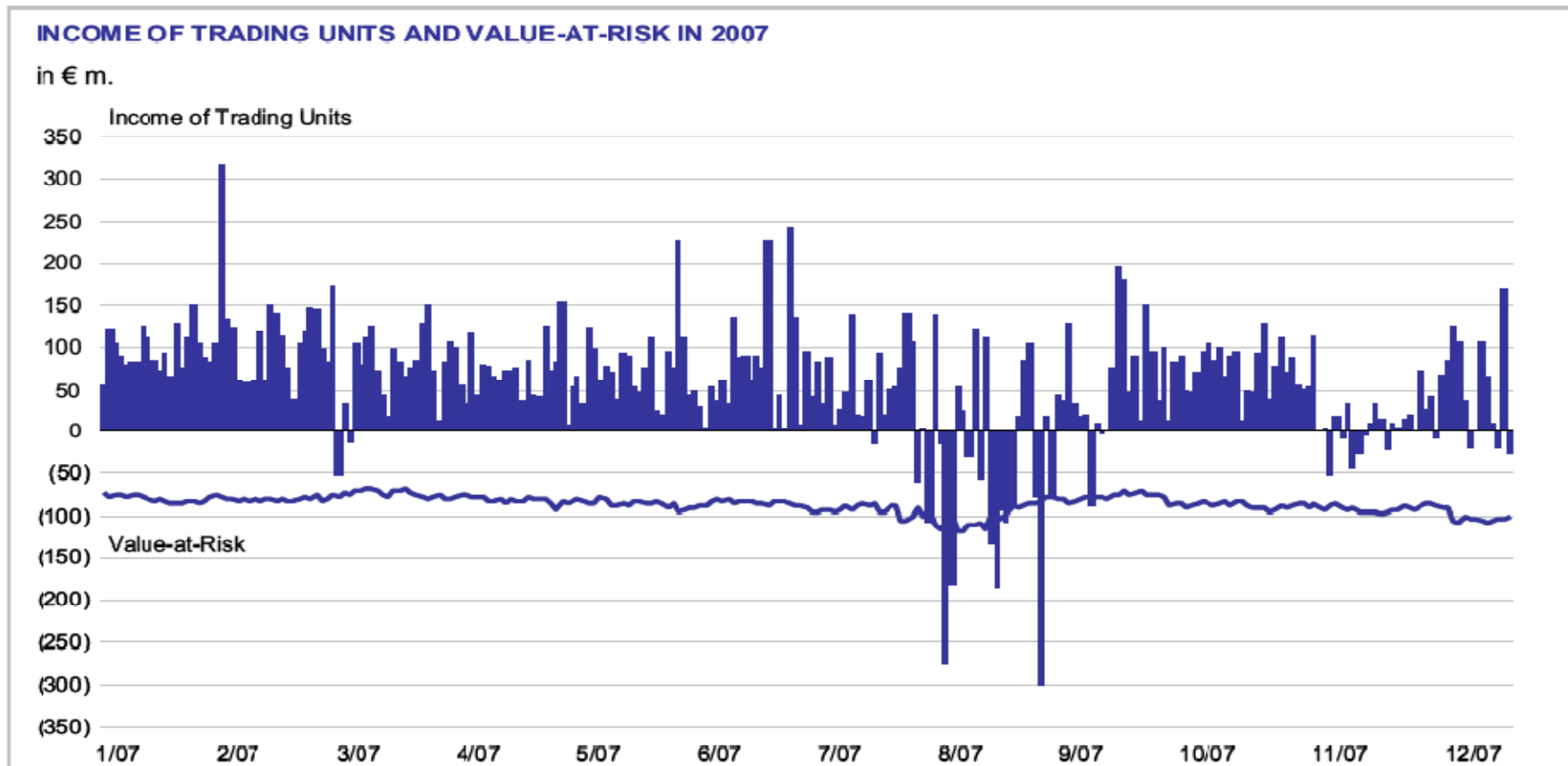
- Perform “backtests”: compare daily VAR numbers with next-day (hypothetical) P&L
- The percent of exceptions should be in line with the confidence level, e.g. approximately 1 percent for 99% VAR: 1 day out of 100
- The decision rule concludes that the model is biased if there are too many exceptions
- However:
  - » rule is not powerful if confidence level too high
  - » this ignores the size of losses beyond VAR

## INCOME OF TRADING UNITS AND VALUE-AT-RISK IN 2006

in € m.



- Our trading units achieved a positive actual income for over 96 % of the trading days in 2006 (over 93 % in 2005). On no trading day in either year did they incur an actual loss that exceeded the value-at-risk estimate for that day.
- In our regulatory back-testing in 2006, we observed three outliers, which are hypothetical buy-and-hold losses that exceeded our value-at-risk estimate for the trading units as a whole. This is in line with the two to three outliers a year that are statistically expected when using a 99 % confidence level...



- Our trading units achieved a positive actual income for over 87% of the trading days in 2007 (over 96% in 2006). On 10 trading days in 2007 we recognized a loss that exceeded the value-at-risk estimate
- In our regulatory back-testing, we observed 12 outliers (hypothetical buy-and-hold losses)... While we believe that the majority of these outliers were related to extreme events outside standard market conditions, we are also re-evaluating our modeling assumptions and parameters...

# Examples of Backtesting: VAR Exceptions

- At the 95%/99% confidence level, we should expect  $n=13/2.5$  exceptions per year

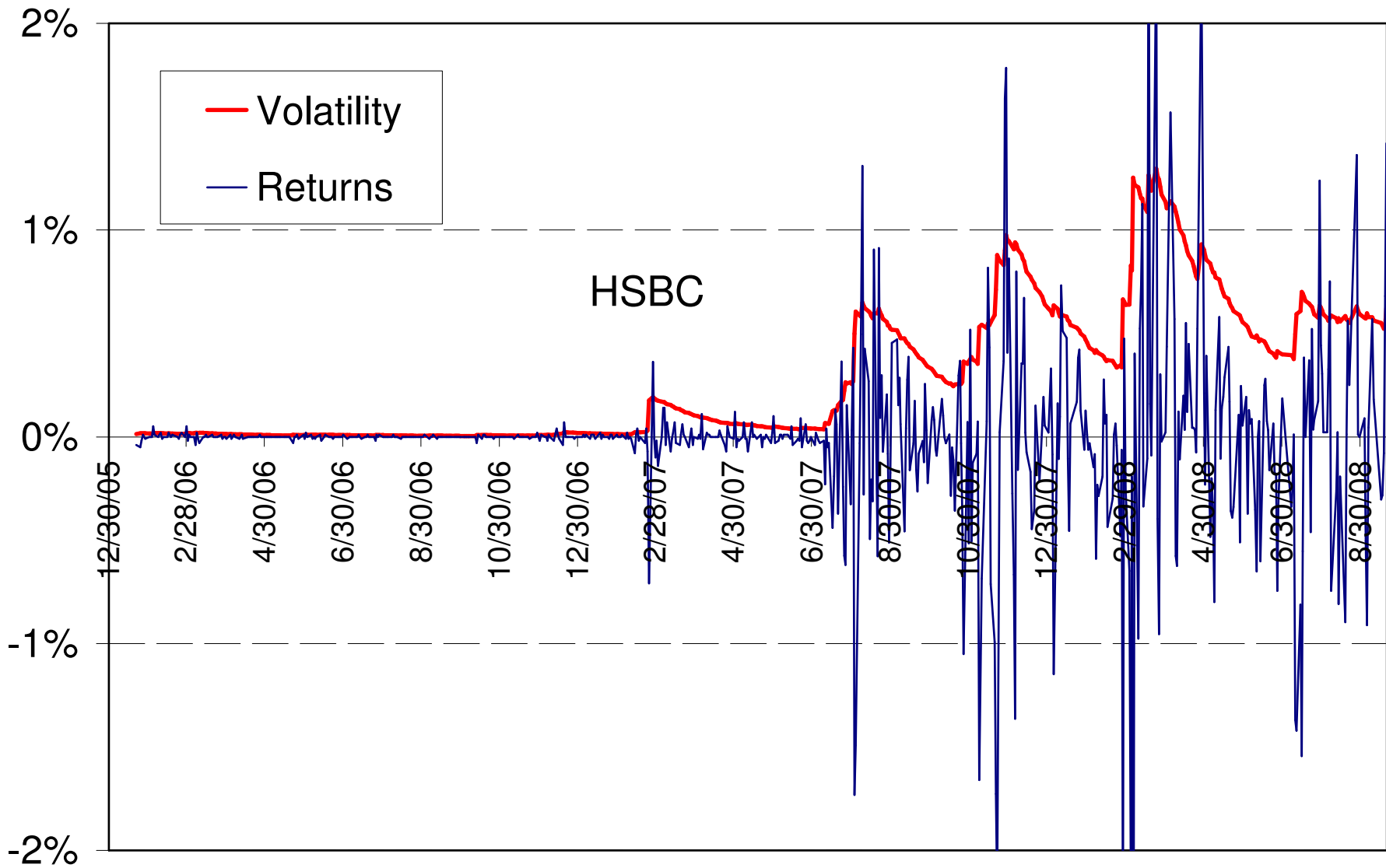
	$E(n)$	2006	2007	Q1	Q2	Q3	Q4
Goldman (95%)	13	3	10	0	1	5	4
Bear Stearns (95%)	13	0	27	1	0	10	17
JPM Chase (99%)	3	0	8	0	0	5	3
Credit Suisse (99%)	3	2	9	2	0	7	0
UBS (99%)	3	0	29	0	0	16	13

# Lessons for Risk Managers

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- Risk models can overweight recent data:
    - » AAA securities backed by subprime debt started to experience unusual moves in March 2007
  - Scenarios should be used to complement the limited vision of VAR windows
    - » longer-term, through-the-cycle perspective
  - Models should be stress tested
    - » top ABS tranches were overrated because models underestimated correlation between defaults
    - » basis risk ignored in many models
- ⇒ Risk of loss can be assessed using position-based mapping, and with scenarios

# Risk Forecast: ABX-HE Tranche Rated AAA



# Differences in Risk Management Practices

<b>Practice</b>	<b>Winners</b>	<b>Losers</b>
Org. structures	-Cooperative	-Hierarchical
Firm analysis	-Shared info across firm	-No prompt discussion
Valuations	-In-house expertise	-Relied on credit ratings
Mgt. of balance sheet, liquidity	-Charged bus. lines for contingent liquidity risk -Avoided CDO, SIV	-Did not consider contingent exposures -Exposed to CDO, SIV
Risk measurement	-Used qualitative and quantitative analysis -Varied assumptions -Tested correlations	-Strict model application -Used historical Aaa spreads -No test of correlations

Source: Senior Supervisors Group, March 6, 2008, "Observations on Risk Management Practices during the Recent Market Turbulence"

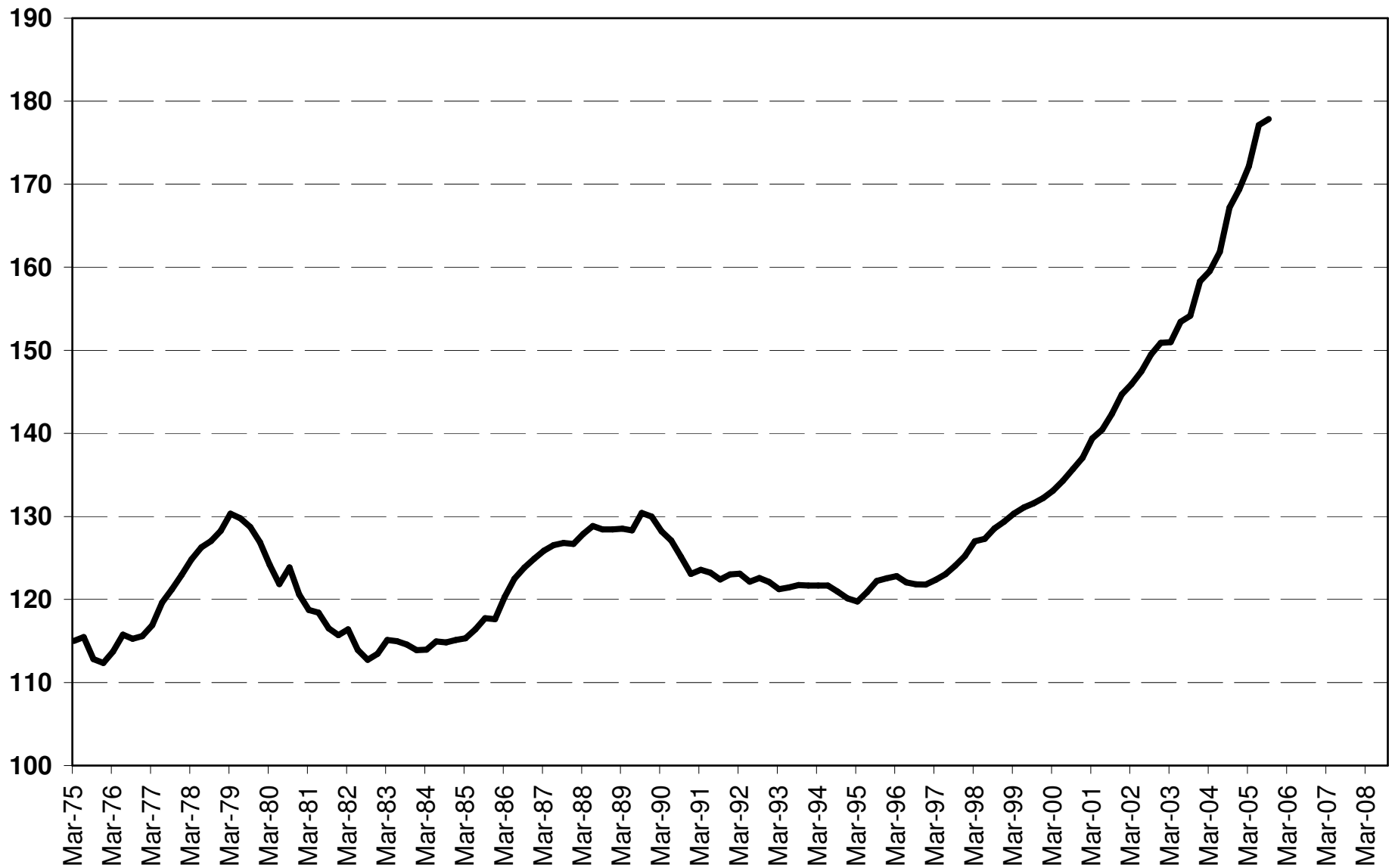
# Lessons from Regulators

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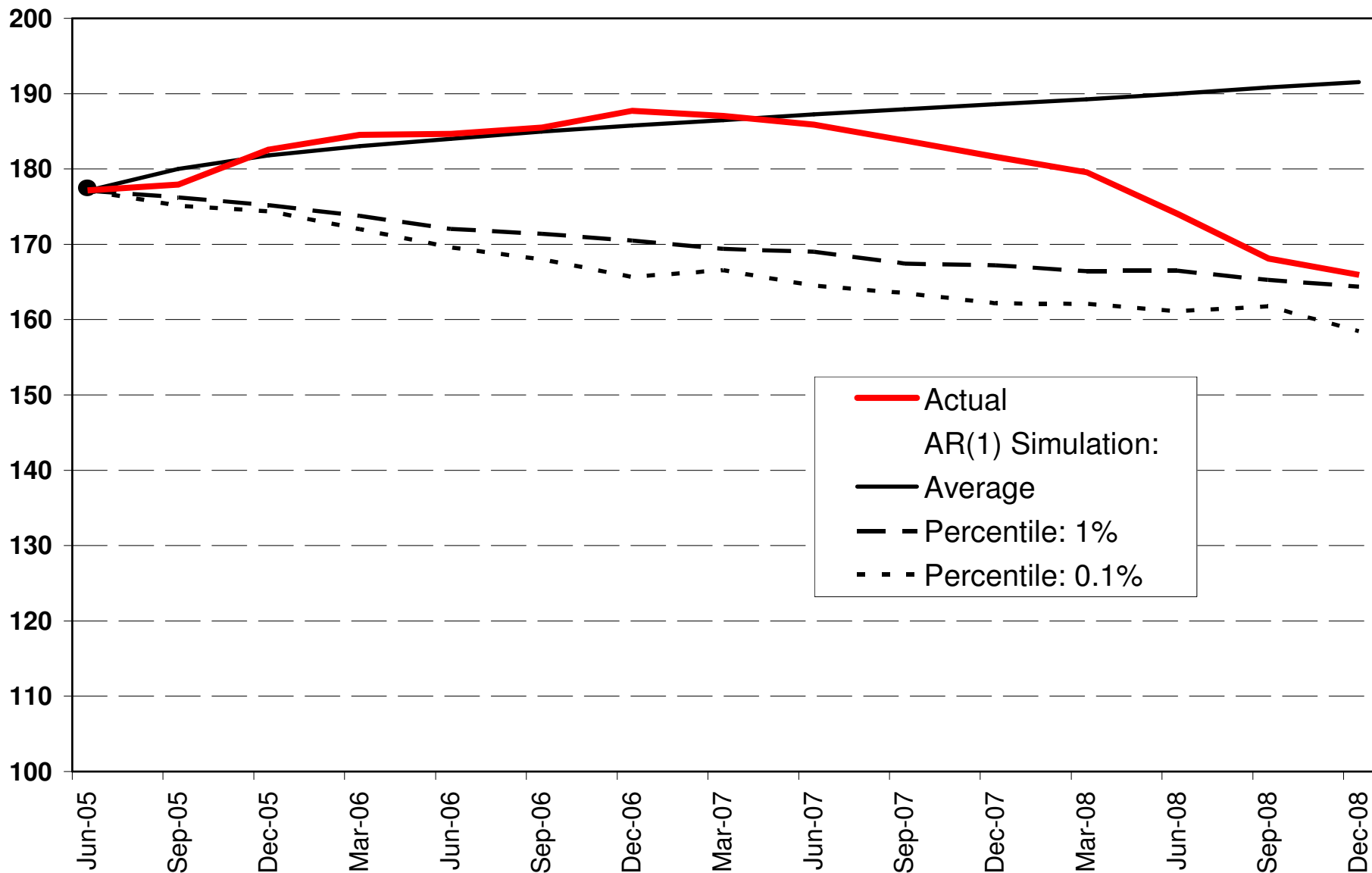
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- Banks failed the stress test because of misaligned incentives: large banks did not perform meaningful stress tests because they knew that they were too big to fail and that regulators would step in
- Regulators are now defining stress scenarios:
  - » Fed is now requiring banks to perform stress tests, reflecting severe downturn
  - » FSA advises “reverse stress tests,” which start from a known stress outcome (insolvency) and work backward

## OFHEO House Price Index (Real)



## Range of Forecasts and Actual Home Price Index



Source: From Loffler, 2008, Caught in the Housing Crash: Model Failure or Management Failure?

Risk Management - Philippe Jorion

# Conclusions (1)

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- Many institutions (banks, hedge funds) have experienced very large losses
- There have been flaws in risk management, in particular in models and mapping process for new products, particularly in 2007 for some banks
- Losses in 2008 are largely due to unknown unknowns: types of risks are not amenable to formal measurement, such as liquidity risk, regulatory risk, and contagion risk

# Conclusions (2)

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- Risk management, however, will not go away as a core function of financial institutions
- Regulators will put more emphasis on pre-defined stress tests
- Such tests can only be assessed with position-level information
- Regulators will require more transparency in financial markets

I COULD BLAME THE HERD EFFECT, THE BASEL ACCORD OR THE OVER-USE OF THE VALUE AT RISK TECHNIQUE, BUT I WON'T. THE BOTTOM LINE IS, WE'VE LOST YOUR MONEY

