Implementing an AMA for Operational Risk

Perspectives on the 'Use Test'

Joseph A. Sabatini

May 20, 2005

Agenda

- Overview of JPMC's AMA Framework
- Description of JPMC's Capital Model
- Applying Use Test Criteria for Banks and Regulators
- Closing Comments

Appendix: JPMC Capital Model Detail

The objective of the op risk framework at JPMC is improving financial performance

The JPMC Operational Risk framework combines quantitative and qualitative elements for effective risk management

The framework is:

- Business-oriented
- Risk-specific
- Firm-wide
- Driven by value proposition

Operational risk system:

- Owned by businesses
- Consistent, firm-wide roll out
- Validated by Audit
- Compatible with Credit / Market risk tools

Implementation:

- Project teams for each initiative
- Audit sign off required for key elements
- Redundancies eliminated

JPMorganChase

Agenda

- Overview of JPMC's AMA Framework
- Description of JPMC's Capital Model
- Applying Use Test Criteria for Banks and Regulators
- Closing Comments

Appendix: JPMC Capital Model Detail

Basel II - The Advanced Measurement Approach

- "Under the AMA framework, a banking organization meeting the AMA supervisory standards would *use its internal operational risk measurement system to calculate* its regulatory requirement for operational risk."

- "*While the supervisory standards are rigorous, institutions have substantial flexibility in terms of how they satisfy the standards* in practice. This flexibility is intended to encourage an institution to adopt a system that is unique to its risk profile, foster improved risk management, and allow for future innovation."

Basel II - The Advanced Measurement Approach (cont'd)

- "The (AMA-qualified) institution would have to use a combination of ….
  - Internal loss event data
  - Relevant external loss event data
  - Business environment and internal control factors
  - Scenario analysis

  …. in calculating its operational risk exposure."

- An institution's analytical framework would have to combine these elements in the manner that most effectively enables it to quantify its operational risk exposure ....

  .... appropriate to its business model and risk profile.

Economic capital model for op risk at JPMC

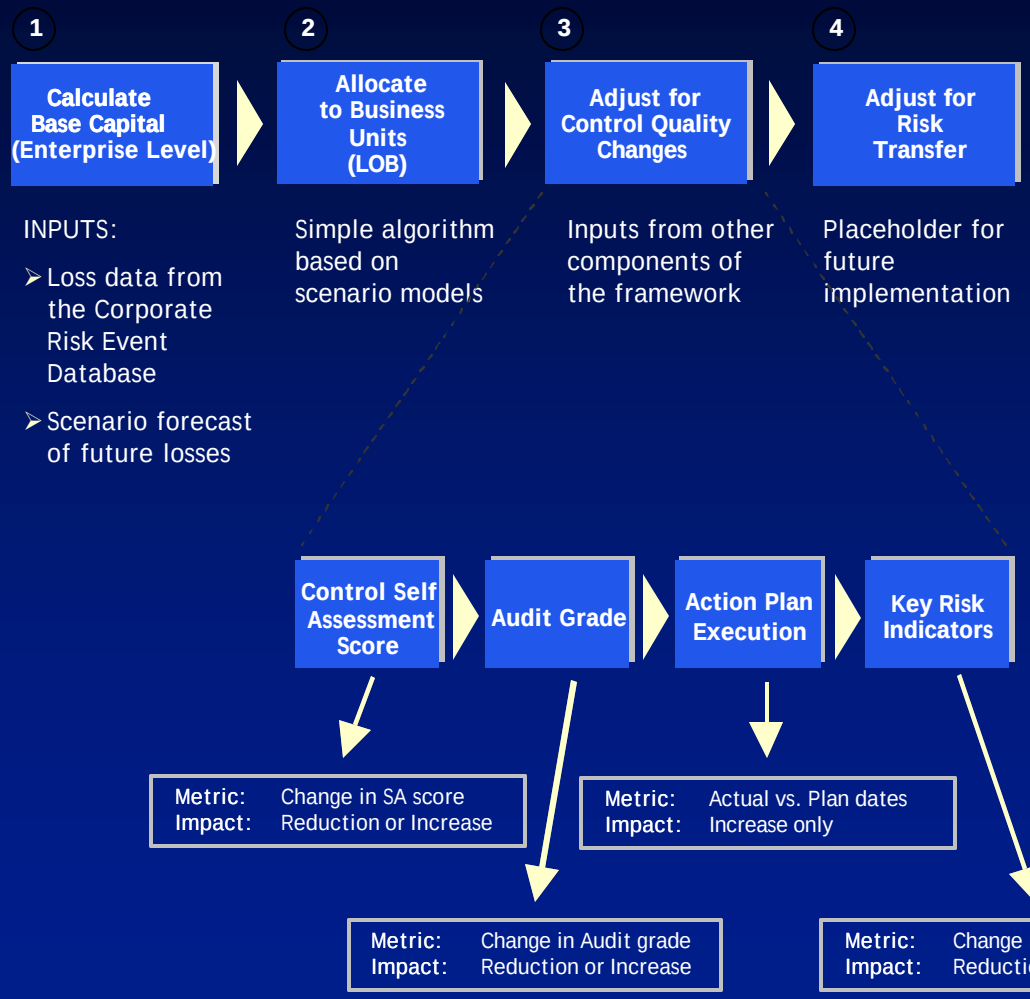
PRINCIPLES UNDERLYING THE MODEL:

- Risk-based calculation, based on operational data
- Directionally correct, progressive and repeatable
- Incentives for good risk management behavior
- Consistent with credit, market and business risk capital
- Consistent with the Advanced Measurement Approach under Basel II

BUSINESSES CAN INFLUENCE CAPITAL BY:

- Reducing Losses
- Improving the quality of controls
- Transferring financial risk

Calculation of capital is a four step process:



JPMorganChase

Agenda

- Overview of JPMC's AMA Framework
- Description of JPMC's Capital Model
- Applying Use Test Criteria for Banks and Regulators
- Closing Comments

Appendix: JPMC Capital Model Detail

Applying Use Test criteria for banks and regulators

Banks

Regulators

Conclusion

Danger Signs

Key Elements

Principles

- Data integrity: complete, timely and accurate
- Efficacy of calibration
- Appropriate governance at all organization levels
- Transparency and escalation of key issues and information

Conclusion

Danger Signs

Key Elements

Principles

- Rigorous standards maintained
- Flexible (non-prescriptive) approach
- Consistent application across banks and national jurisdictions
- Accommodate innovation

Use Test Criteria: Principles

Both banks and regulators should be guided by key principles

Banks

- Data integrity: complete, timely and accurate
- Efficacy of calibration
- Appropriate governance at all organization levels
- Transparency and escalation of key issues and information
- Clear accountability in remediation
- Integrated into business and risk management

Regulators

- Rigorous standards maintained
- Flexible (non-prescriptive) approach
- Consistent application across banks and jurisdictions
- Accommodate innovation
- Mandate ongoing improvement

Use Test Criteria: Key Elements

Banks

- Policies and governance forums
- Loss data, internal & external
- Scenarios
- Control environment measures
- Others: Audit results, KRI's, etc
- Reporting

Regulators

- In depth understanding of bank's business and risk profile
- Established standards communicated in advance
- Facilitate creative dialogue
- Focus on improving risk management

Use Test Criteria: Danger Signs

Banks

- Weak data integrity
- Inadequate transparency and escalation
- Uninformed / unengaged business managers
- Lack of integration or linkage into business performance measures
- Unnatural limitations on effort

Regulators

- Fixed expectations
- Inconsistent standards
- Inconsistent application
- Prescriptive requirements
- Emphasis of form over substance

Use Test Criteria: Conclusion

Banks

- Enormous progress and momentum
- Challenges remain
- Compliance vs. risk management
- Avoid rationalizing short comings

Regulators

- Share the burden for success
- Behavior will drive banks to:
  - improved risk management or
  - compliance role
- Focus needs to be validation of integrity rather than prescriptive remediation

Agenda

- Overview of JPMC's AMA Framework
- Description of JPMC's Capital Model
- Applying Use Test Criteria for Banks and Regulators
- Closing Comments

Appendix: JPMC Capital Model Detail

Implementing an AMA for Operational Risk

Perspectives on the 'Use Test'

Joseph A. Sabatini

May 20, 2005

Agenda

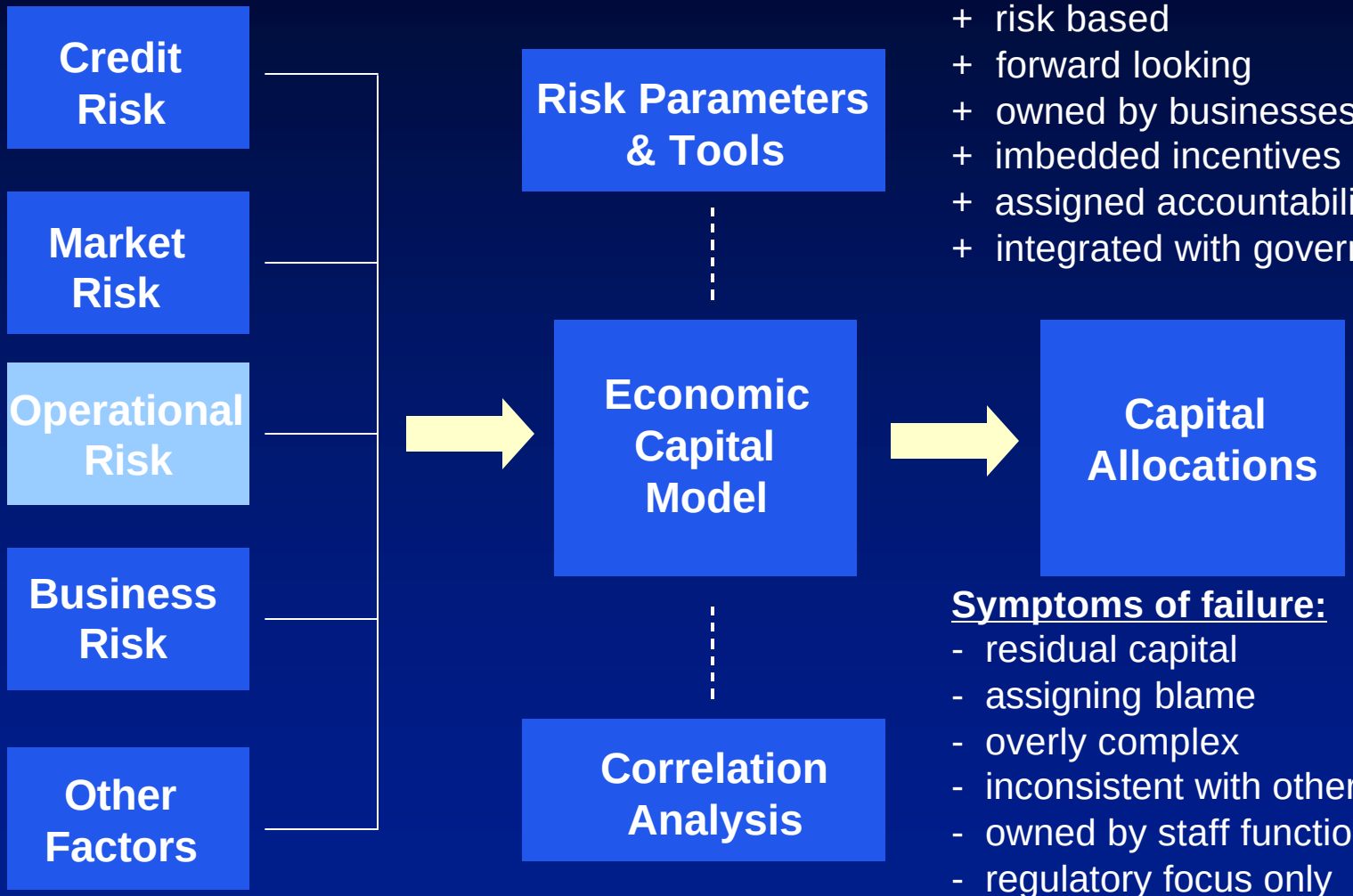
- Overview of JPMC's AMA Framework
- Description of JPMC's Capital Model
- Applying Use Test Criteria for Banks and Regulators
- Closing Comments

Appendix: JPMC Capital Model Detail

Appendix

JPMC Operational Risk Economic Capital Model

Operational Risk is an integrated component of the firm's overall capital framework



Success drivers:

+ risk based
+ forward looking
+ owned by businesses
+ imbedded incentives
+ assigned accountability
+ integrated with governance

Symptoms of failure:

- residual capital
- assigning blame
- overly complex
- inconsistent with other risks
- owned by staff function
- regulatory focus only

Economic capital model for op risk at JPMC

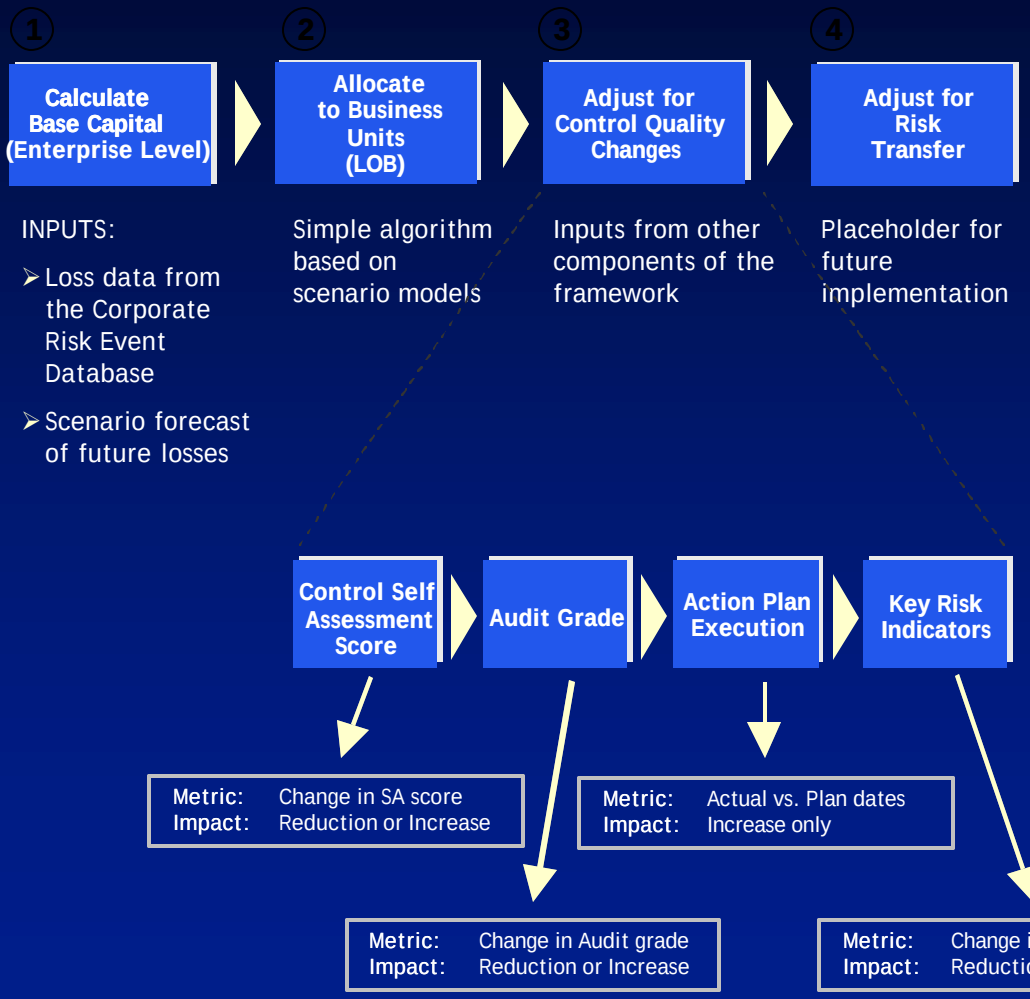
PRINCIPLES UNDERLYING THE MODEL:

- Risk-based calculation, based on operational data
- Directionally correct, progressive and repeatable
- Incentives for good risk management behavior
- Consistent with credit, market and business risk capital
- Consistent with the Advanced Measurement Approach under Basel II

BUSINESSES CAN INFLUENCE CAPITAL BY:

- Reducing Losses
- Improving the quality of controls
- Transferring financial risk

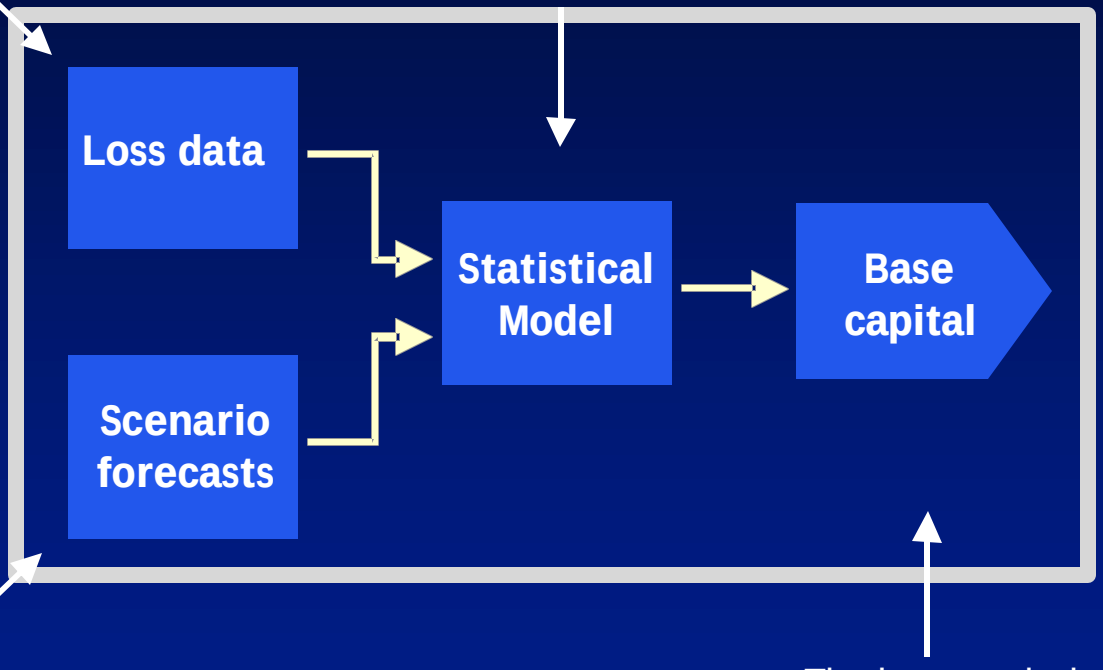
Calculation of capital is a four step process:



We firstly calculate a “base capital” number by combining loss data and scenario forecasts of loss

1. Losses > $20,000 from 1/1/2002 to the current period

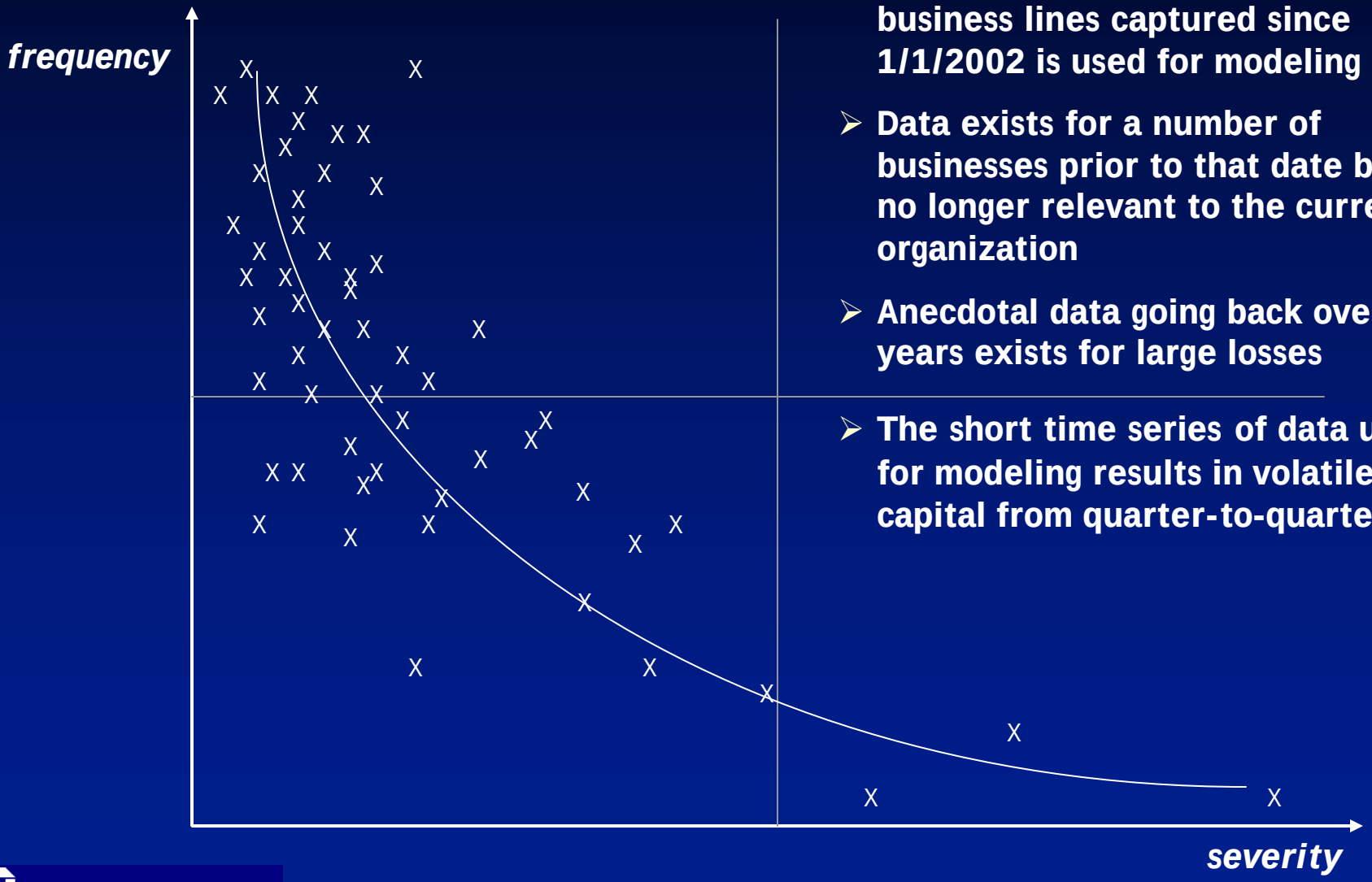
3. The statistical engine combines frequency and severity distributions derived separately from the data and scenarios in a Monte Carlo simulator



2. Future loss scenario forecasts, including stress events, by line of business and risk category

4. The base capital number represents the unexpected loss portion of the total Operational Value-at-Risk

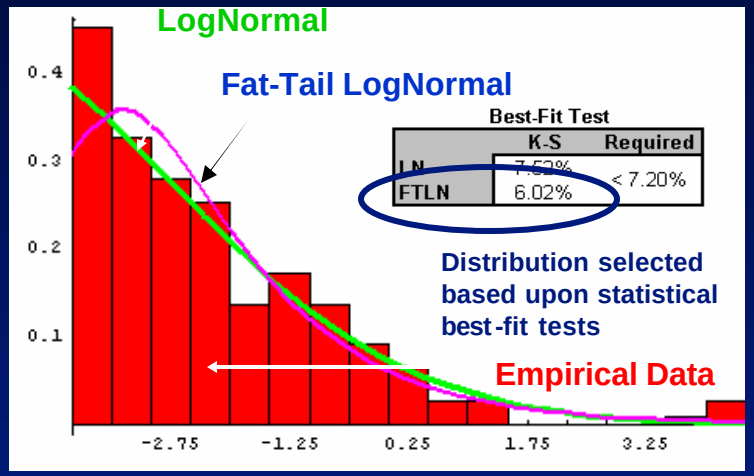
We have a limited time series of complete, quality data



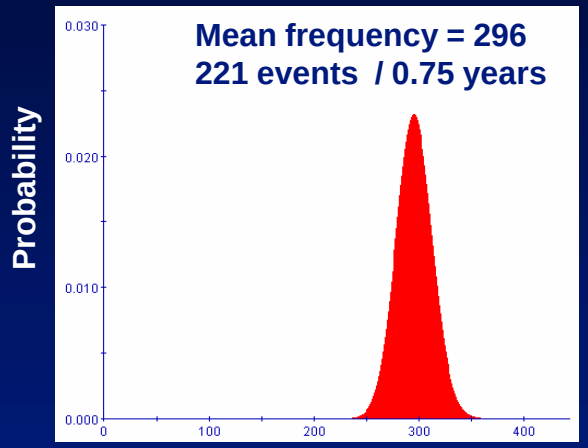
- Complete, quality data across all business lines captured since 1/1/2002 is used for modeling
- Data exists for a number of businesses prior to that date but is no longer relevant to the current organization
- Anecdotal data going back over 10 years exists for large losses
- The short time series of data used for modeling results in volatile capital from quarter-to-quarter

Severity and frequency distributions are generated from the loss data for each business line

Severity of Loss



Event Frequency



- Theoretical distributions are fitted to the empirical data using a statistical fitting technique called Maximum Likelihood Estimation
- "Best-Fit" distribution is selected based on statistical tests which calculate the maximum difference between the theoretical distribution and the empirical data

- Annual frequency of event determined using historical event occurrence, taking into account business changes, adjustment for trends
- Absent additional information, frequency is assumed to follow a Poisson distribution, standard in the industry used to model randomly distributed events

Scenario analysis – definition

- Systematic process of obtaining expert opinions, from business managers and risk management experts
- Derive reasoned assessments of likelihood and impact of plausible operational losses, consistent with the regulatory soundness standard
- May rely to a large extent on internal or, especially, external data
- Particularly useful where internal or external data do not generate a sufficient assessment of the institution's operational risk profile

Scenario analysis – JPMC implementation

Loss scenarios were generated by teams from 20 businesses

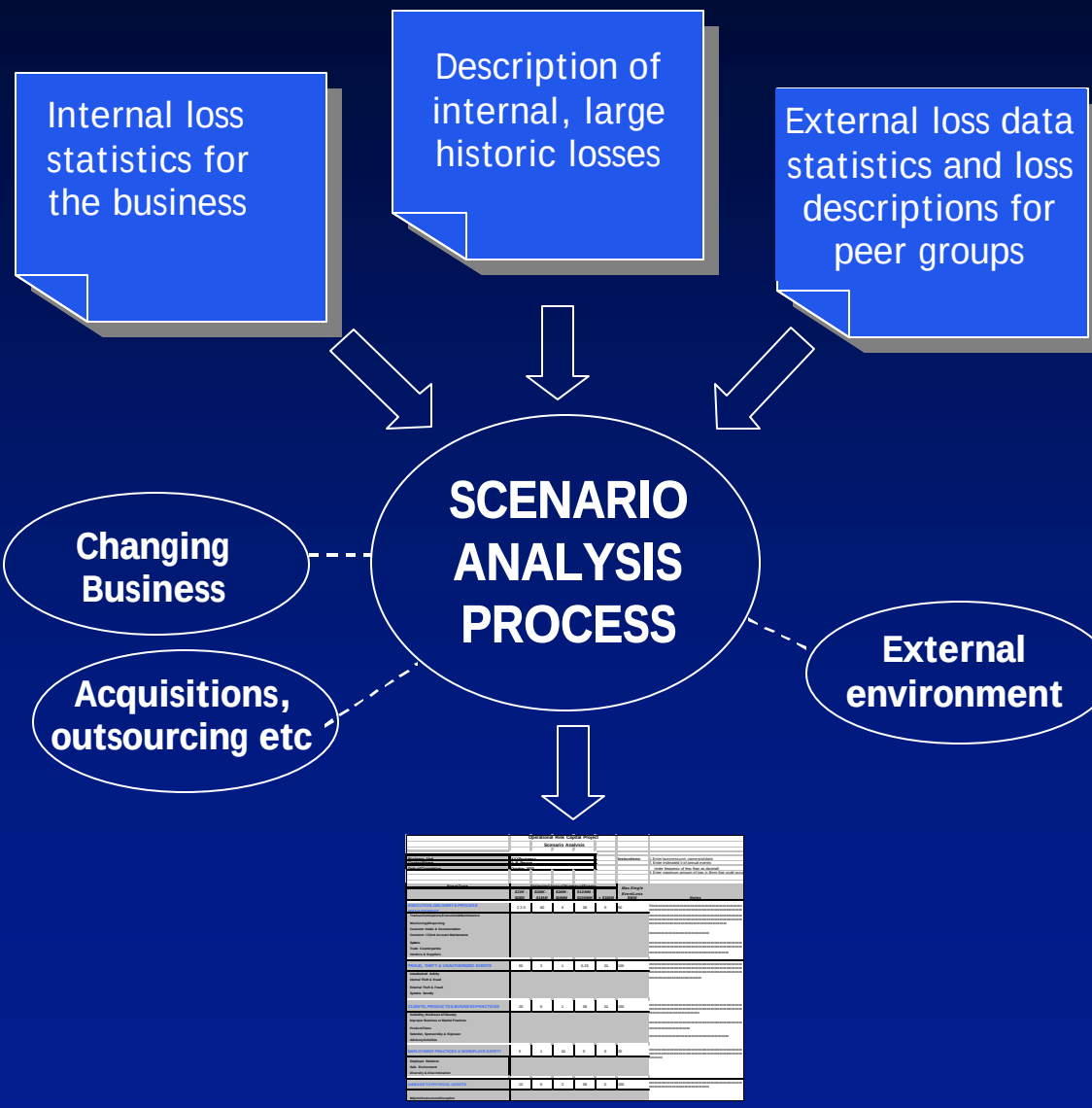
1. **Typical teams consisted of:**
   - Business managers
   - Operations managers
   - Risk managers
   - CFOs
   - Legal
   - Internal audit

   Other specialists included:
   - Compliance
   - Technology
   - Information security

2. More than one meeting was normally held to develop and review the scenarios

3. Scenario data and modeled results were compared across businesses

4. Scenarios will be updated annually and when material changes to the business occur



JPMorganChase

Scenario analysis - JPMC implementation (cont'd)

The target output of the scenario analysis process was a complete loss profile for a given business, by major risk category, that could be modeled

1 ***Major event risk categories*** (we use 5 major categories internally that map – via Level 2 – to the industry/ regulator standard 7 categories)

2 ***Frequency by $ range***

3 ***Maximum potential loss from a single event***

4 ***Description of stress events***

Business Unit	*ABC Business*						*Date: October 2002*
Event Type	*Estimated Annual Number of Events*					*Max. Single Event Loss $MM*	*Notes*
	$20K - $100K	*$100K - $1MM*	*$1MM - $10MM*	*$10MM - $100MM*	*> $100M*		
EXECUTION, DELIVERY & PROCESS MANAGEMENT	220	60	6	0.5	0	50	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Transaction Capture, Execution & Maintenance							
Monitoring & Reporting							
Customer Intake & Documentation							
Customer / Client Account Maintenance							
Systems							
Trade Counterparties							
Vendors & Suppliers							
FRAUD, THEFT & UNAUTHORIZED EVENTS	50	3	1	0.25	0.1	100	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Unauthorized Activity							
Internal Theft & Fraud							
External Theft & Fraud							
Systems Security							
CLIENTS, PRODUCTS & BUSINESS PRACTICES	20	5	1	0.5	0.1	150	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Suitability, Disclosure & Fiduciary							
Improper Business or Market Practices							
Product Flaws							
Selection, Sponsorship & Exposure							
Advisory Activities							
EMPLOYMENT PRACTICES & WORKPLACE SAFETY	5	1	0.1	0	0	10	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxx
Employee Relations							
Safe Environment							
Diversity & Discrimination							
DAMAGE TO PHYSICAL ASSETS	10	5	2	0.05	0	100	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Major Infrastructure Disruption							

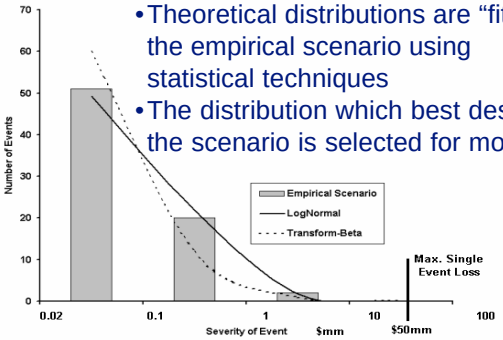
Distributions are created from the "buckets" of frequency and severity

Business Managers Provide Frequency and Severity Information by Risk Category for each Sub-Business Unit

Event Type	Estimated Annual Number of Events					Max. Single Event Loss $MM	Total Frequency
	$20K - $100K	$100K - $1MM	$1MM - $10MM	$10MM - $100MM	> $100M		
EXECUTION, DELIVERY & PROCESS MANAGEMENT	51	20	2	0.03		50	73.03

Severity of Loss

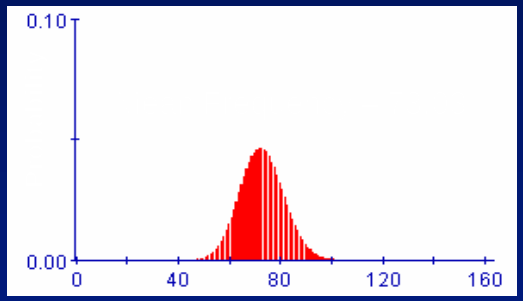
- Theoretical distributions are "fitted" to the empirical scenario using statistical techniques
- The distribution which best describes the scenario is selected for modeling



	Empirical Scenario	Theoretical Distributions: LogNormal	LogNormal Delta	Transform-Beta	Transform-Beta Delta
$20K - $100K	51	49.28	5.54	60.09	99.06
$100K - $1MM	20	21.87	4.46	11.87	164.00
$1MM - $10MM	2	1.83	3.49	1.00	38.97
$10MM - $100MM	0.03	0.04	3.13	0.08	137.73
	73.03		16.63		439.76

"Best-Fit" distribution selected based upon weighted sum of differences from the empirical scenario

Event Frequency



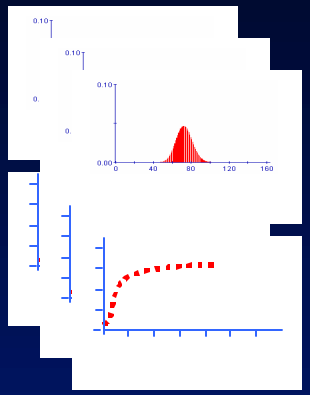
Annual Frequency

- Annual average frequency obtained directly from scenario
- Absent additional information, frequency is assumed to follow the Poisson distribution, a standard in the industry used to model randomly distributed events

Next the distributions are combined

Data

Internal Losses



Scenarios

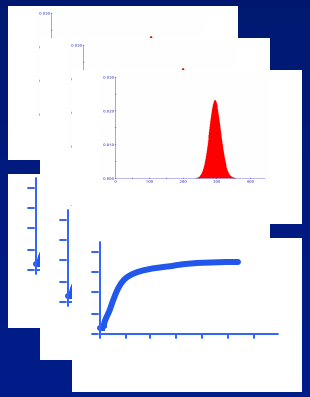
Internal Losses (including anecdotal data)

External Losses: Peer Group Data

Business Profile and External Environment

Scenario Workshops

Forecast Loss Profiles



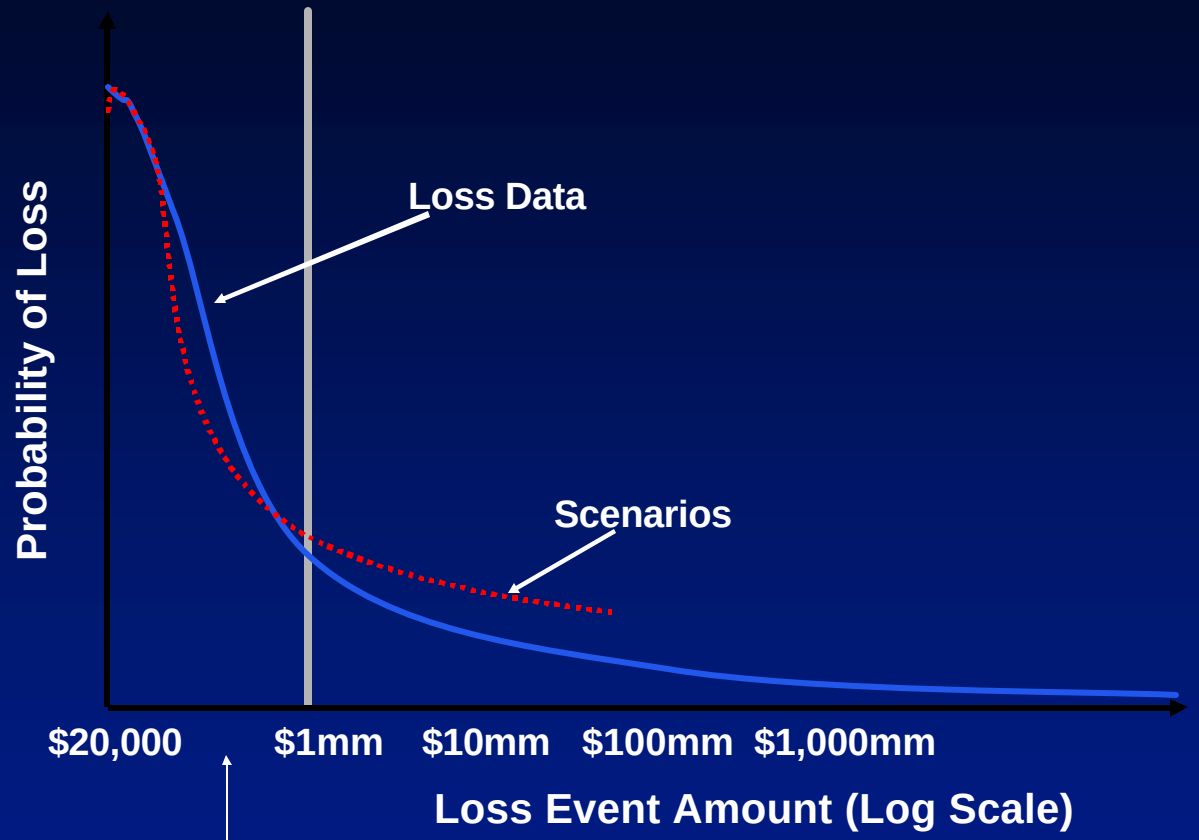
Monte Carlo Simulator

Base Capital

CALCULATION:

- One year holding period
- 99.97% Confidence Interval
- Capital excludes EL
- Distributions:
  - Poisson (frequency)
  - Lognormal
  - Fat-Tail Lognormal
  - Transformed Beta

The loss data and scenario distributions are combined in a Monte Carlo simulation



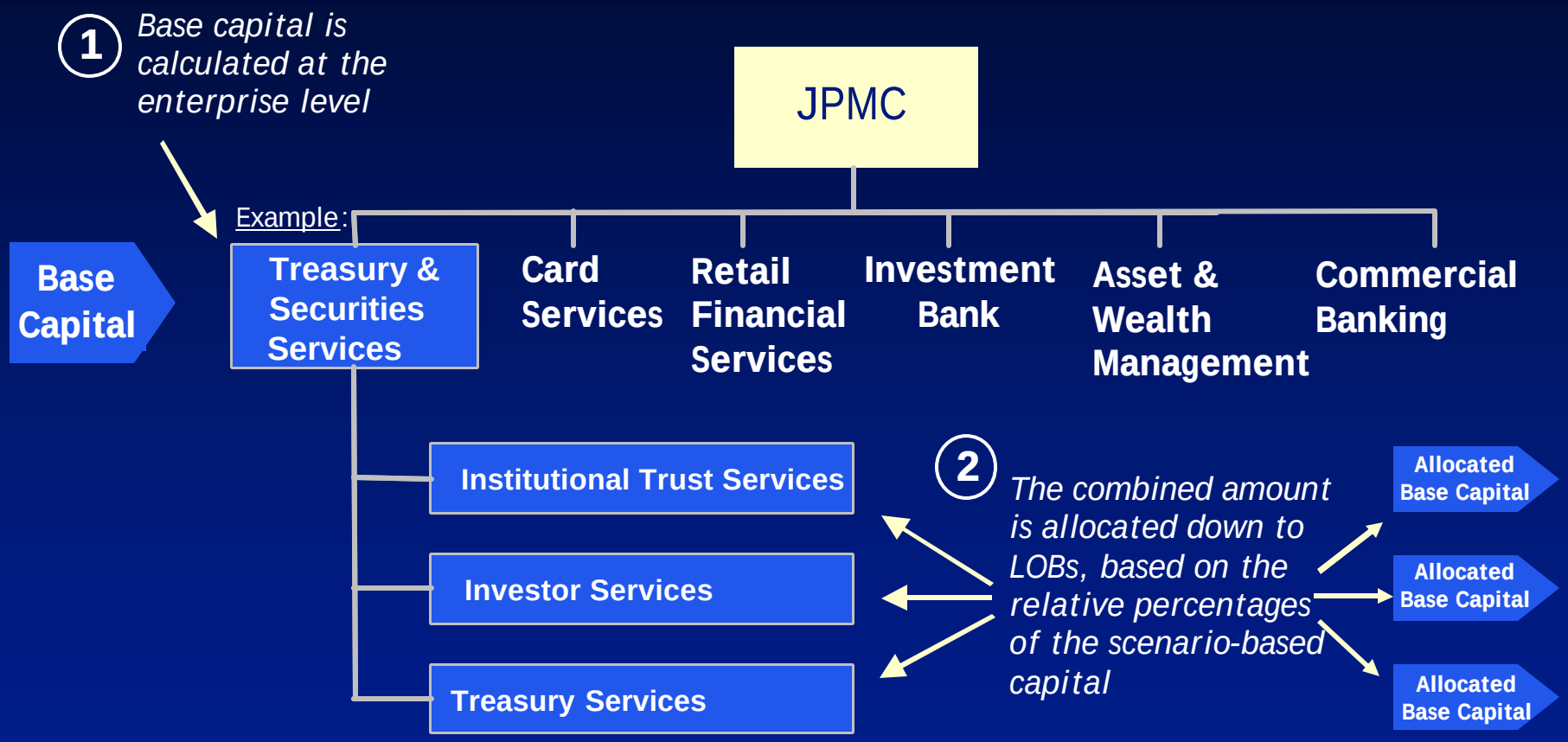
Confidence in data in this range high – use data curve 100%

Initially, confidence in data over $1mm is low. Weight Data 20%, Scenarios 80%

Over time, increase $1mm threshold

And increase weight of data relative to scenarios

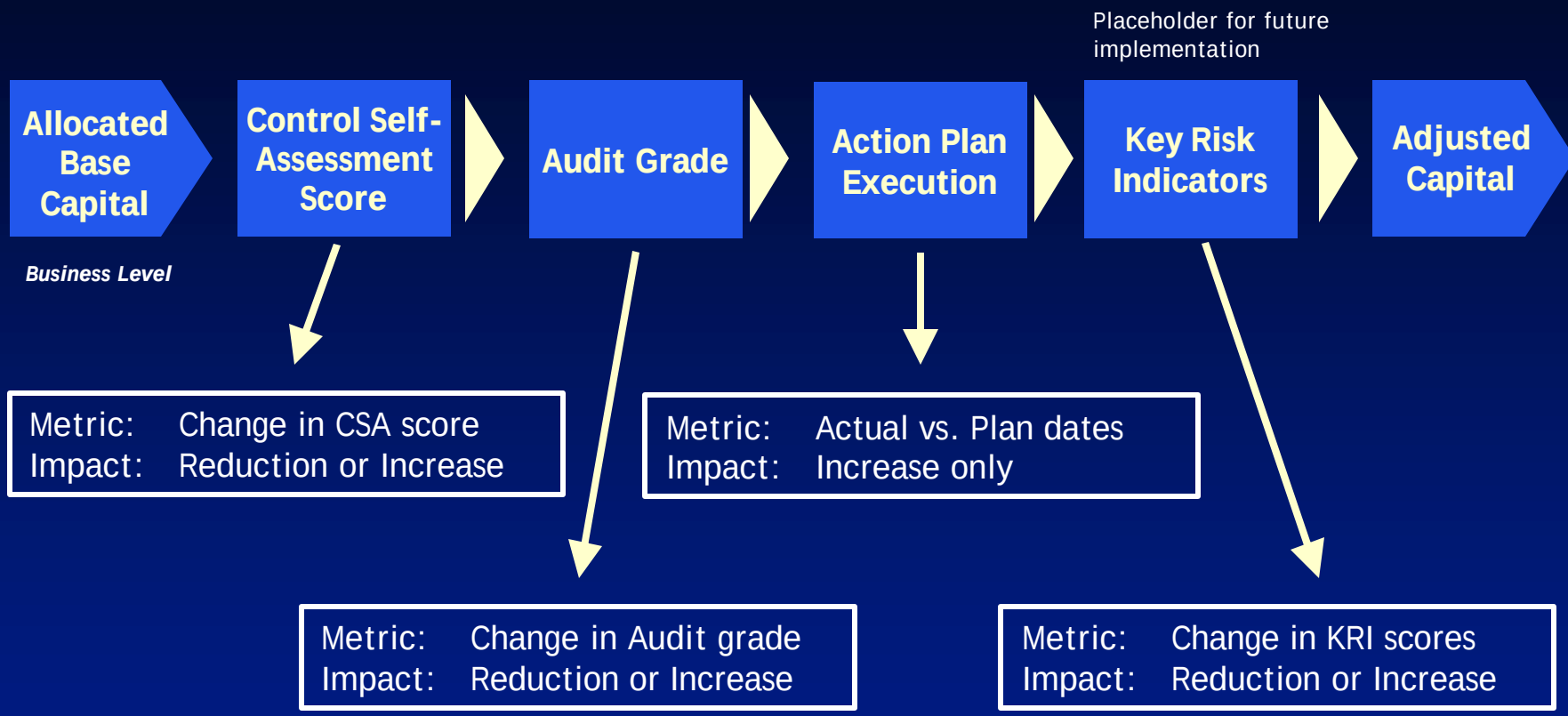
In Step 2 the base capital is allocated to each major business line



Qualitative factors - challenges

- Selecting and calibrating the metrics
  - Determining what metrics are appropriate
  - Determining the “slope-of-the-line” for each metric
  - Determining the relationship between individual metrics (e.g. RCSA, Audit grades)
- Correlating the benefits / penalties with results, over time

The allocated base capital is adjusted in Step 3 for each line of business to reflect changes in the quality of the control environment



Audit provides the checks and balances to validate the integrity of the adjustment metric

Validation - definition

- “An institution has to test and verify the accuracy and appropriateness of the operational risk framework and results”
- “An institution has to periodically compare its assessment of these (internal control) factors with actual operational loss experience”
- “An institution’s operational risk framework has to include...independent testing and verification”

Validation – JPMC implementation

The availability of comparable benchmarks today is limited.
Our validation is based, for now, on a series of reasonability checks.

1. **Internal data**
   - Comparison of scenario forecasts vs. internal and external loss data
   - Trends in losses vs. trends in control quality metrics

2. **Internal ratios**
   - Comparison of capital levels by line of business
   - Ratio of actual losses to capital
   - Ratio of theoretical mean-to-VaR
   - Theoretical mean vs. observed loss levels
   - Ratio of op risk capital vs. total economic capital

3. **External data**
   - Commercial database
   - ORX

4. **Internal Audit**
   - Model
   - Business Data Quality

Validation – JPMC implementation example

The importance of scenarios in the model demands particular scrutiny of forecasts vs. experience over time

1. **Absolute frequency of losses**

   Q: *Do the scenario frequency projections match our internal annualized loss experience, particularly at the tail?*

   A: Over $1mm the scenario frequency is greater than the actual loss experience

2. **Distribution of losses (shape of the loss curve)**

   Q: *Does the distribution of losses in the scenarios match the actual loss experience?*

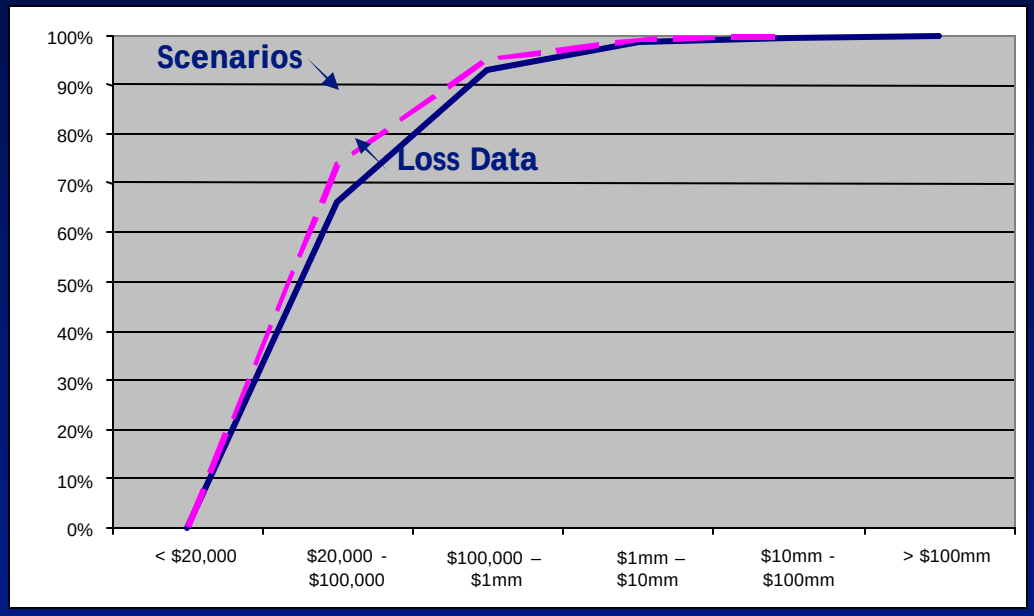
   A: The data curve has a more volatile profile

3. **Maximum Loss**

   Q: *How do maximum loss data, internal or external, influence scenario model inputs?*

   A: Loss experience should very strongly guide, but not dictate, scenario model inputs

Loss Distribution Curve – Actual results vs. forecast

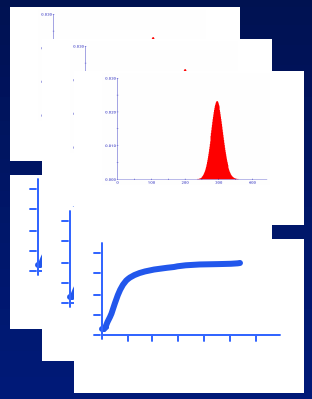


The scenario analysis model lends itself to assessing the impact of potential changes in the risk profile

The frequency and severity factors can be changed and remodeled with ease, to assess changes in the risk profile:

- *By risk type*
- *By business*

From	To	#
20,000	100,000	100.00
100,000	1,000,000	50.00
1,000,000	10,000,000	10.00
10,000,000	100,000,000	3.00
100,000,000	250,000,000	0.20
250,000,000	500,000,000	0.10
500,000,000	750,000,000	0.05
750,000,000	1,000,000,000	0.02



Monte Carlo Simulator

Base Capital

Change parameters **Redraw curves** **Re-simulate**

Examples:

- What if the probability of a $10mm event doubles?
- What if the maximum loss increases from $100mm to $200mm?
- What if the frequency of losses less than $100,000 increases by 50%?
- What would the impact be if the loss just experienced at XYZ Bank happened here?

JPMorganChase