



FINANCIAL RISK MANAGEMENT

Model Risk and a Framework for Control

Actuaries Club of the Southwest

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AUDIT - TAX - ADVISORY

Agenda

- ◆ What Is a Model?
- ◆ What Is Model Risk?
- ◆ Model Risk Drivers
- ◆ Framework For Model Risk Controls
- ◆ Benefits of Model Risk Management

Definition of Model

“A model is broadly defined as a process within a system that transforms data and/or assumptions into values, inferences, or information for the purpose of valuation or business decision making”

“A model is a proxy for the real thing”

Model Uses

- ◆ Financial Reporting
- ◆ Decision Support
- ◆ Risk Management

Model Uses

◆ Financial Reporting

- Claim reserves
- Premium deficiency reserves / Gross Premium Valuation
- Policy Reserves
- Deferred Acquisition Costs/Value of Business Acquired
- Administrative Expense Allowance
- Asset valuation
- Future Developments: Principles Based Reserving, Fair Value

Model Uses

◆ Decision Support

- Claims Cost Experience Analysis—including medical trend and medical cost
- Actual to Expected Analysis
- Forecasting, budgeting and surplus planning
- Predictive and Behavioral Modeling
- Disease Management
- Provider Reimbursement/Contracting
- Dynamic Modeling and Scenario Planning
- Financial Management
- Pricing & Product Development
- Underwriting

Model Uses

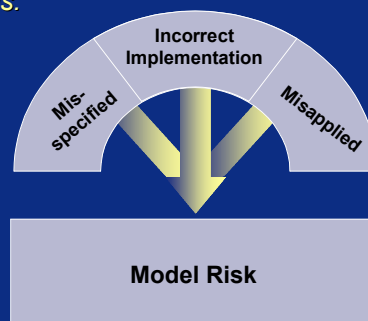
◆ Risk Management

- Reinsurance and securitizations
- Economic capital
- Enterprise risk management models

What is Model Risk?

Model risk is the adverse financial impact caused by incorrectly:

- *Specifying*
- *Implementing*
- *Applying models.*



Model Use: Spreading Like A Virus

- ◆ An increasingly important means of evaluating, analyzing and reporting key business information
- ◆ Use has expanded significantly in recent years; the complexity and risk has increased
- ◆ No longer in the “Keep it Simple Stupid!” world

The biggest driver of model risk is management's lack of awareness of exposure to mission critical models.

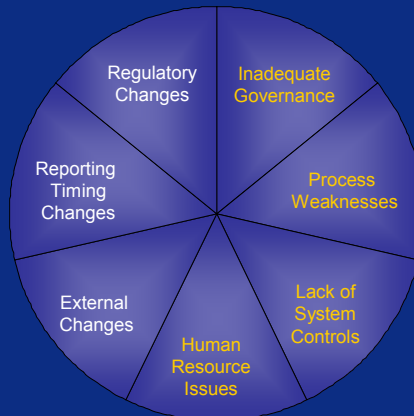
Heightened Awareness:

- ◆ Proliferation of model use
- ◆ Heightened regulatory expectations
- ◆ Sarbanes – Oxley compliance
- ◆ Principles Based Reserving
- ◆ Internal audit processes and focus
- ◆ Enterprise Risk Management Programs
- ◆ Rating Agency evaluation

Model Risk Drivers

External

Internal



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External Drivers

- ◆ **Regulatory Changes** - Not anticipated or accommodated by model software
- ◆ **Changes in financial reporting timing requirements**
- ◆ **External environment**
 - Technology improvements outpace software package
 - Changes in the company structure, merger or purchase/sale of a line of business
 - Rating agencies assessing companies risk management process

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Internal Drivers

- ◆ **Inadequate Governance** – Lack of direction on approach, strategy, policies and procedures (i.e. control infrastructure)
 - Model development guidelines
 - Documentation
 - Theory/methods
 - Validation and testing procedures

- ◆ **Human Resource Issues** – staff persons, programmers, and key users:
 - Inadequate training
 - Fast close
 - Turnover

Internal Drivers (continued)

- ◆ **Process Weakness** – Poor controls around assumptions, data inputs, data outputs, model updates, reporting, and interpretation of reports/output:
 - Processing design risk: Model works as designed but does not produce intended results (e.g., oversimplification)
 - Processing integrity risk: Model is modified so that it does not produce results intended by design
 - Processing implementation risk: Model is improperly used or has material limitations and consequently does not produce intended results
- ◆ **Lack of Systems Controls** – Internal systems, vendor systems, system integration, implementation, and testing

These risks are generally not mitigated by IT Controls

What Don't You Know About Your Models?

- ◆ **Management often is not fully aware of:**
 - How many models they have in place
 - Whether the models remain valid
 - If the models are used appropriately

- ◆ **Management often may not consider all model types:**
 - Vendor supported models
 - Internally developed models
 - Spreadsheets
 - Other

Are Model Risks Clearly Managed?

- ◆ **Use of models affects many aspects of a company's financial health and reputation; however,**

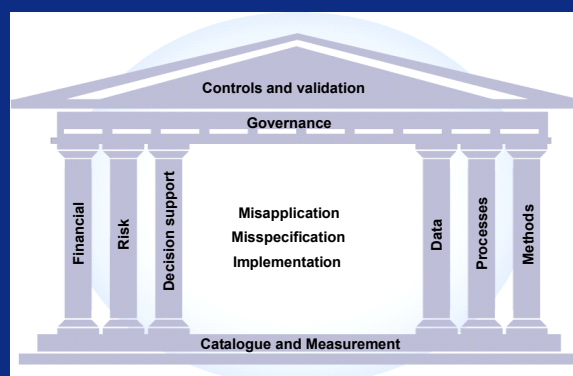
- ◆ **Model development and validation are not typically items on senior leadership's agenda; however, the company's reputation may depend on them.**

Didn't SOX 404 Address This?

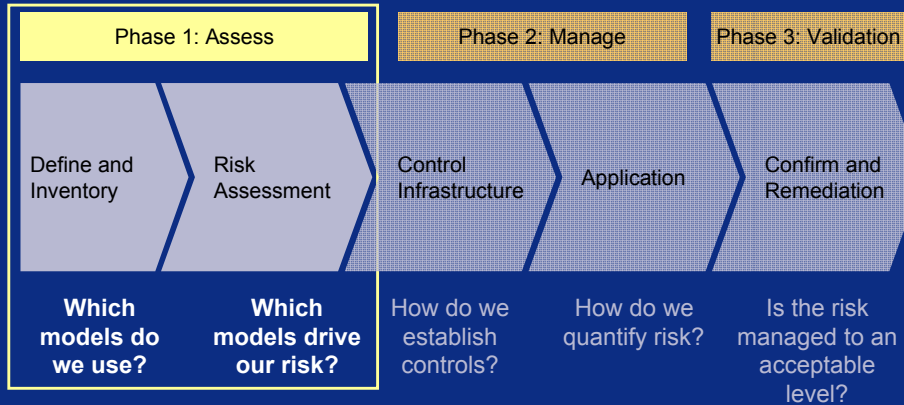
- ◆ Sox 404 controls only address financial reporting processes.
- ◆ Model controls go beyond and address *mission critical* decision support and Enterprise Risk Management programs.
- ◆ Model control decisions are:
 - Made by management, not auditors or regulators
 - Based on identification and quantification of model risks and not by rules and regulations

Framework for Model Risk and Control

Organizations should address model risk by developing a framework for comprehensive model control



Model Risk Management Process



Which Models Do We Use?

Define and Inventory

Definition

- ◆ Model
- ◆ Model Risk

Inventory

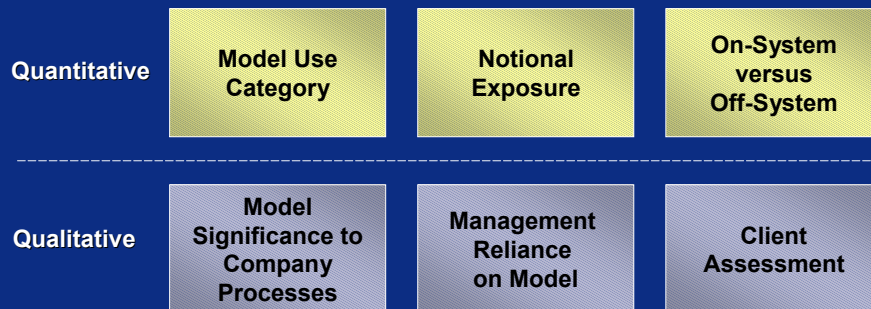
- ◆ Model
- ◆ Flow: Model inputs/sources
- ◆ Flow: Model linkages

Categorization

- ◆ Financial
- ◆ Risk Management
- ◆ Decision Support

Creating a Model Inventory

Possible Criterion for Inclusion as a Key Model



Which Models Drive the Company's Risk?

Risk Assessment

Risk Assessment

- ◆ Conduct risk assessment using a disciplined framework

Ranking Factors

- ◆ Financial impact: balance sheet and income statement
- ◆ Existing controls
- ◆ System versus ad hoc: platform and frequency
- ◆ Robustness: model fit, systemic error, and usage
- ◆ Input reliability
- ◆ Timelines versus precision

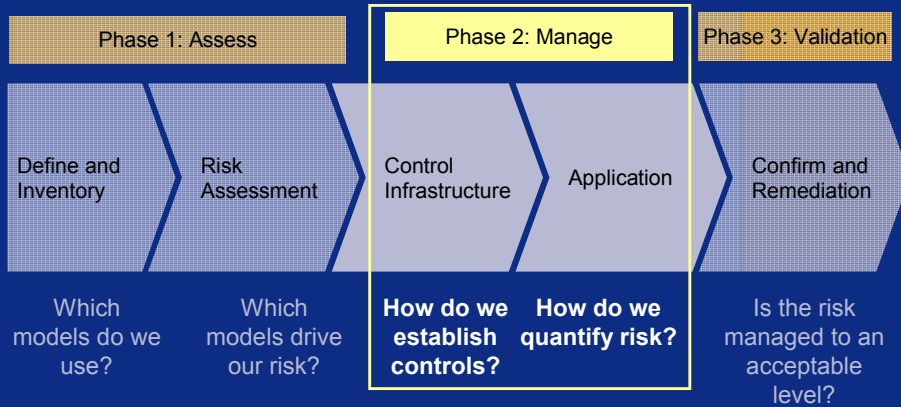
Model Risk Assessment: Primary and Secondary Considerations

Primary Area	Secondary Components
Model Controls	<ul style="list-style-type: none"> ◆ Access ◆ Process ◆ Data
Timeliness Versus Precision	◆ N/A
Financial Impact	<ul style="list-style-type: none"> ◆ Balance Sheet ◆ Income Statement ◆ Economic Impact
Robustness	<ul style="list-style-type: none"> ◆ Model Fit ◆ Systemic Error ◆ Appropriateness
Model Design	<ul style="list-style-type: none"> ◆ Frequency of Run - Systematic or Ad Hoc ◆ Form of Platform
Input Reliability	<ul style="list-style-type: none"> ◆ Source ◆ Form of Interface ◆ Downstream Dependencies for Results

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Model Risk Management Process



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How Do We Establish Controls?

Control Infrastructure

Documentation

- ◆ Model usage & limitation
- ◆ Change process
- ◆ Ownership: usage, testing, & maintenance
- ◆ Policies: oversight, roles/responsibilities, & validation

Control Structure

- ◆ Interview users
- ◆ Review data controls
- ◆ Review model control to Model Risk and Control
- ◆ Review access controls

How Do We Quantify Risk?

Application

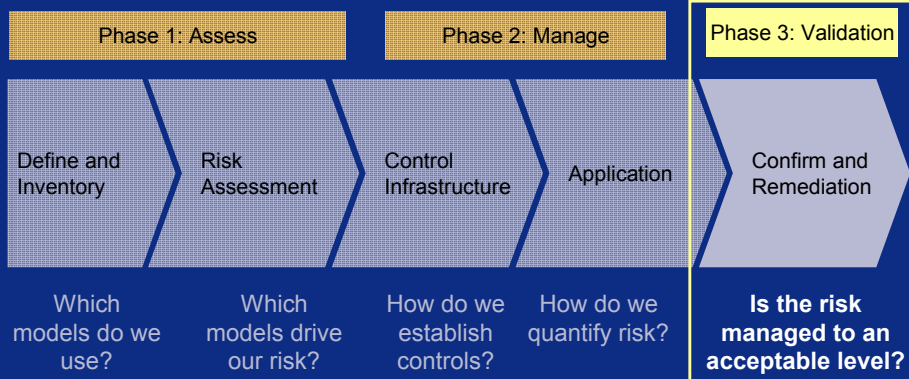
Methodology

- ◆ Technical documents
- ◆ Correct application?
- ◆ Correct implementation?
- ◆ Industry approaches
- ◆ Alternative approaches
- ◆ Risk of misspecification and misuse

Results Testing

- ◆ Value comparisons (e.g., market data, portfolio replication, parallel tests)
- ◆ Model limitations (e.g., limiting cases, extreme values, path-dependency)
- ◆ Input sensitivity (e.g., hard-coded inputs, linked data dependency)

Model Risk Management Process



Is the Risk Managed to an Acceptable Level?

Confirm & Remediation

Methodology

- ◆ Review of processes
- ◆ Detailed testing
- ◆ Actual to expected analysis

Benefits of a Disciplined Model Risk Assessment Framework

- ◆ More clearly assess areas of concern
- ◆ Management can compare their model risk assessment scores against their own appetite for risk and take action if these are not aligned as expected
- ◆ Substitute model risk perceptions with an objective score based on tangible criterion

Strategic Benefits of Model Risk Management

- ◆ “Streamlined” model development and validation
- ◆ Higher modeling confidence
- ◆ End Result: Quicker valuation with a higher degree of confidence
- ◆ Natural extension of model risk management driven by regulatory concerns

Model Risk Management: A Sustainable Process

- ◆ Replaces people-driven activities with process-driven activities
- ◆ Common framework for *all* model development and validation processes
- ◆ Control infrastructure should provide effective model risk information as models, people, and regulations change
- ◆ Redundancies may be reduced by:
 - Leveraging existing modules into new models
 - Creating consistent documentation standards
 - Delineating specific validation steps to be applied on all models

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