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REVIEWING PREDICTIVE MODELS: A REGULATORS PERSPECTIVE

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Ratemaking and Product Management
Seminar & Workshops
March 14–16, 2016



WHY ARE WE HERE TODAY?

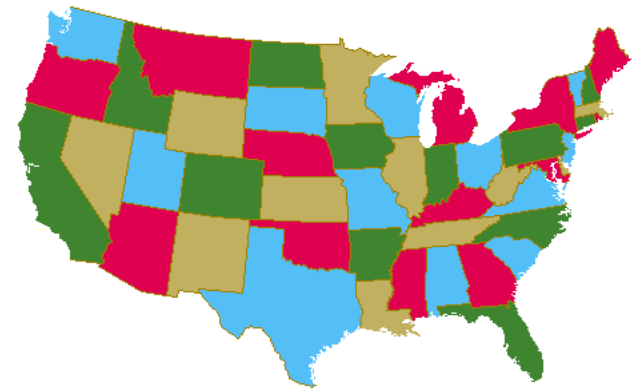
- Merlinos Perspective
- General Regulatory Concerns
- Regulatory Challenges
- Documenting Model Specifics

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OUR PERSPECTIVE

- Merlinos & Associates has been engaged by many jurisdictions over the years to provide actuarial review of rate filings.
- Over the last 25 years, we have reviewed thousands of rate filings, including over 100 filings with PA.
- We work with the smallest and largest States, and those with and without actuaries.



MERLINOS – OUR PERSPECTIVE

Half of my work is for regulators,
half for industry...



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REGULATORS OVERALL CONCERNS

Rating Statutes Require:

- Rates Not Inadequate
- Rates Not Excessive
- Rates Not Unfairly Discriminatory

REGULATORS OVERALL CONCERNS

Reasonability of Variables Used



- Clear relationship to loss potential.
- 4th moment of distribution of humidity in a ZIP code?

Fairness and Ethical Concerns



- Number of insured's relatives in 20 mile radius with felony convictions?
- Percentage of single mother households in a ZIP code?

REGULATORS OVERALL CONCERNS

Transparency of Rating Process



■ Can I re-create someone's rate from a manual if I need to respond to a complaint?

- *Are there scoring components that aren't visible in the manual, or can't be recreated based on some clear criteria.*



■ Can insureds naturally relate and identify themselves in a certain class?

- *Consistent concern with extremely granular geographic rating.*
- *Also concern with more esoteric variables.*

REGULATORS OVERALL CONCERNS

Applicability of Model to “my” State

- **Small states** are concerned countrywide models potentially are *unfavorable* to their consumers:

“Why treat our State the same as ‘others’ when there is no data to support it?”

- **Large states** are concerned countrywide models potentially are *unfavorable* to their consumers:

“We are large and different, need to justify using this model in our State by testing against ‘our’ experience.”

REGULATORS OVERALL CONCERNS

Dislocations and Potentially Unfair Discrimination

- **Predictive Model implementations often lead to large changes for some policyholders.**
- **Renewal Capping routines complicate future reviews and delay price signaling within the market.**
- **Gaps between models and proposals are drawing more skepticism as Price Optimization discussion grows.**

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OLD REGULATORY FRAMEWORK

Data
+ Models
+ Results

= Effective
Oversight

- Data = Trust but Verify
- Models = Review of Calculations
- Results = Reasonability Tests

NEW REGULATORY FRAMEWORK

$$\begin{aligned} & \text{Data} \\ & + \text{Models} \\ & + \text{Results} \\ \hline & = \text{????????} \end{aligned}$$

- **Data** = How can we trust and verify new data sources?
- **Models** = How do we review complex models?
- **Results** = What if the results are not intuitive or understandable?

WHY IS A NEW PARADIGM SHIFT DIFFICULT?

- Sophisticated modeling calls for **skills** that humans naturally lack.
- Sophisticated modeling requires **knowledge** that is often not in our educational backgrounds.
- Modeling is often **interdisciplinary**.
- The modeling field is constantly **changing**, bringing in concepts from math, statistics, natural and behavioral sciences, and computer science.



WHY IS A NEW PARADIGM SHIFT DIFFICULT?



- Modeling process naturally lacks transparency.
- Lots of problematic language and acronym problems.
- The job of regulators has not changed, but challenges have grown.

WHAT ARE THESE CHALLENGES?

**Number of Filings
Containing Models!**

**Lines of Business
Expansion**



WHAT ARE THESE CHALLENGES?

- Predictive modeling is a growing discipline that spans industries...therefore it is constantly changing.
- GLMs are common in insurance, but other techniques are beginning to be adopted...

Decision
Trees

Ensemble
Trees

Clustering
Techniques

Approximate Bayesian
Computation

Neural
Networks

and more

Continued developments in the realm of machine learning will surely be adopted into the insurance arena in the near future.

WHAT ARE THESE CHALLENGES?

Understanding and Reviewing Third Party Data

- IN-HOUSE
- OUTSOURCE



**Budgets and Staffing Levels
Largely Haven't Changed!**

With all of these developments and complex statistical routines...

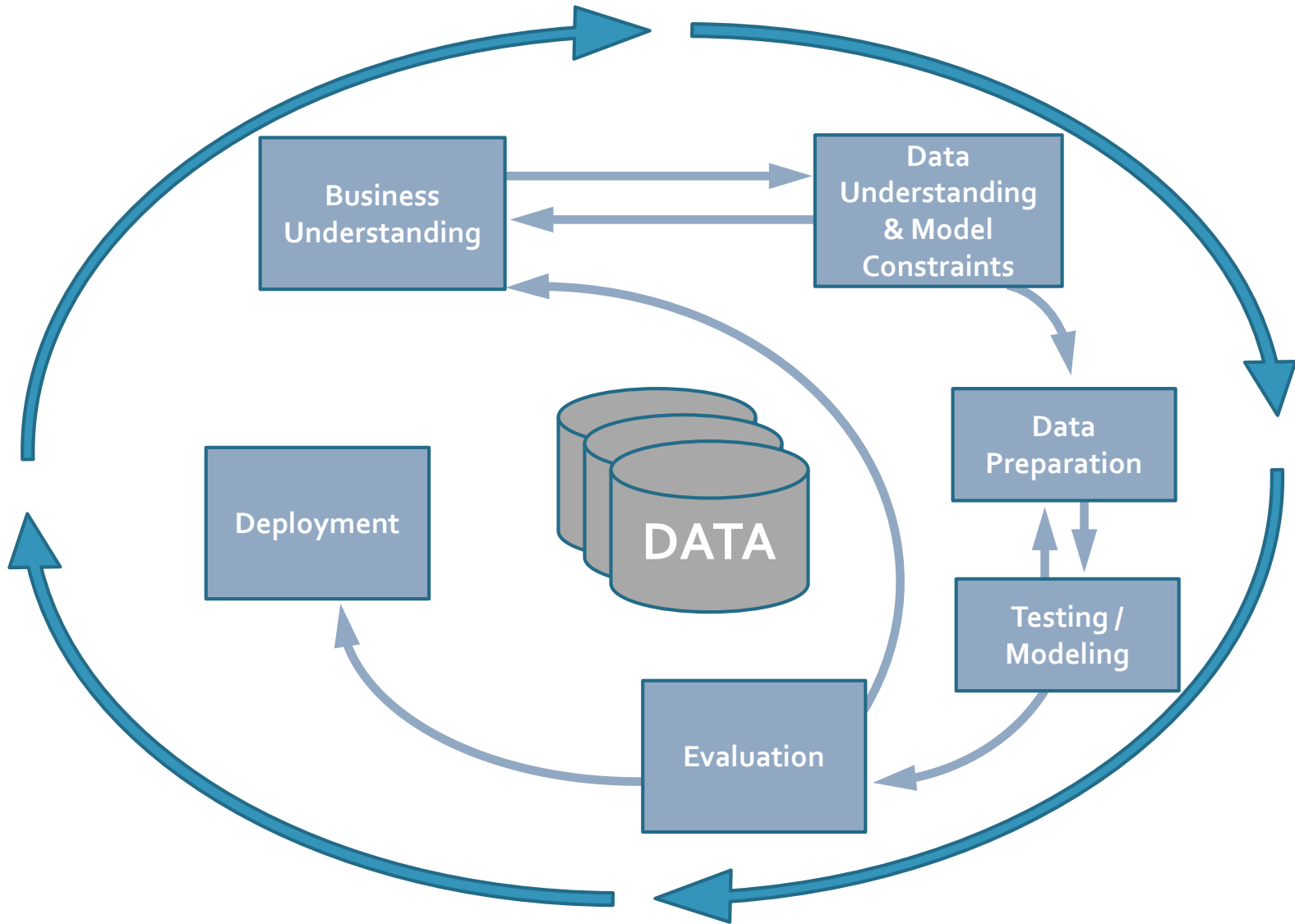
Q ■ ■ How can the regulator keep up and make sure these types of analyses are reviewed and used properly?

A ■ ■ **Fortunately...**
■ Focus on Broad Controls
■ Framework of modeling process can lessen need to verify every calculation

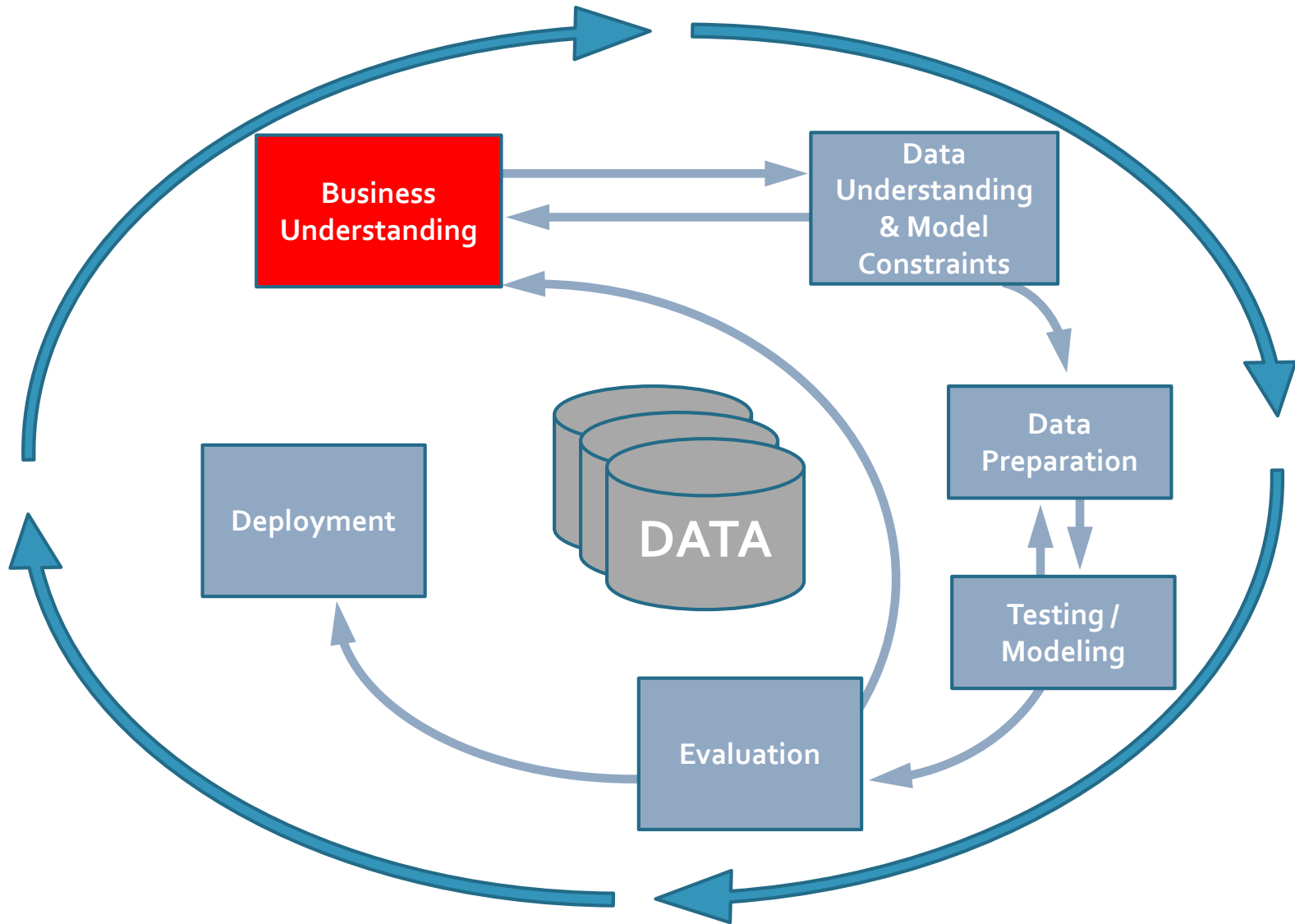
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GENERAL MODELING FRAMEWORK



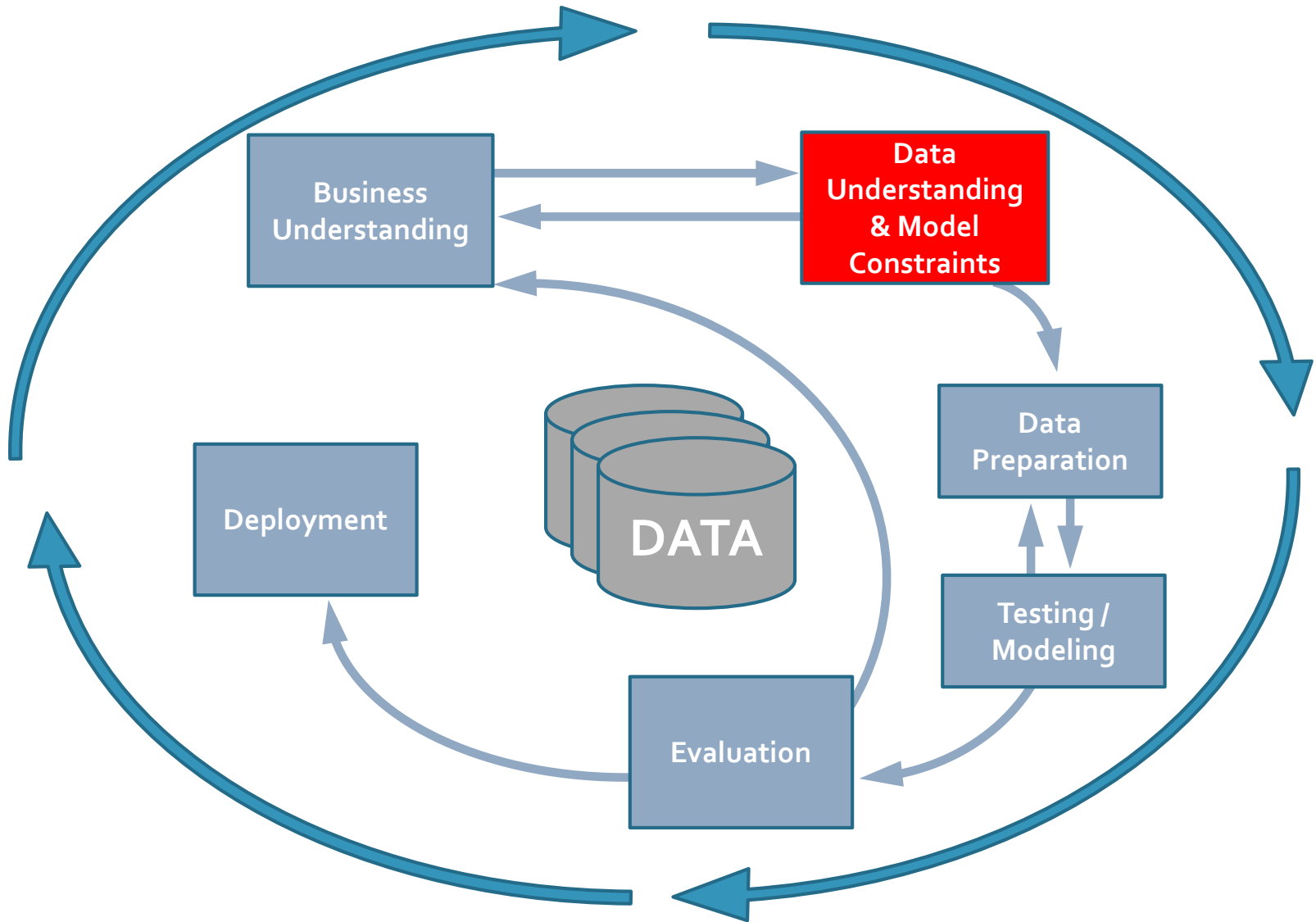
GENERAL MODELING FRAMEWORK



BUSINESS UNDERSTANDING

- What is the **purpose** of the modeling effort?
- What business segments **will be affected**? Which will not?
- Is this the **first time** a model has been used for these exposures? Is there a **significant shift** from prior practices?
- Who **owns** the modeling efforts? Internal company? Third party consultant?

GENERAL MODELING FRAMEWORK



DATA UNDERSTANDING/CONSTRAINTS

What are data volumes?



Time
Exposures

Has modeling database
been audited?



*What controls are in place
to ensure that data is
complete, accurate, etc.*

Using third party data?



DATA UNDERSTANDING/CONSTRAINTS

Is the data being used a match to what you are trying to accomplish with the model?

Includes extra exposures?

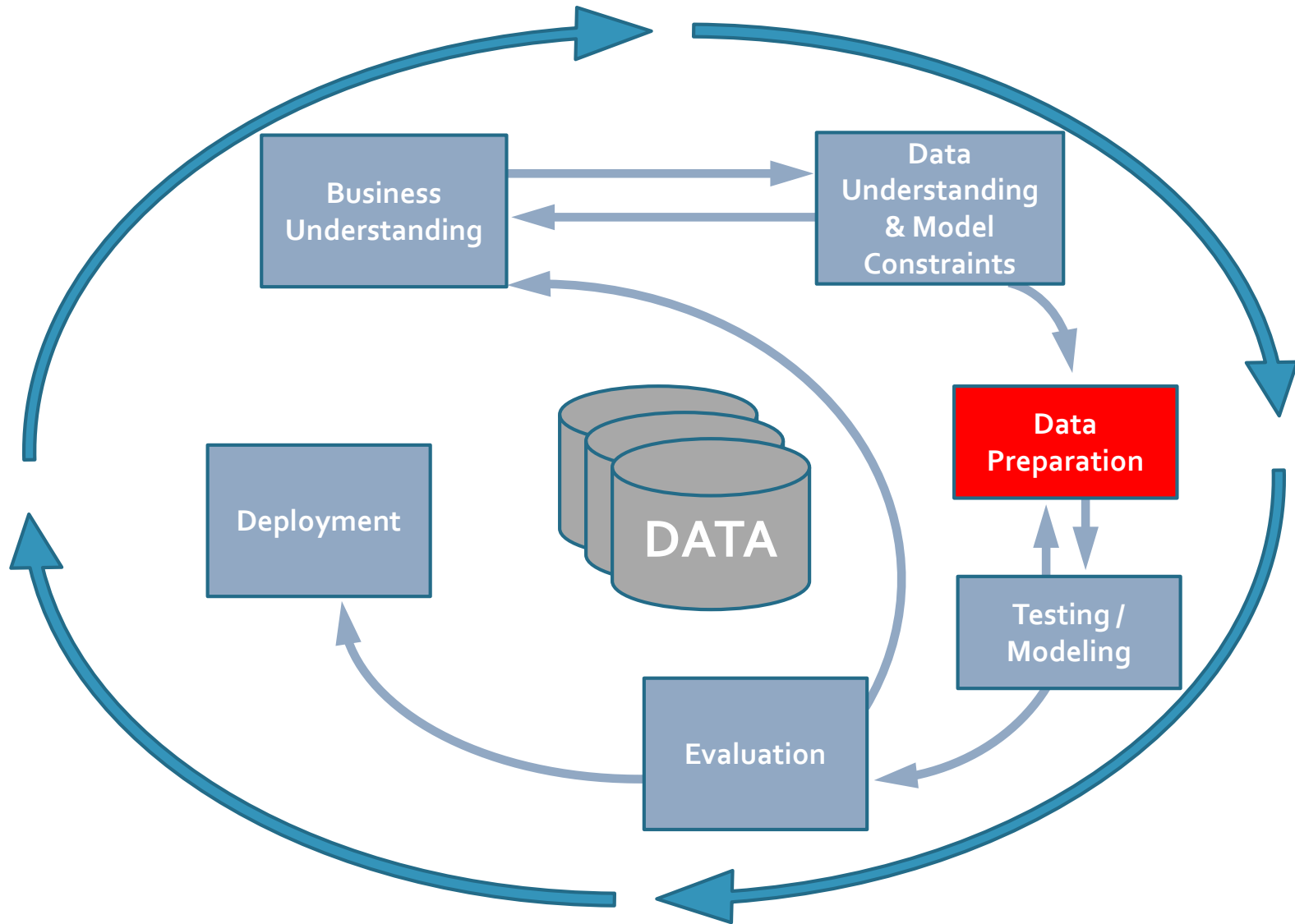
Missing something?

Same premium base?

What are the variables available? Define!

Causality not required, but regulators want reasonability.

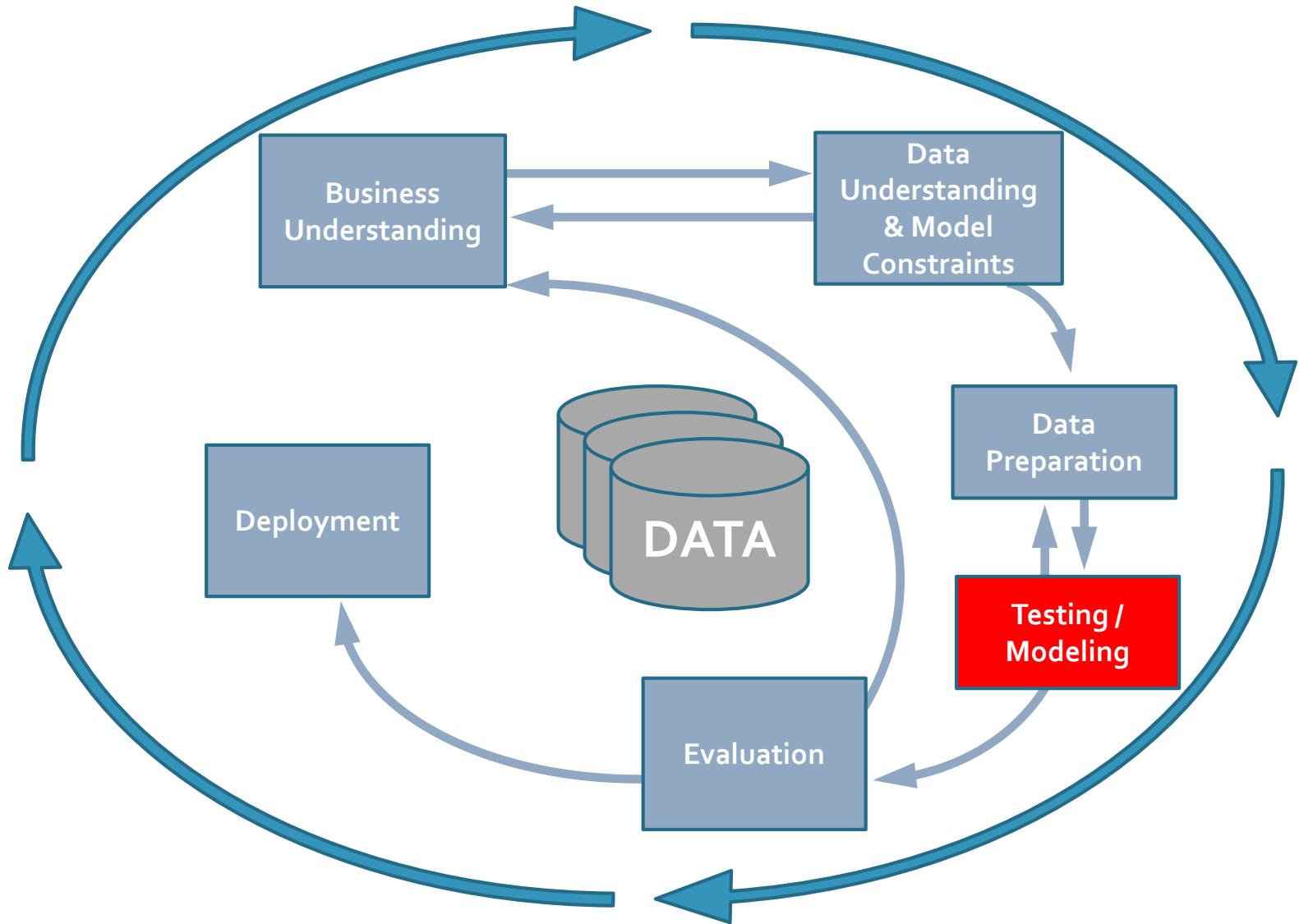
GENERAL MODELING FRAMEWORK



DATA PREPARATION

- Was there any **cleaning** of data required?
Am I **missing** values for modeled variables?
- What **adjustments** were made to loss data?
Excluding CATS? Trended? Developed?
 - ✓ *Are those adjustments (or lack thereof) reasonable for this exposure?*
- Is there any **separation** of data for future training/testing? Explain!

GENERAL MODELING FRAMEWORK



TESTING / MODELING

What type of model are you using?

Frequency & Severity v. Pure Premium?

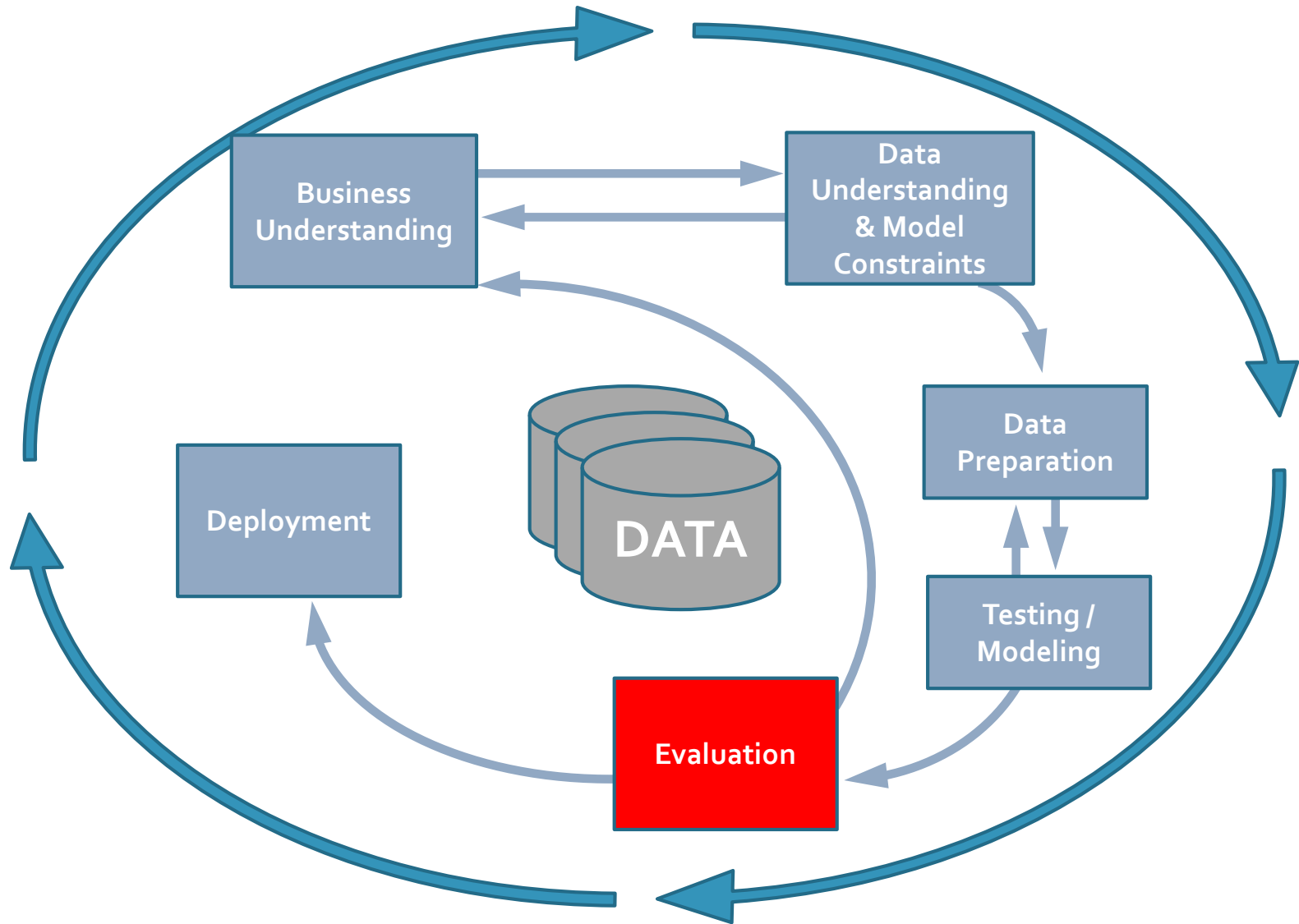
GLM v. Decision Trees?

Others?

THEN ASK...

- Has the modeled information proven to show predictability at the factor/predictor variable level?
- What processes were carried out to test for the inclusion/exclusion of the variables?
- Were outlier results reviewed and understood?

GENERAL MODELING FRAMEWORK



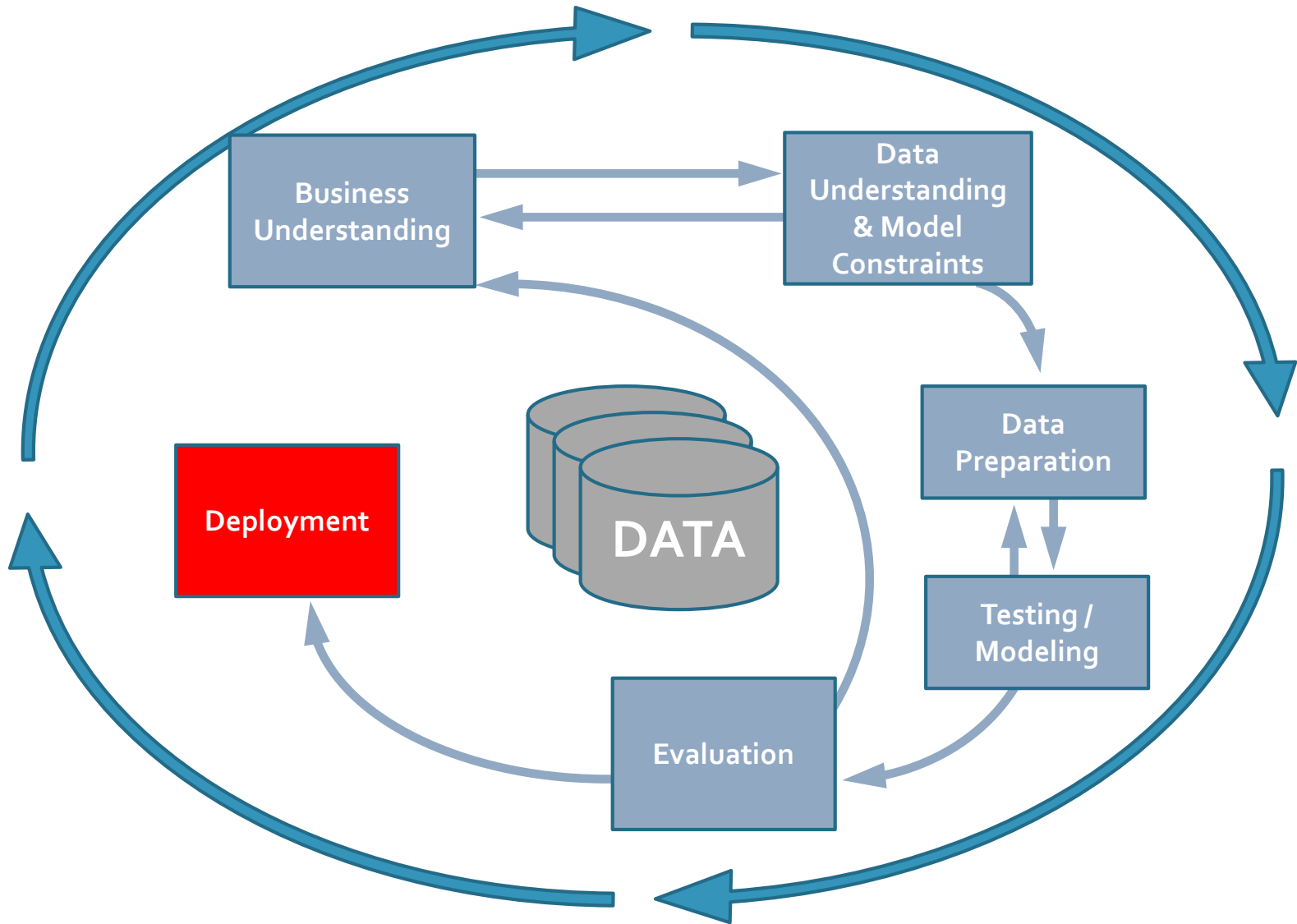
EVALUATION

- Are multiple models considered?
 - ✓ *How are they compared?*
- Has the model in its entirety shown predictability?
- Does the model predict better than the current system?
- Was there independent validation of the modeling process?
 - ✓ *Who checks?*

EVALUATION

- Document results of testing vs training processes.
 - ✓ *What was considered reasonable?*
- Were there any tests against data not in testing/training?
 - ✓ *(e.g. out of time sample)?*
- Explain how this model meets business objective.

GENERAL MODELING FRAMEWORK



DEPLOYMENT

- Is company proposing something **other** than indicated?
 - ✓ *Why? What are the other considerations?*
 - ✓ *Lack of clarity here can lead to drawing negative conclusions (redlining, price optimization, etc.)*
- Are any rate effects overall **off-balanced** in jurisdiction?
- Is there a use of **renewal premium caps**?
 - ✓ *Need lots of documentation here!*
 - ✓ *Are other models considered?*
 - ✓ *Are other actuarial processes able to deal with capping? (i.e. rate indications?)*

DEPLOYMENT

- Document policyholder dislocations, both capped and uncapped.
- Document plans on model updates.
 - ✓ *Especially important on loss ratio model.*

SUMMARY

- Regulators have to review lots of models...**Be helpful!**
- Many filings focus on statistical detail only...don't neglect to **tell the story** of the modeling process.
- Demonstrating a well thought out and controlled modeling process can be **more important** than a hard statistic
- Step back from numbers, and **ask**:
 - ✓ *Do the variables make sense?*
 - ✓ *How is management using/adjusting my model? Is that appropriate? Do they understand potential model risk?*
 - ✓ *If I was a regulator, might I have a concern with this?*

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