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**May 21<sup>st</sup>, 2014**

## **Practical Predictive Modeling**





## Agenda

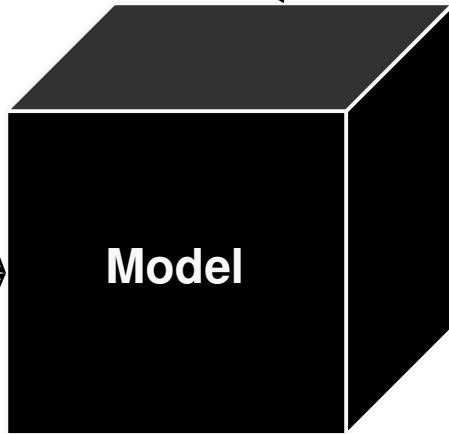
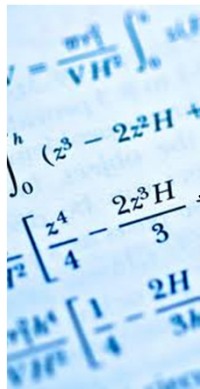
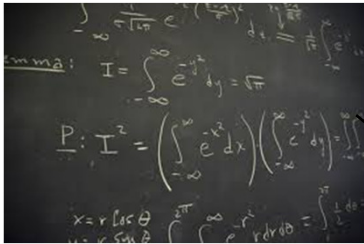
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1. What is predictive modeling and how should actuaries think about it?
2. Current state in P&C market
3. Current state in Life market
4. Predictive Modeling Case studies & Building a Model
5. Challenges
6. Business Interface

# How do you think about predictive modeling? Is it actuarial voodoo?

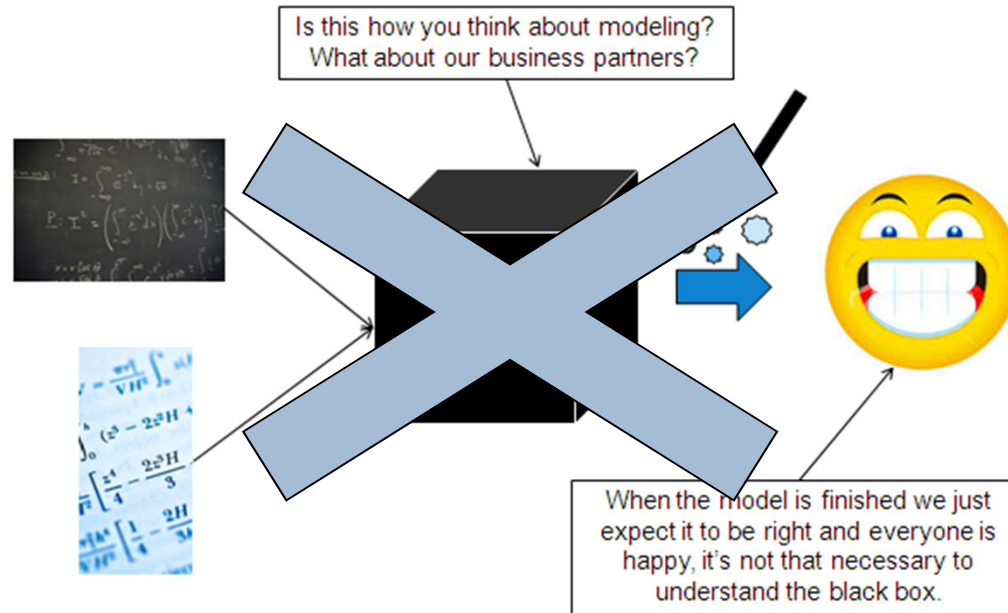


Is this how you think about modeling?  
What about our business partners?



When the model is finished we just expect it to be right and everyone is happy. Some people feel it is not that necessary to understand the black box.

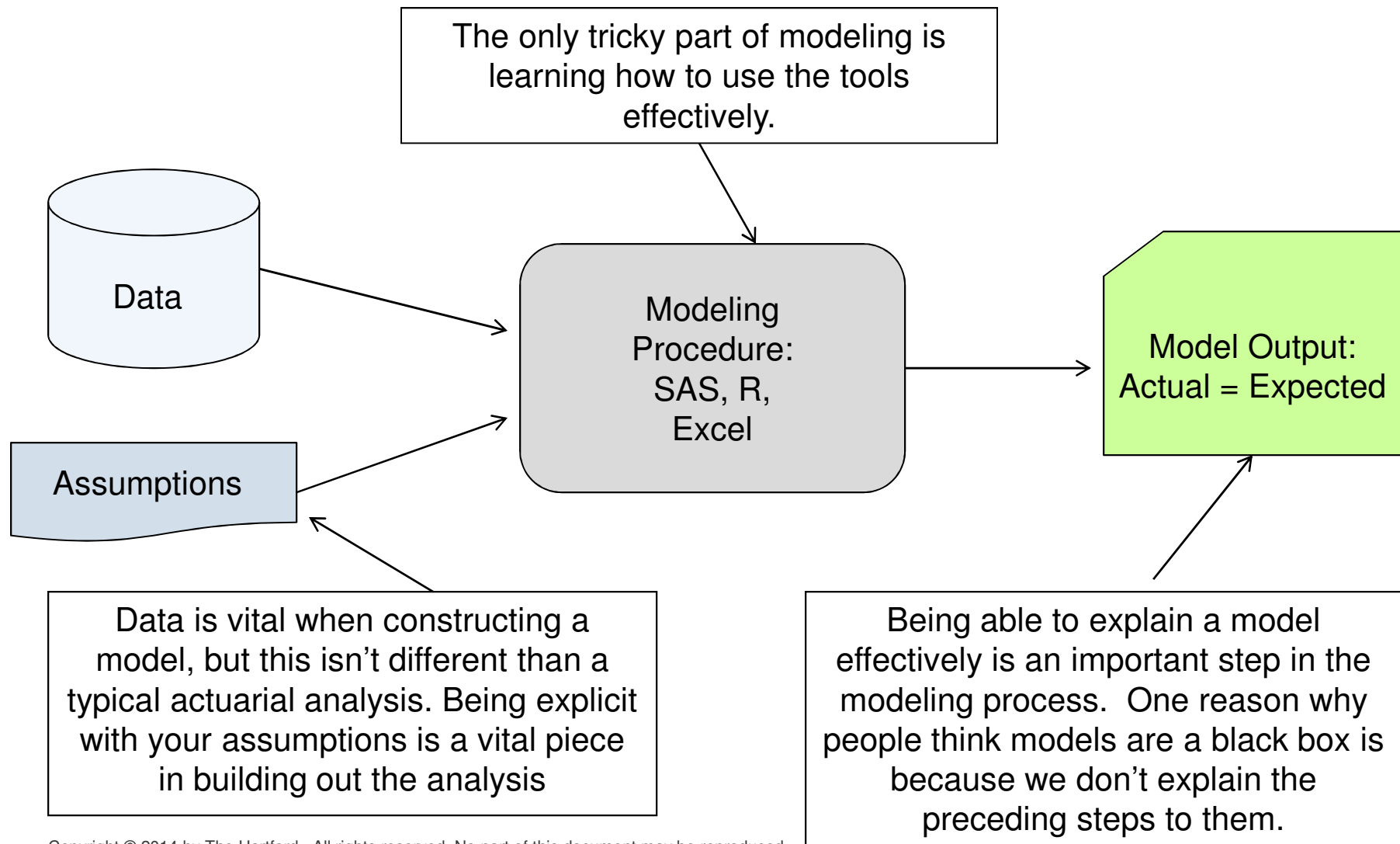
# What was on the previous slide is not predictive modeling. What is the definition of predictive modeling?



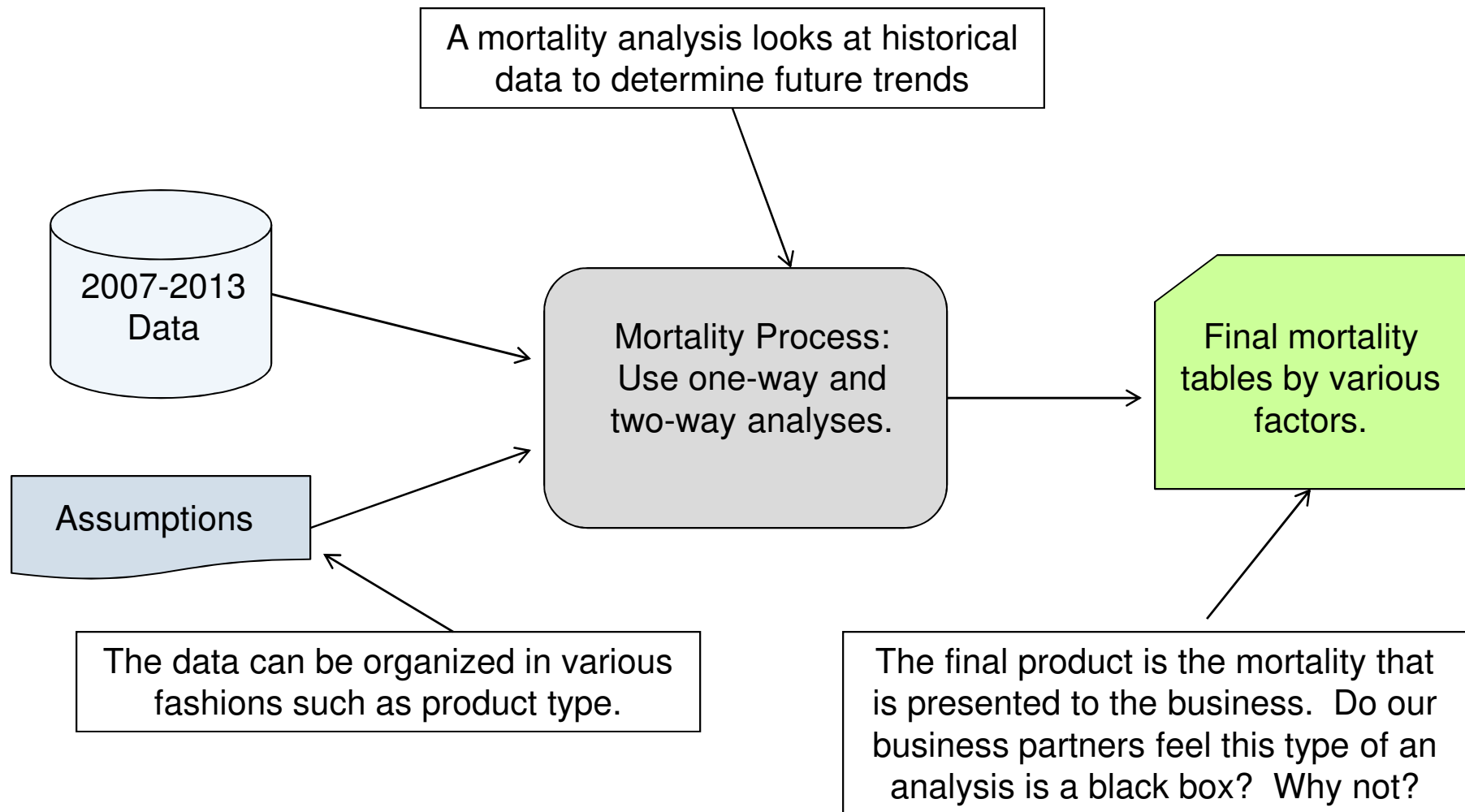
Predictive modeling is the ability to predict future outcomes using various statistical techniques.

Wait a second, haven't actuaries always done predictive modeling? Couldn't mortality, policyholder behavior, or claim incidence be a predictive model?

# Predictive modeling is not a black box, but rather a more sophisticated way to do our analytics. This is how we should look at models.



# Let's break this down into a model we all know: Mortality Rate Study





### Prelude

- Min Bias Procedure was used for insurance pricing
- GLMs became increasingly popular in the 1990s with computing power
- GLMs became the norm in the 2000s for most of the insurance products with personal lines being the leader

### Current State

- Companies are developing predictive modeling capabilities for commercial lines
- Price optimization algorithms being developed for personal lines
- Models being built to improve claim processes

### Future State

- Predictive modeling branching outside of core product base
- Price Optimization being developed for commercial lines
- Incorporate modeling to better understand buying behavior and lifetime value of a customer
- Models being built outside of traditional pricing and claims

## CURRENT STATE - LIFE





## 2012 SOA SURVEY OF LIFE COMPANIES



### SOA Survey on Fully Underwritten Life Insurance:

	Currently Using or Considering	Not Considering
Term/Whole/Universal	45%-50%	<b>50%-55%</b>
Variable Life	22%	<b>78%</b>
Other	17%	<b>83%</b>

Source: Society of Actuaries. January 2012. Report of the Society of Actuaries Predictive Modeling Survey Subcommittee. Retrieved from <http://www.soa.org/research/experience-study/bus-practice-surveys/research-2012-02-predictive.aspx>

### Towers Watson Survey on P&C Usage:

	Currently Use	Plan to Use	Don't Plan to Use
Personal Auto	80%	15%	<b>5%</b>
Homeowners	62%	33%	<b>5%</b>

Source: Stoll, Brian, & Southwood, Klayton. March 2013. 2013 Predictive Modeling Benchmarking Survey. Retrieved from

<http://www.towerswatson.com/en-US/Insights/Newsletters/Americas/americas-insights/2014/predictive-modeling-usage-for-property-casualty-insurers-grows>

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### Percentage of Companies Using PM for Marketing:

	Yes	Maybe	No
Cross-selling to Current Customers	18%	25%	57%
Up-selling to Current Customers	18%	24%	59%
Lead Generation	14%	26%	60%
Target Marketing	20%	34%	46%
Level of Future Sales	8%	31%	61%

Source: Society of Actuaries. January 2012. Report of the Society of Actuaries Predictive Modeling Survey Subcommittee. Retrieved from <http://www.soa.org/research/experience-study/bus-practice-surveys/research-2012-02-predictive.aspx>



## PREDICTIVE ANALYTICS IN THE HEADLINES

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- Lincoln Financial Press Release:
  - “... Lincoln has implemented Predictive Modeling in its analysis of linkage between lapse behavior and variables such as age, gender, and policy size and duration.”
- CIGNA Press Release:
  - “The Cigna study found that a combination of predictive analytics and a nurse health advocate-led intervention can produce a measurable reduction in future disabling illness or injury incidents...”
- MassMutual Job Posting 50354868:
  - “The ... (FPD) Consultant ... will be responsible for developing a Global Fraud Prevention and Detection strategy ... utilizing fraud surveillance technology, predictive analytical models and relational databases.”

## BUILDING A MODEL & CASE STUDY



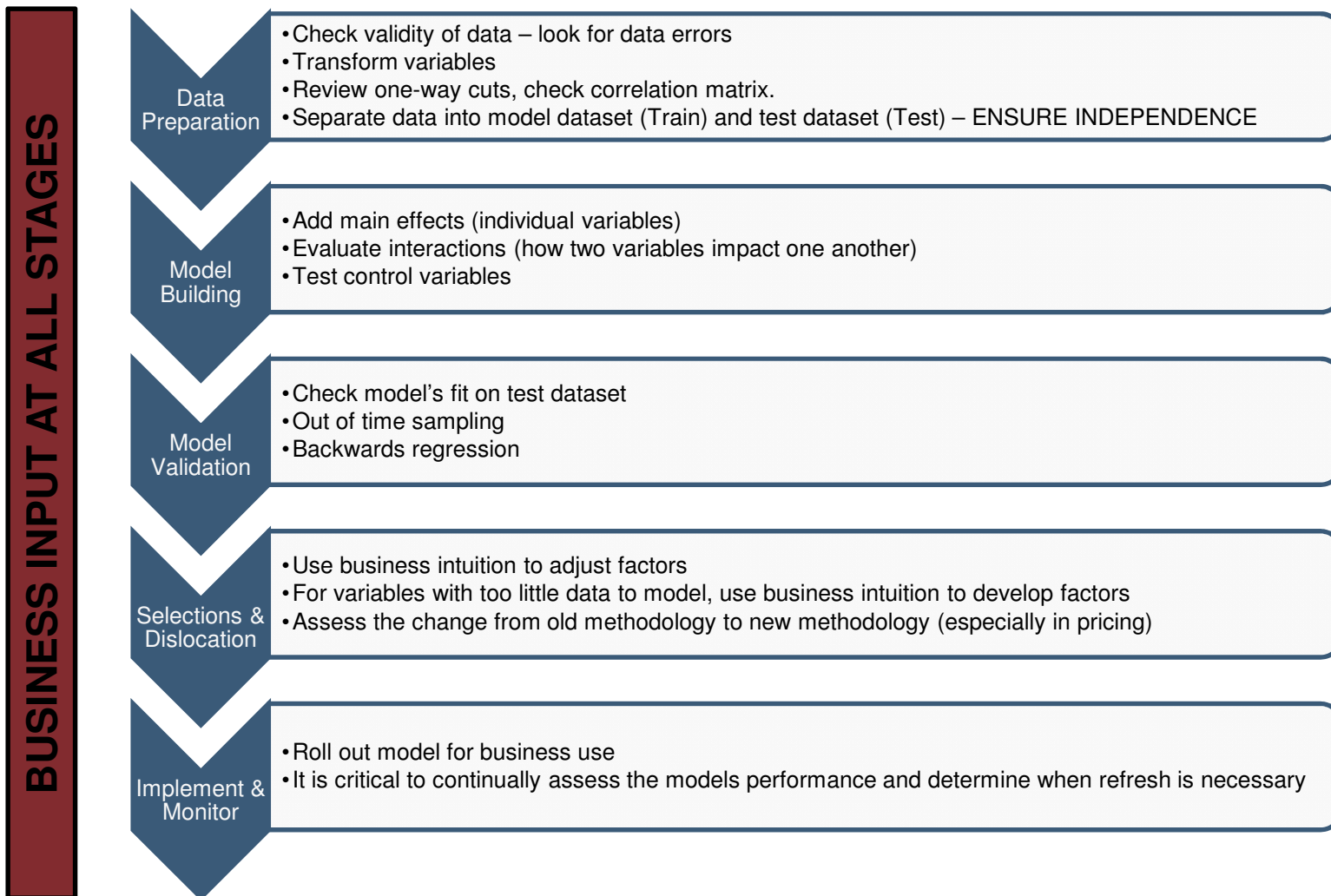
## MODELING REQUIREMENTS

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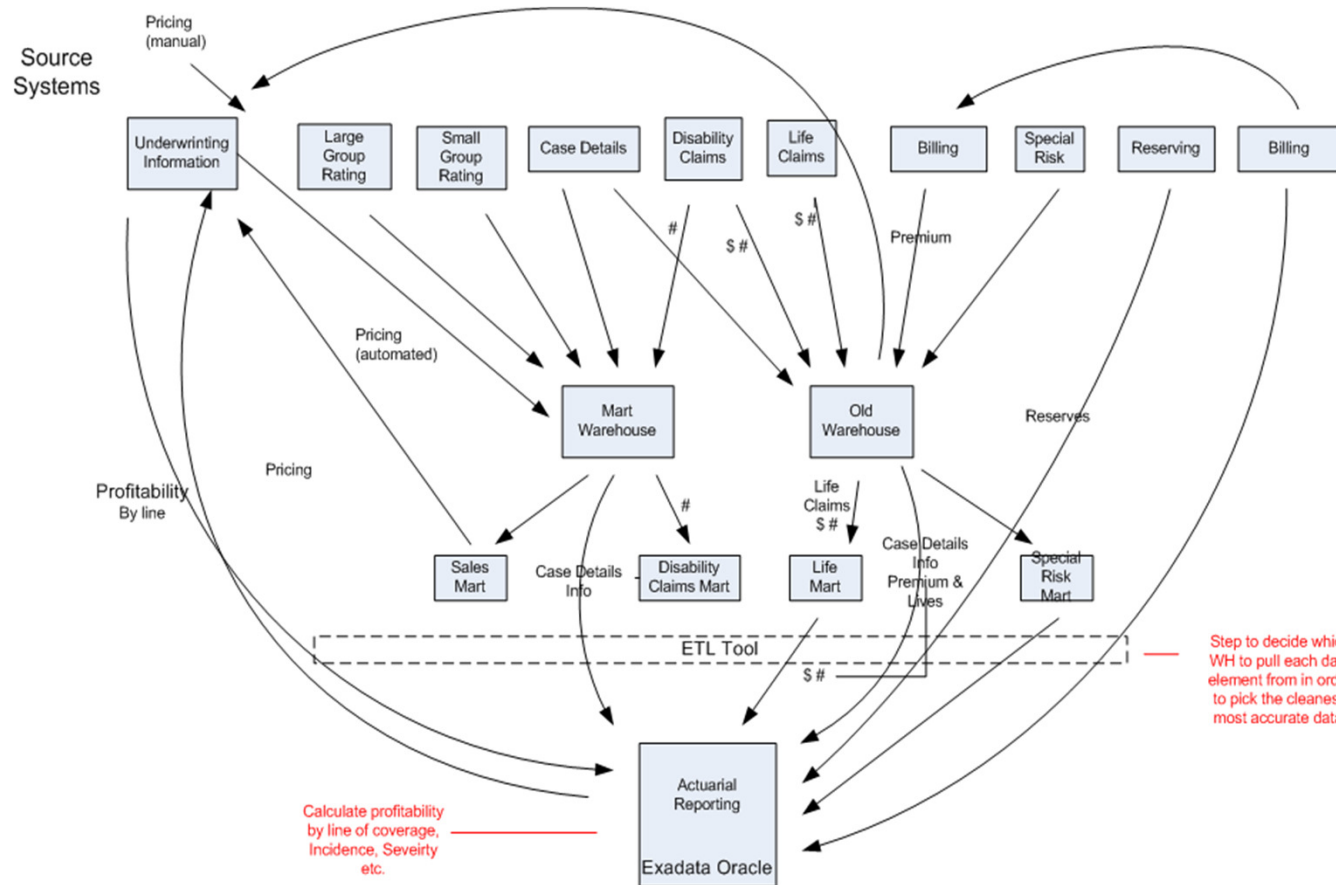


- Data, data, data
  - The more volatile the response, the more data you need
  - Data availability can be the biggest hurdle
  - Time horizon – not too long, not too short
- Awareness of system limitations
- Ability to translate into business action
- Modeling software

## THE MODELING PROCESS

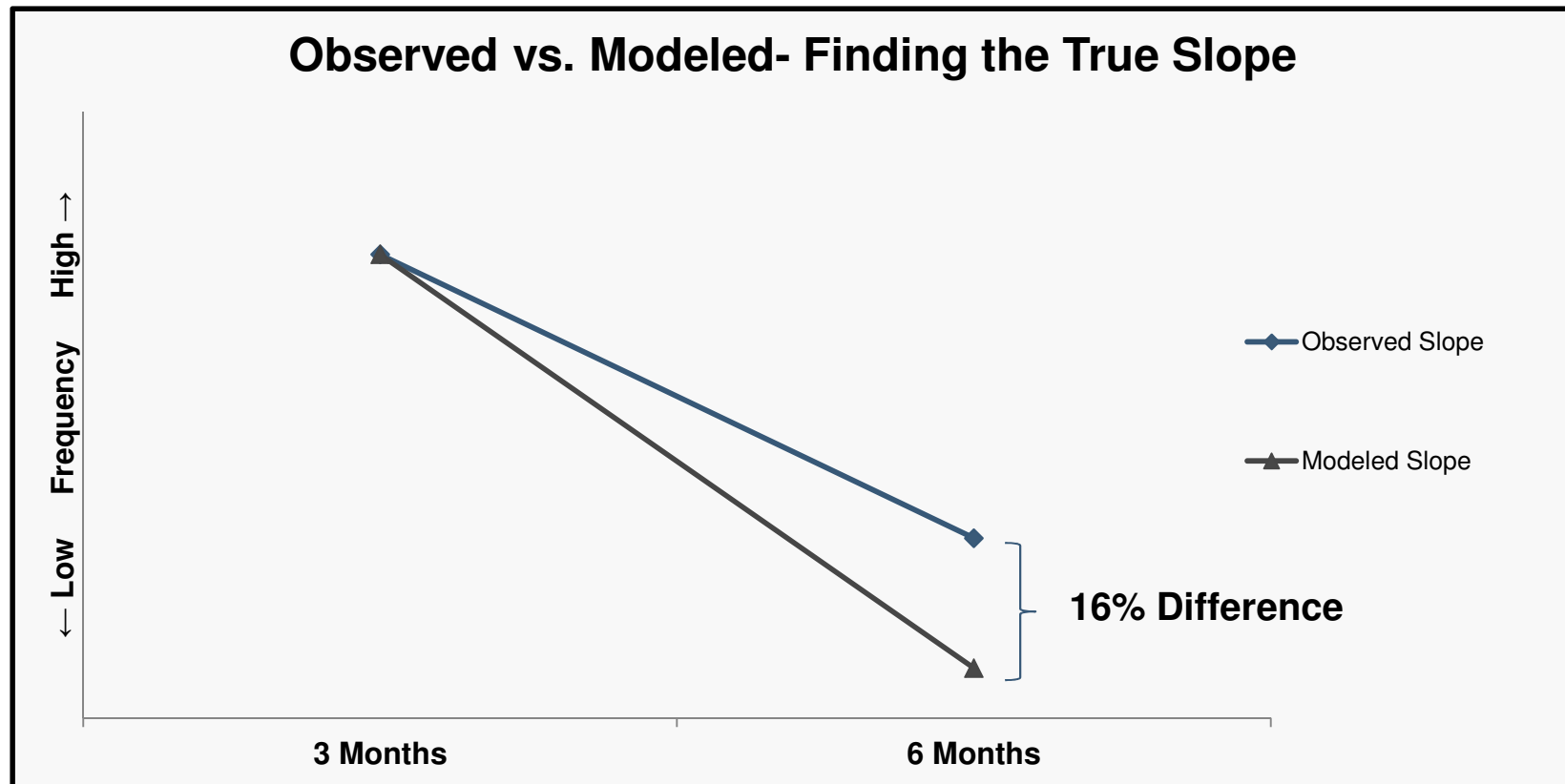


# DATA PREPARATION – THE 80%



It is critical to understand the data. Source systems may be fed manually. Data is probably not entered with you in mind.

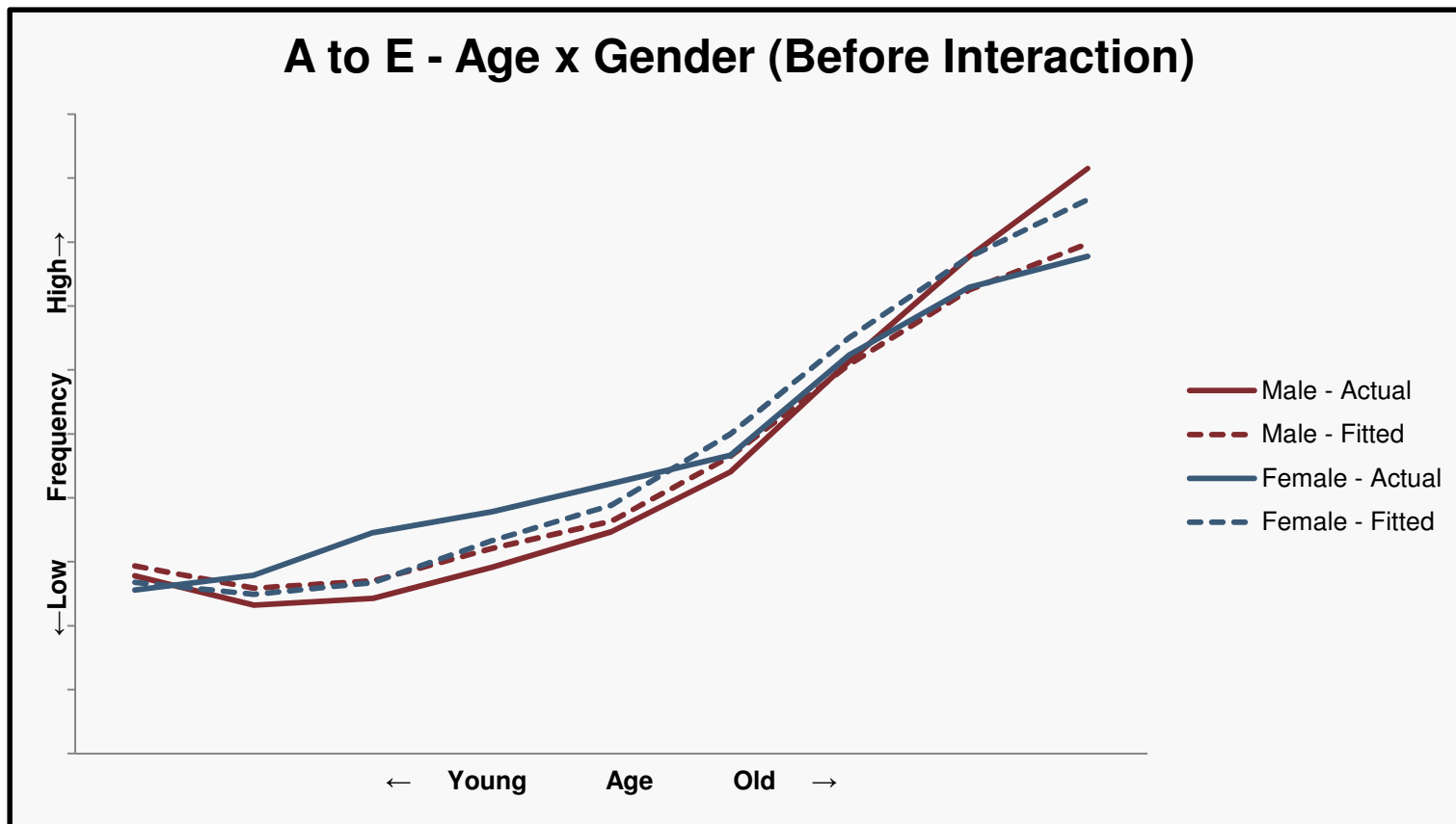
## FINDING THE TRUE IMPACT OF VARIABLES



One-way analysis would yield a much flatter incidence slope. The true effect of EP on incidence is much steeper!

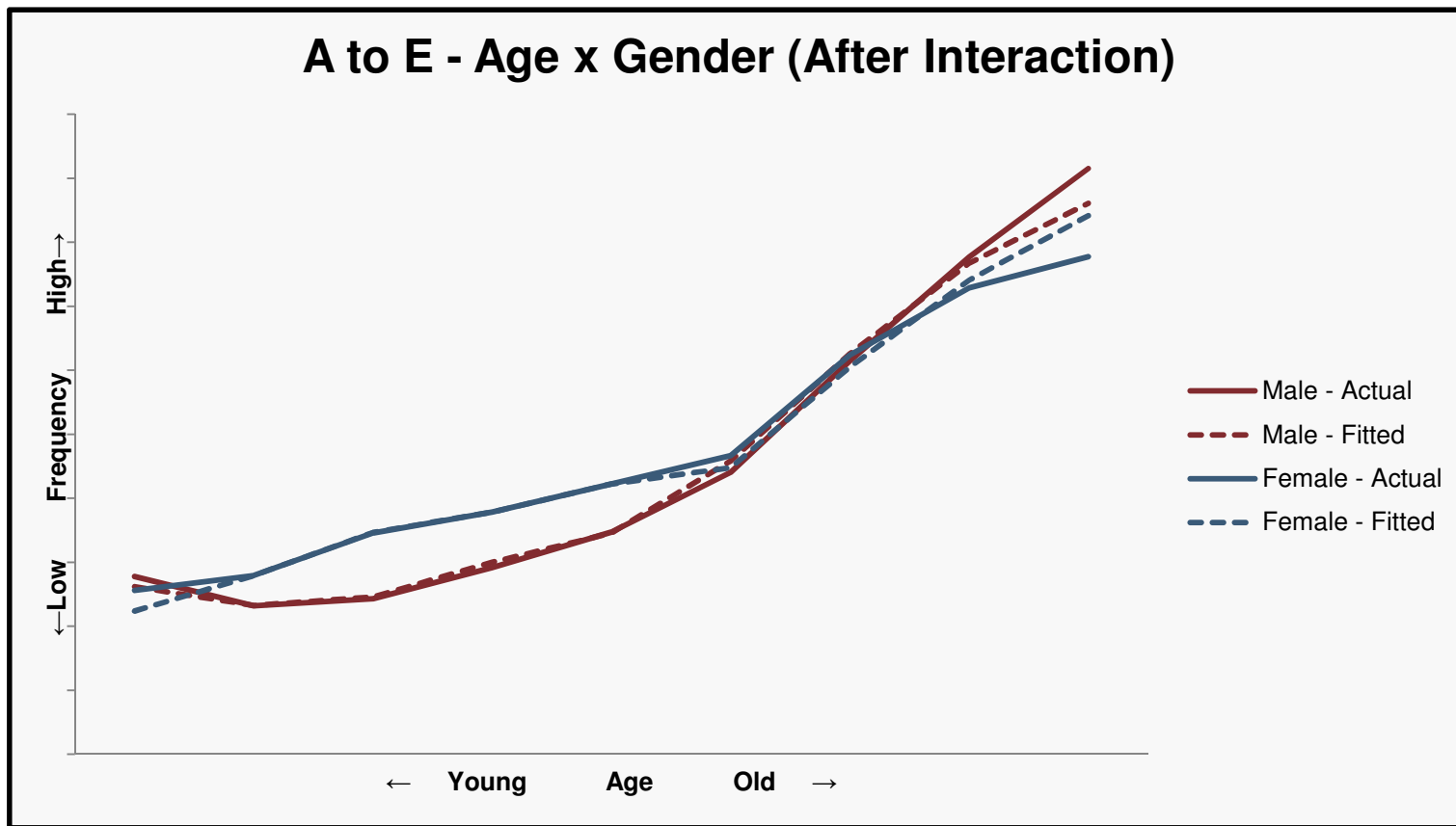


## INTERACTIONS – ASSESSING POTENTIALS



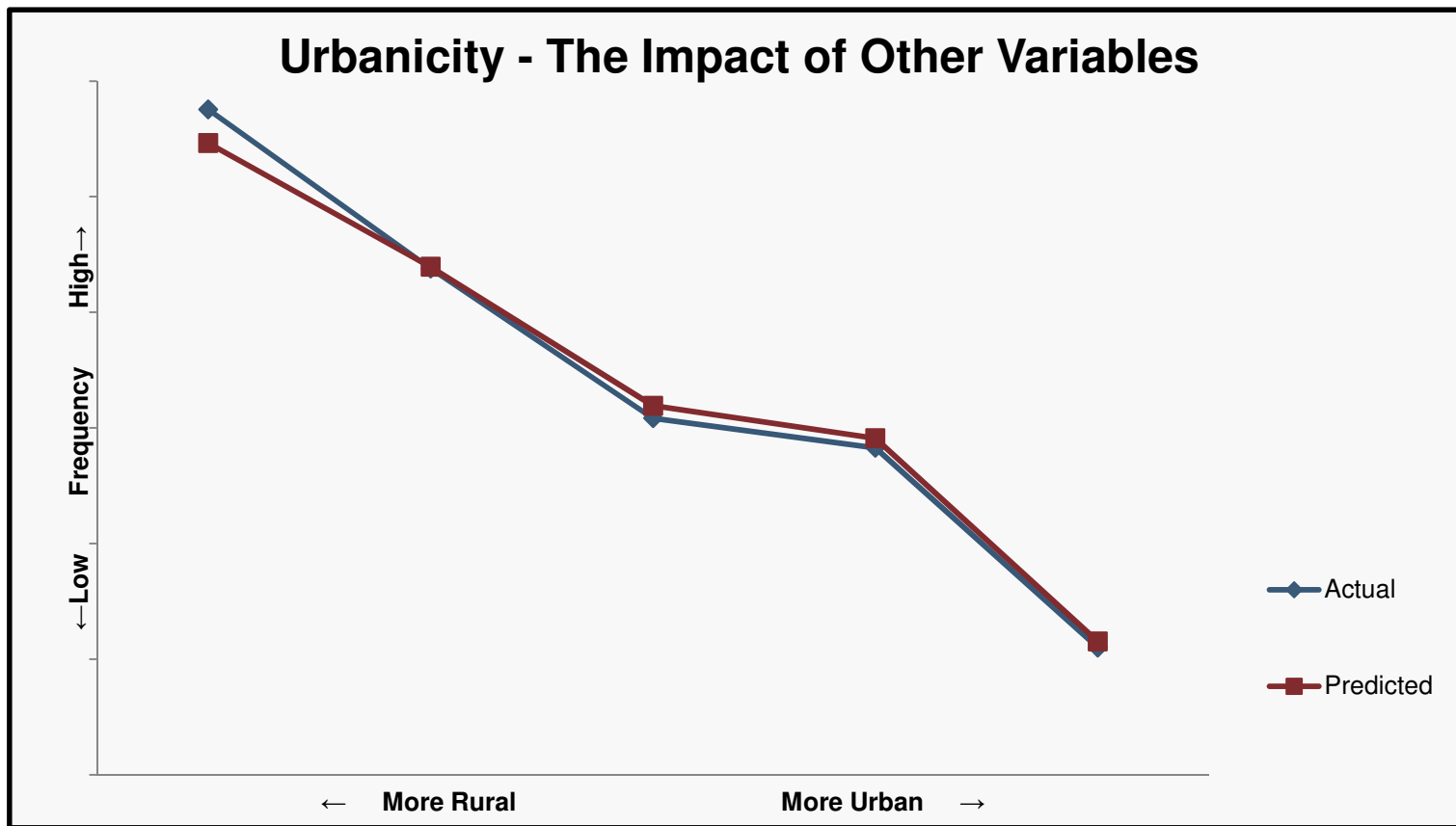
Actual incidence for younger females is much higher than predicted. Without an interaction in the model, we do not appropriately differentiate younger males and females.

## INTERACTIONS – FITTING THE INTERACTION



After adding the age & gender interaction we are able to more accurately predict the incidence for younger individuals.

## WHAT IS A VARIABLES IMPACT, IF ANY?



The other variables in the model do a very good job of predicting rural vs. urban areas. Most rural incidence is double that of most urban incidence.

## ASSESSING THE POWER OF EACH VARIABLE

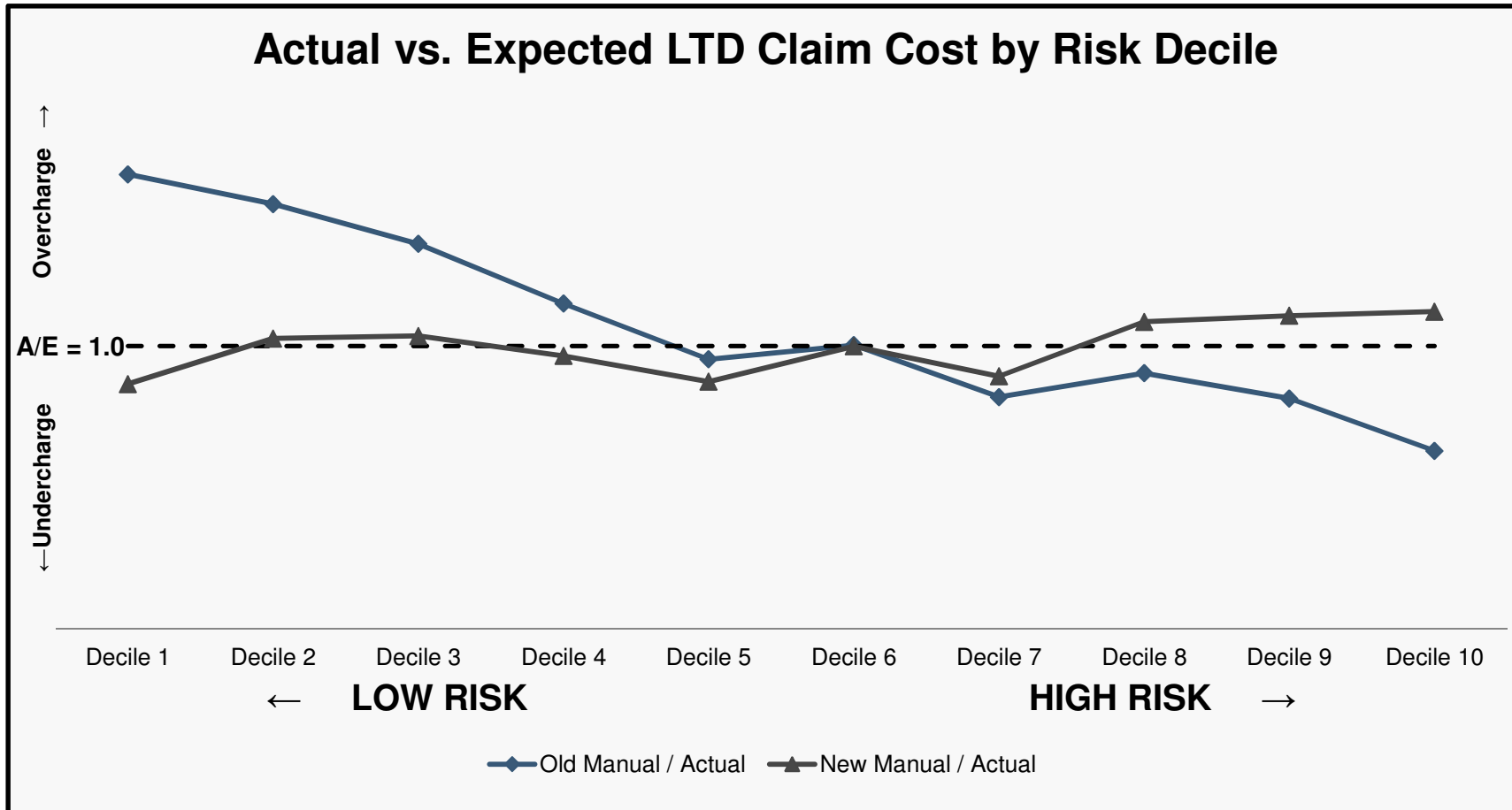


### LTD Incidence Rate Model – Power of Each Variable

Variable #	% Deviance	Cumulative %
Variable 1	49.90%	49.90%
Variable 2	14.62%	64.53%
Variable 3	7.48%	72.00%
Variable 4	7.46%	79.46%
Variable 5	4.87%	84.33%
Variable 6	3.23%	87.57%
Variable 7	2.37%	89.93%
Variable 8	2.20%	92.14%
Variable 9	1.91%	94.04%
Variable 10	1.71%	95.75%
⋮	⋮	⋮

One variable provides 50% of the predictive power of the model. Later variables only add slight predictive power.

# ACTUAL TO EXPECTED – OLD VERSUS NEW METHOD

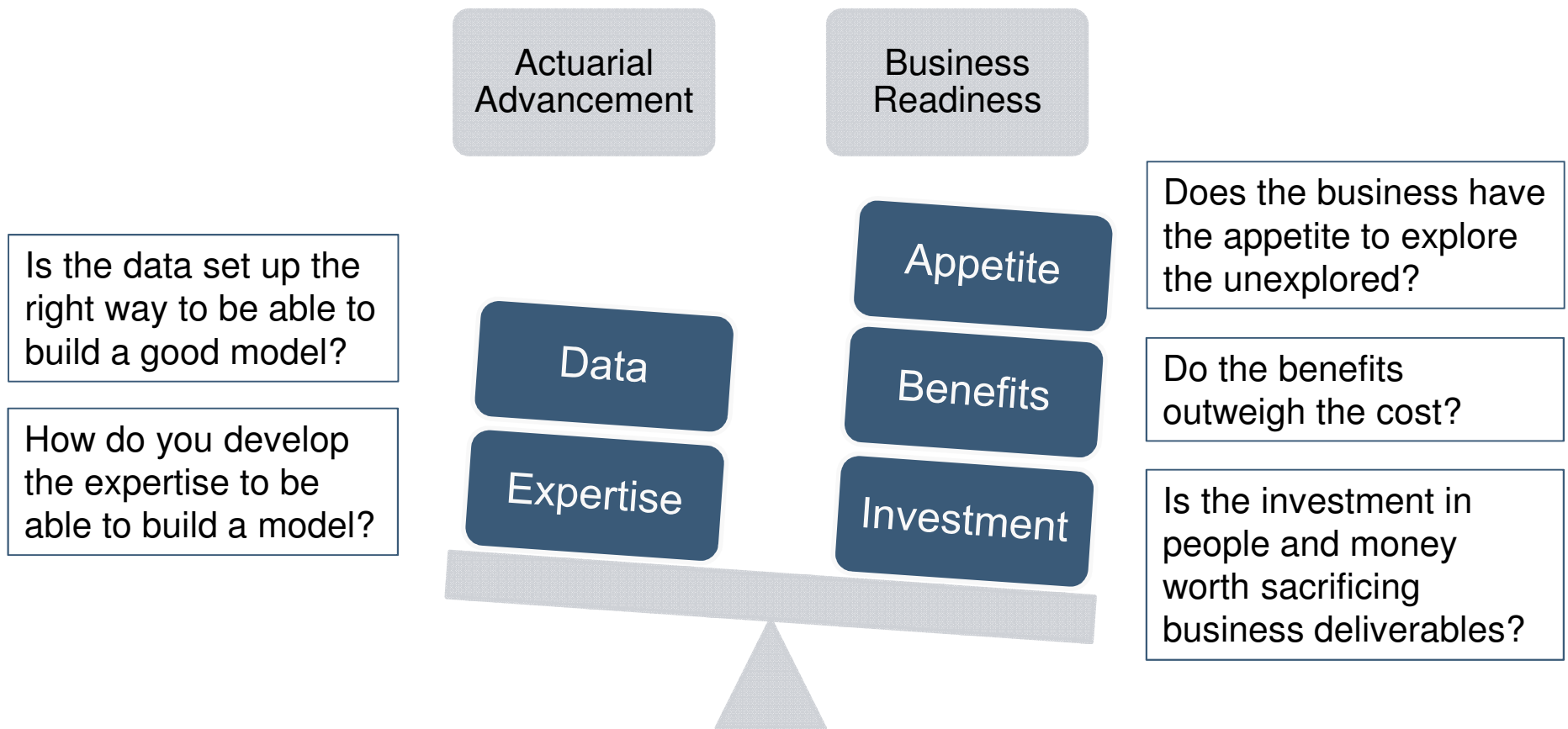


Flatter line indicates more appropriate pricing of risk. The old manual was overcharging for lowest risk cases and undercharging for highest risk cases.

## BUSINESS INTERFACE



# There is a balance between advancing the science the adoption of the new techniques.





# Business Interface: Know your customer

## Understand the Business

Understand how business is conducted

How/what data is captured?

What variables can we use?

## Understand the business issues

Ask questions, lots of questions

Even though you can do cool stuff doesn't mean you should

Don't waste valuable time

## Talk the language

Allows you to become a trusted advisor

People have more confidence in your work



# Business Interface: Clear and frequent communication!

