

Death by Chartjunk? Graphical Excellence In Insurance

Aon Benfield Analytics

CAS 2012 Annual Meeting



Agenda

Section 1

Introduction

Section 2

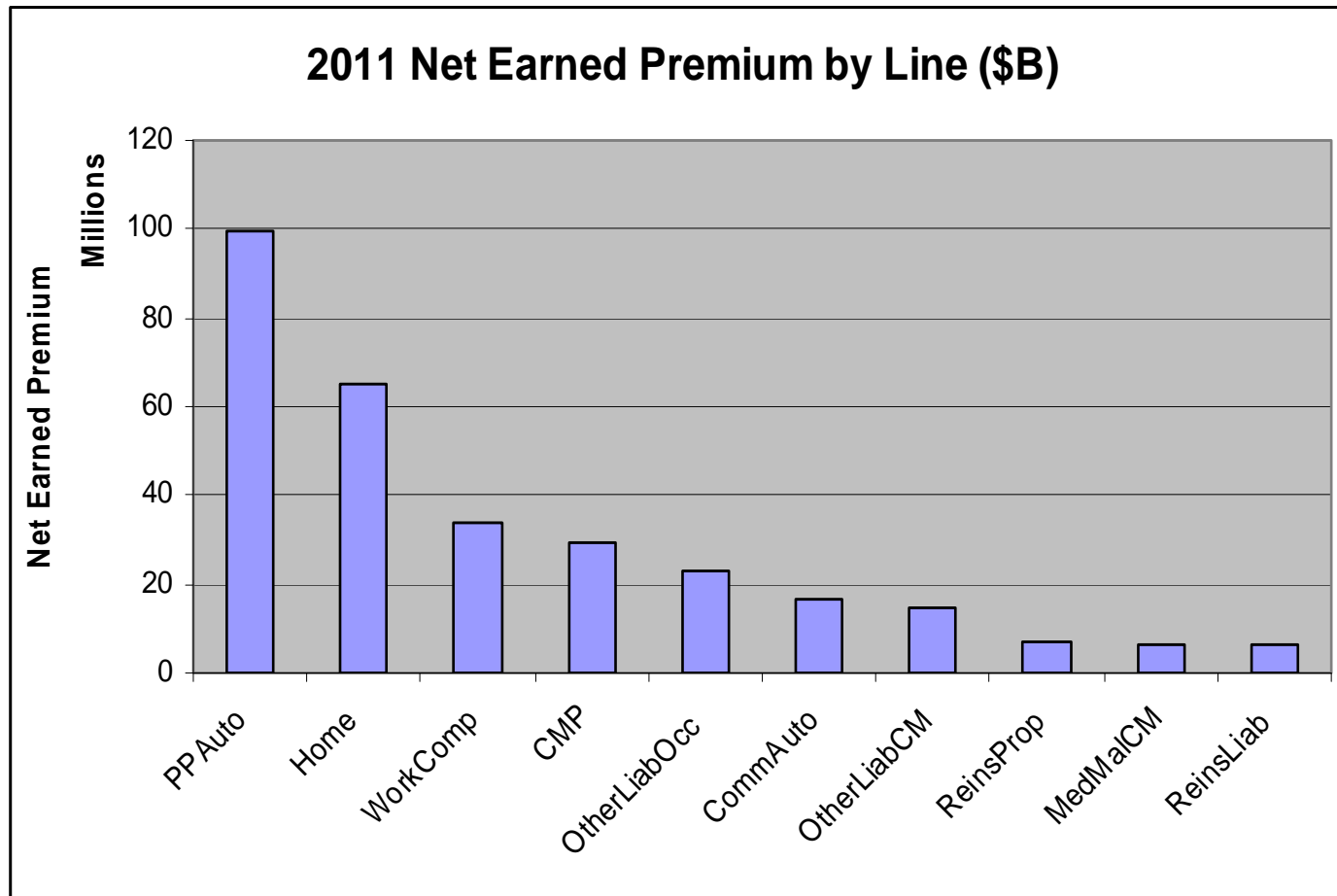
Theory of Data Visualization

Section 3

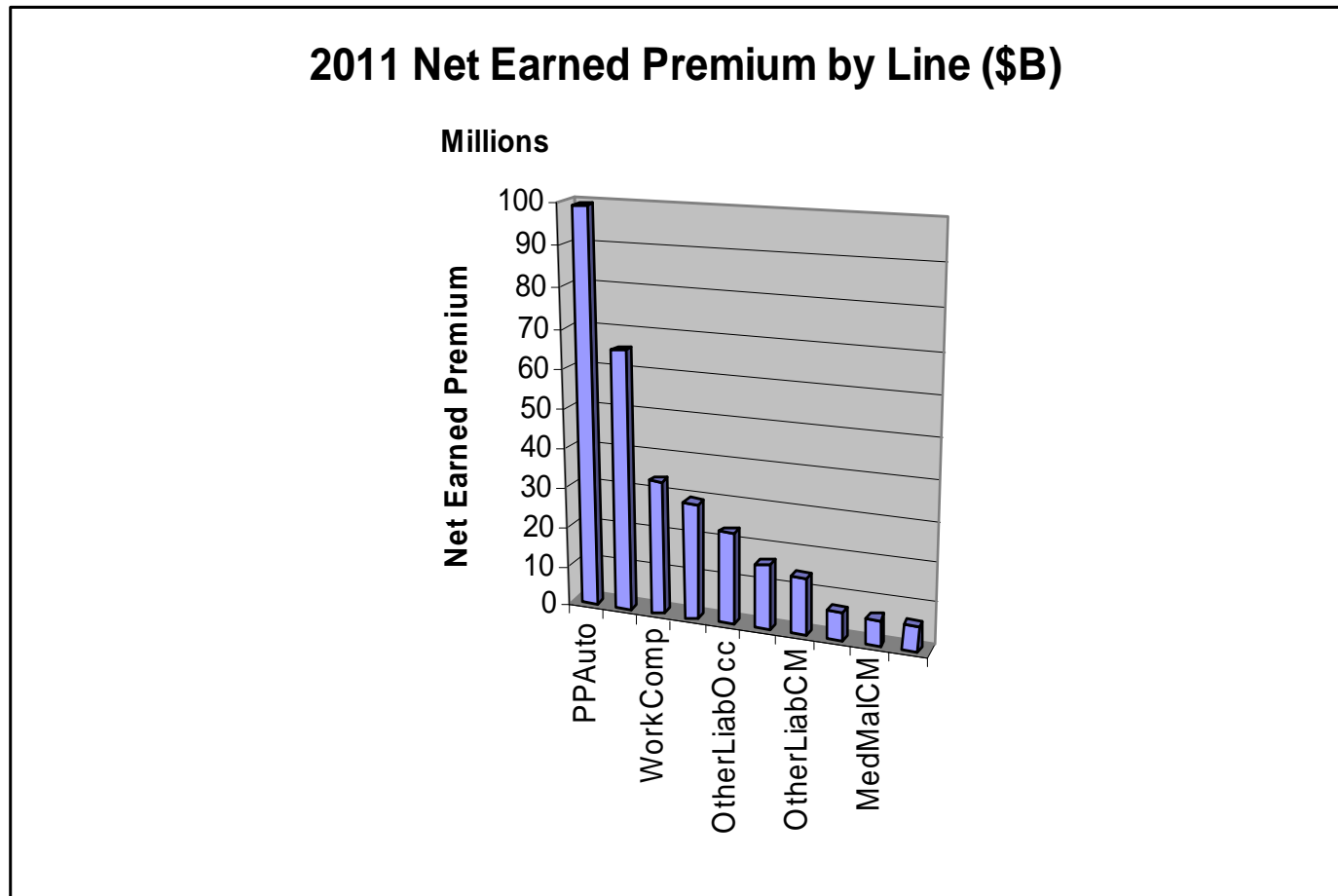
Examples

Section 1: Introduction

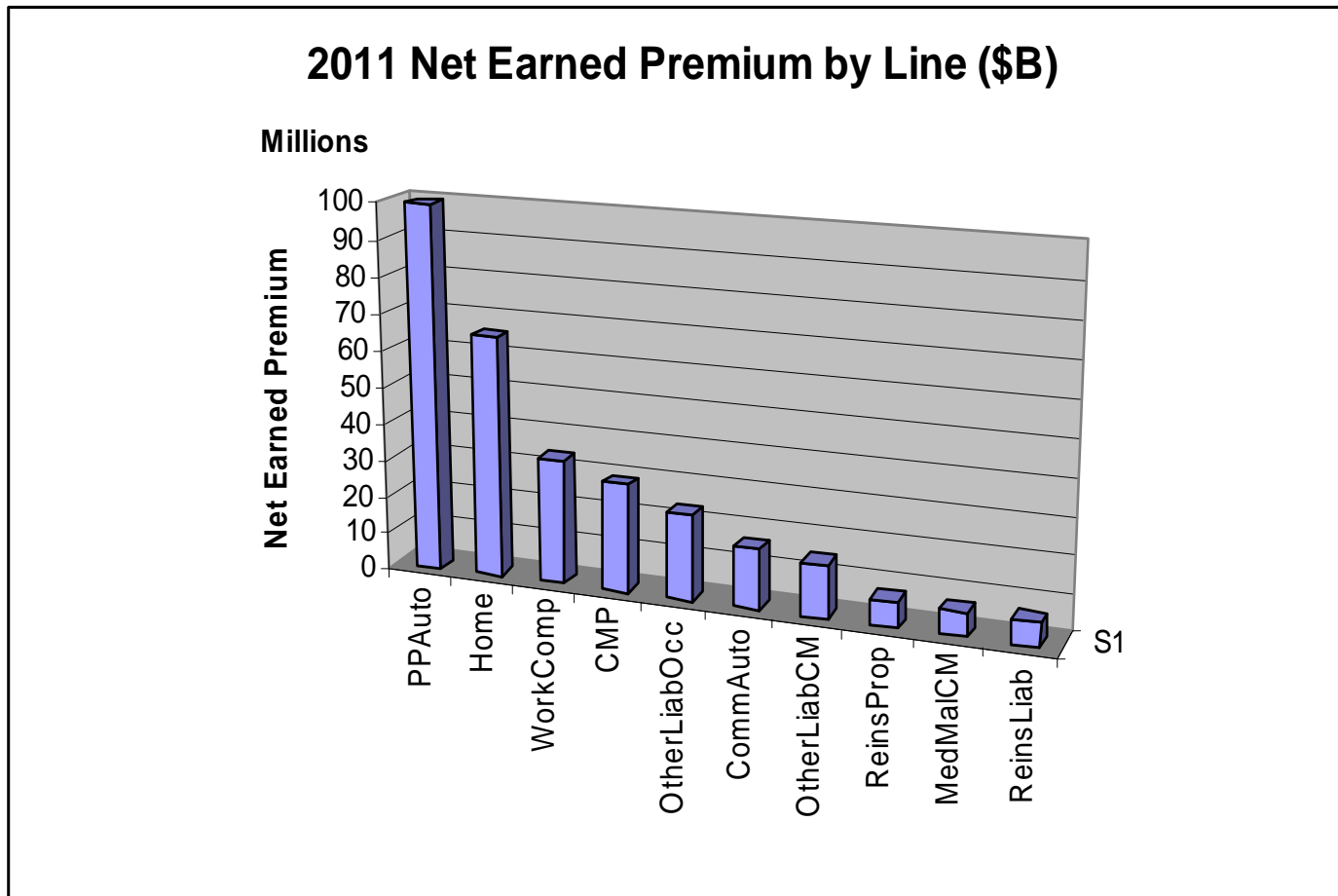
Doomed from the start...



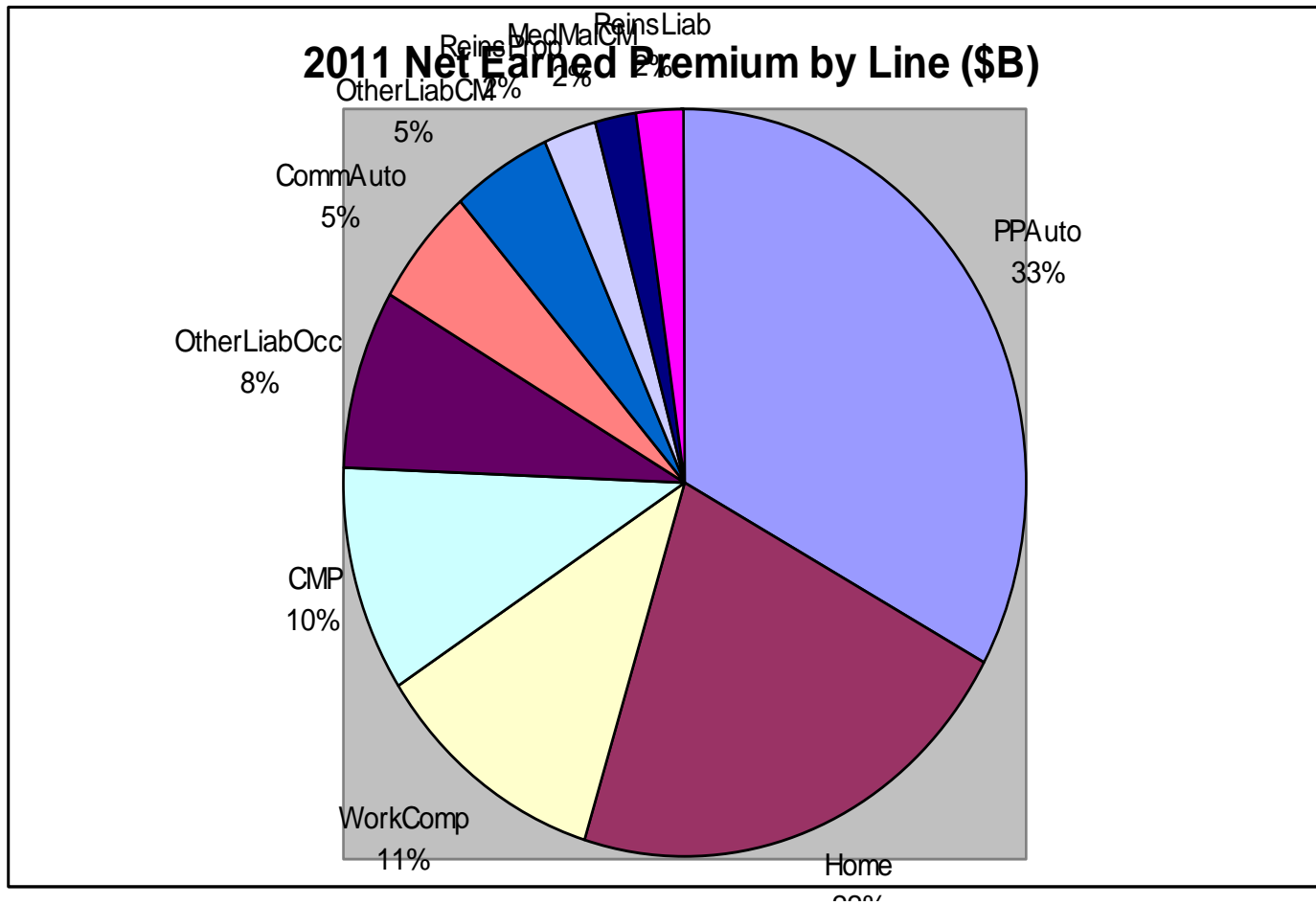
Doomed from the start...



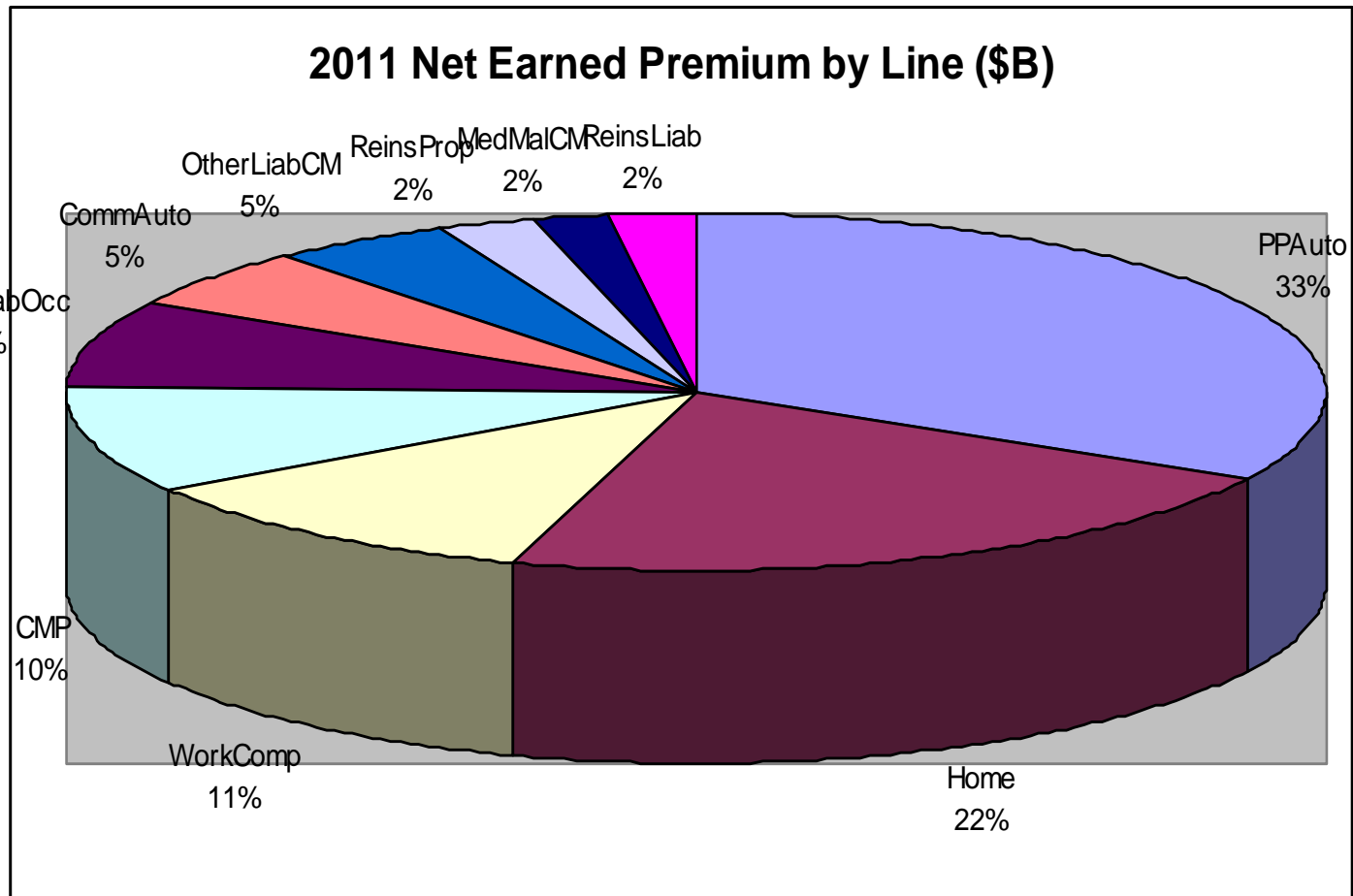
Doomed from the start...



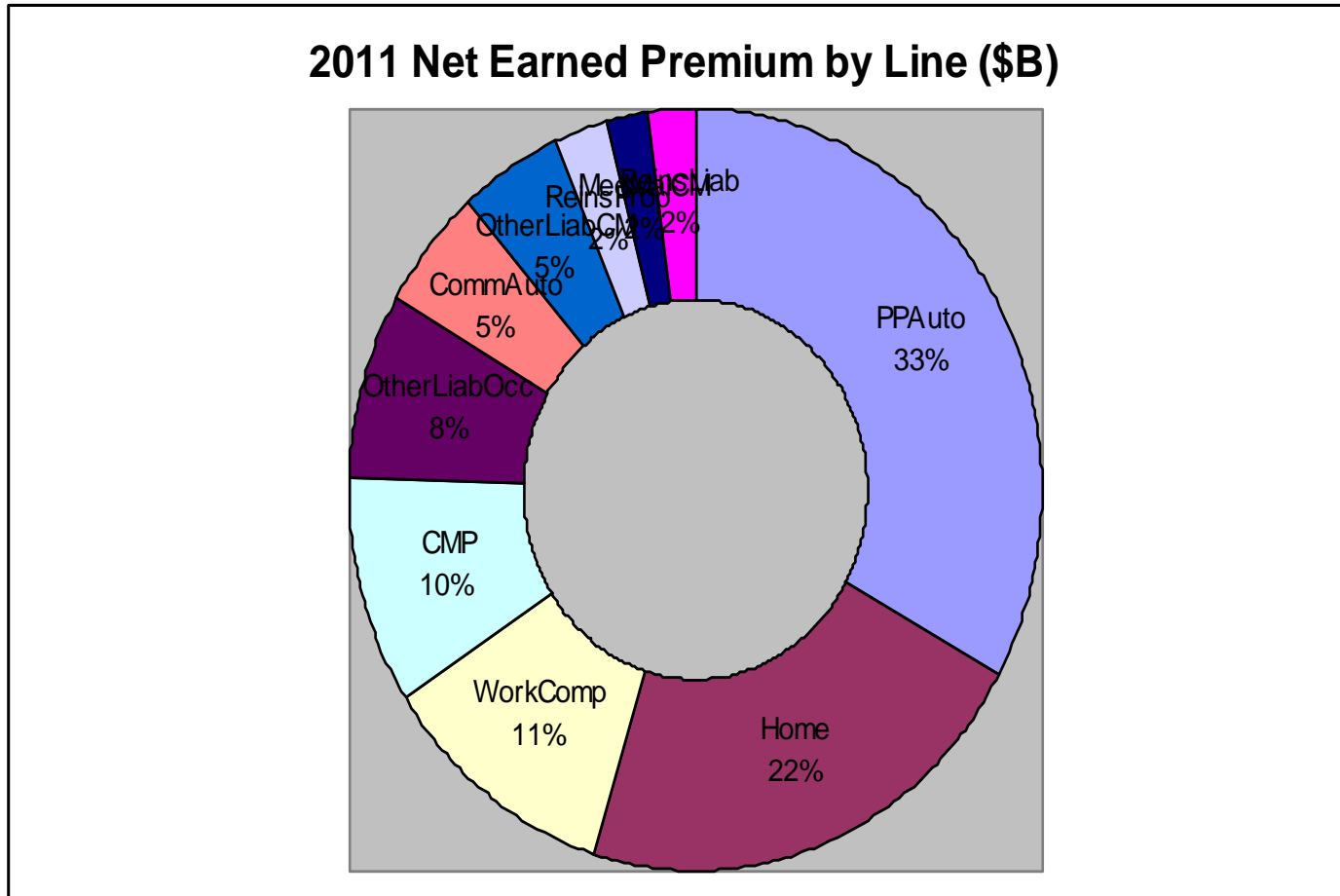
Doomed from the start...



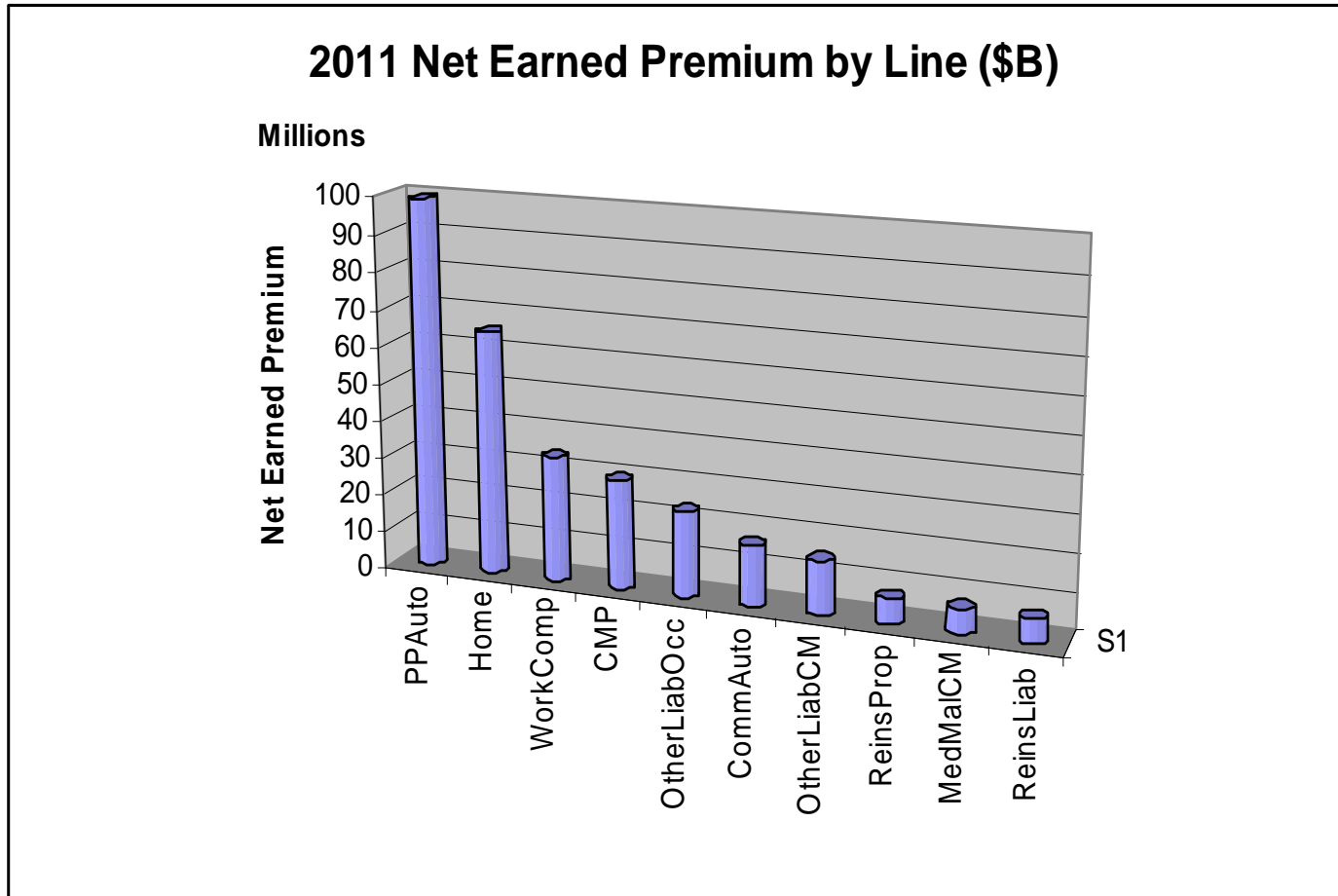
Doomed from the start...



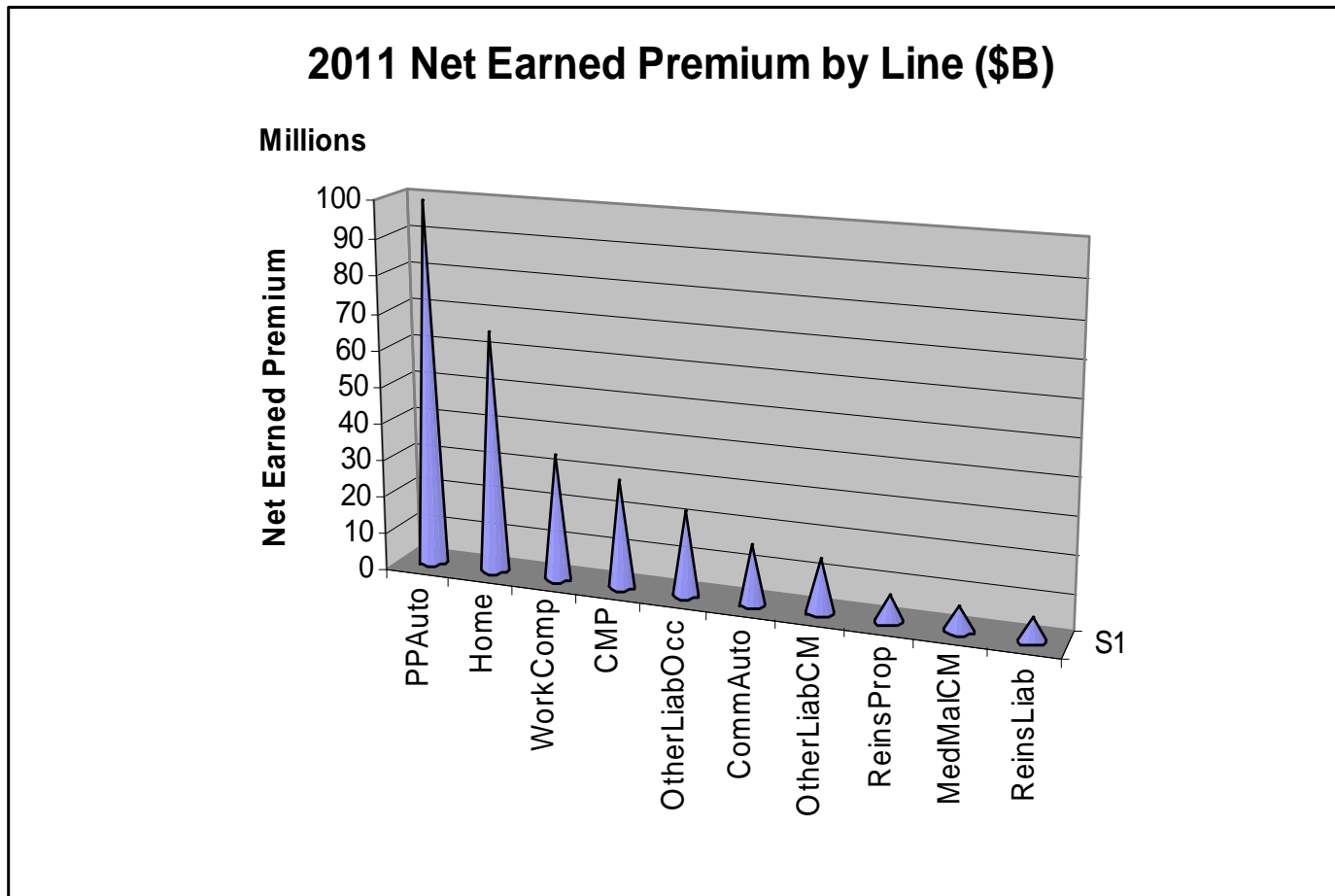
Doomed from the start...



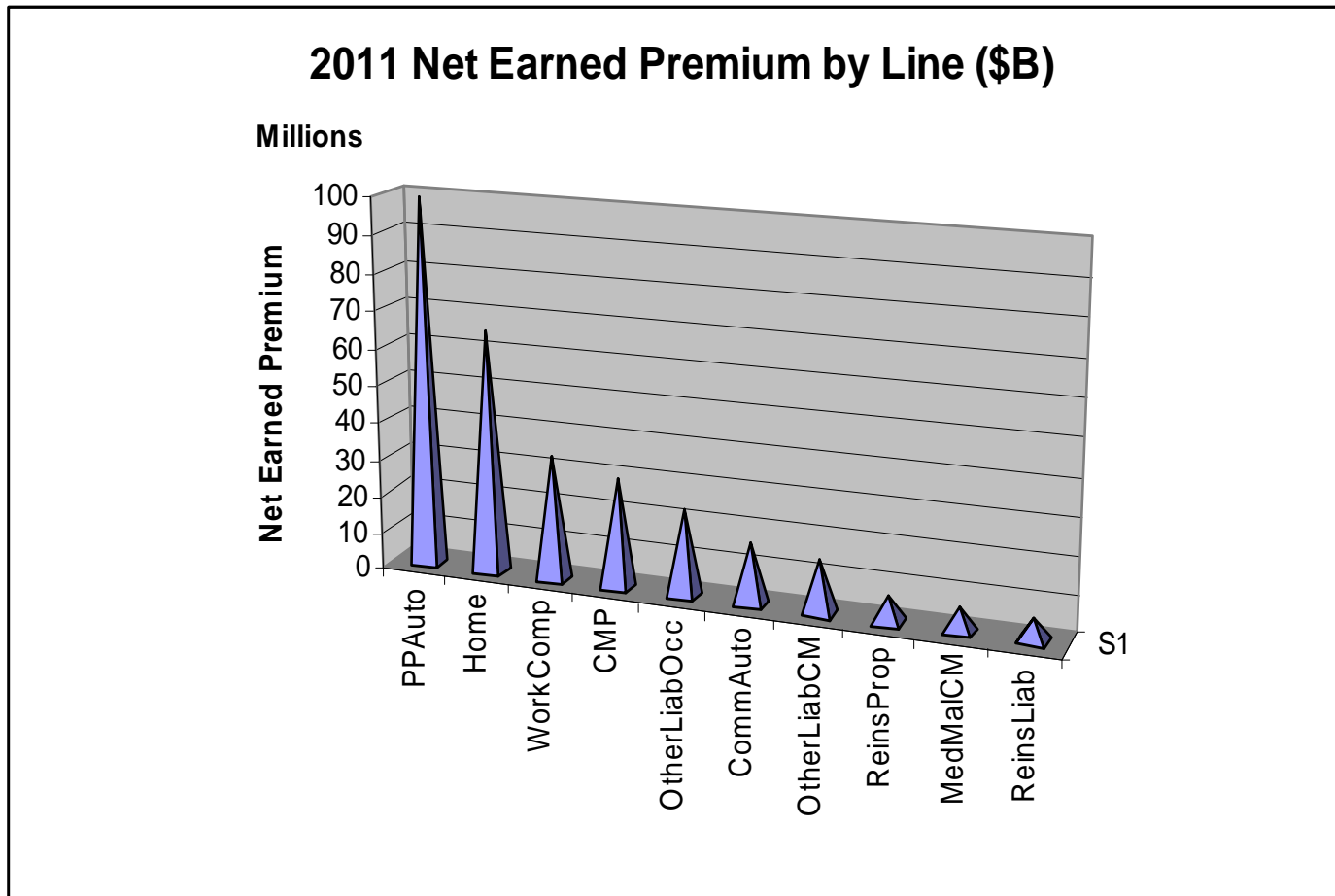
Doomed from the start...



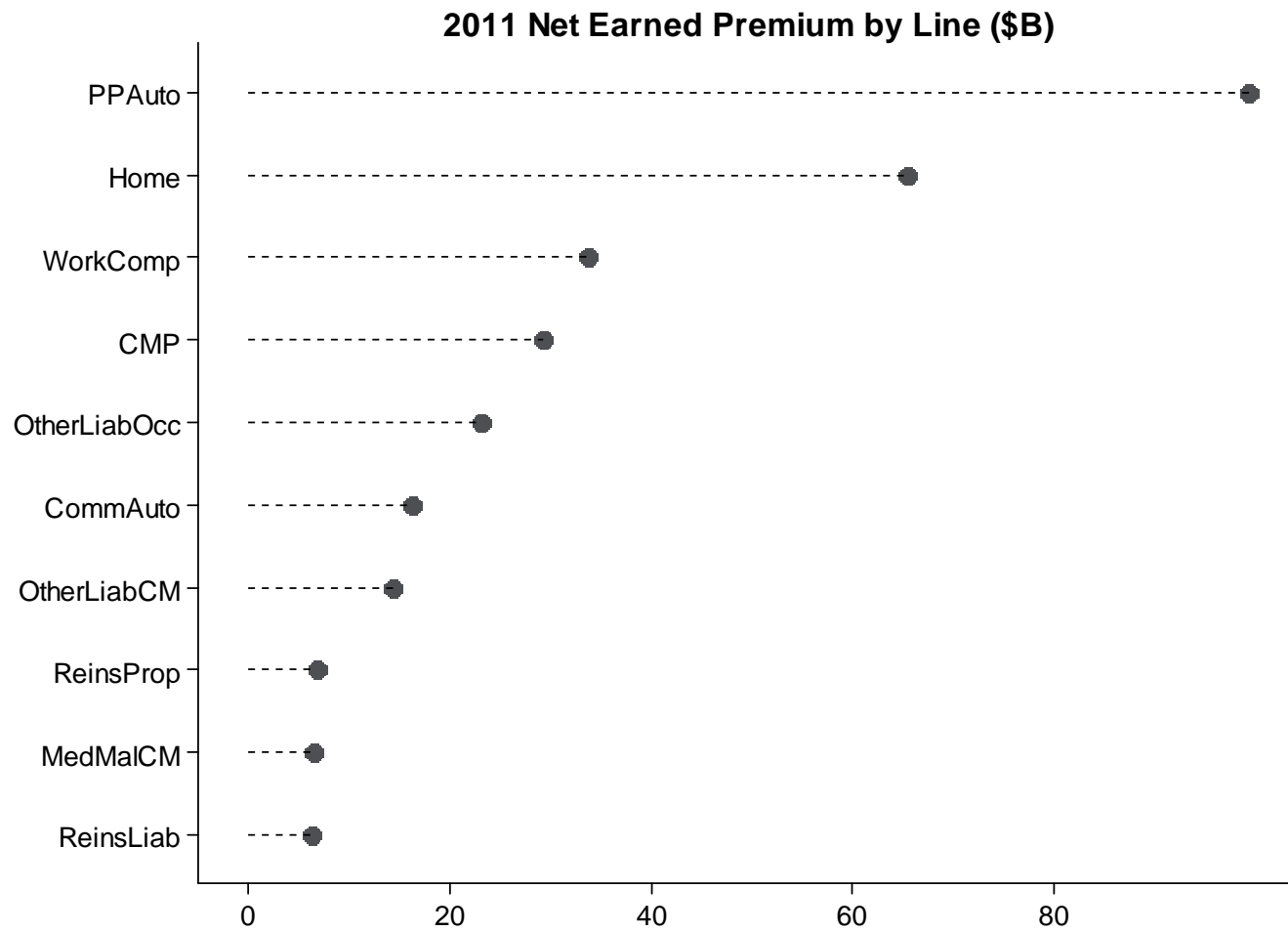
Doomed from the start...



Doomed from the start...



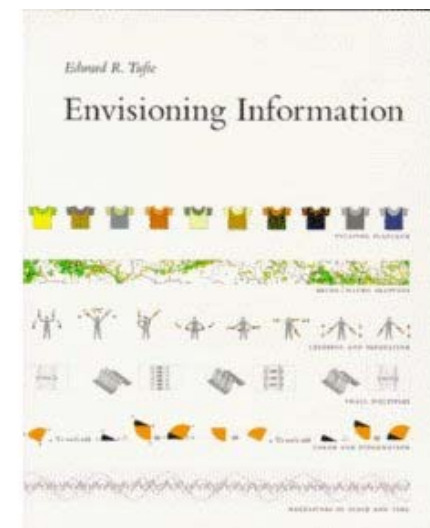
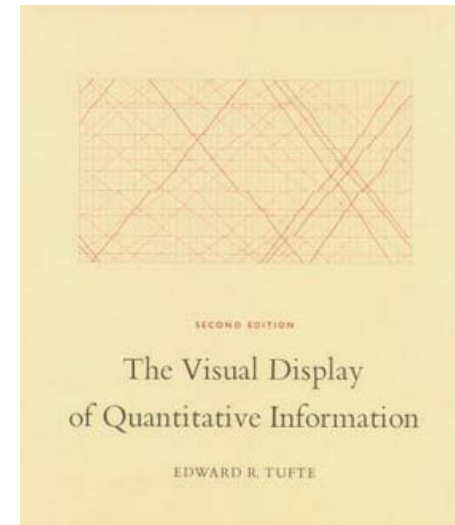
...but there is another way...



Edward Tufte



- Data visualization expert
- Professor at Yale University
- Author of four books on the topic of information design
- Inventor of sparklines
- Avid sculptor



Graphical Excellence Defined

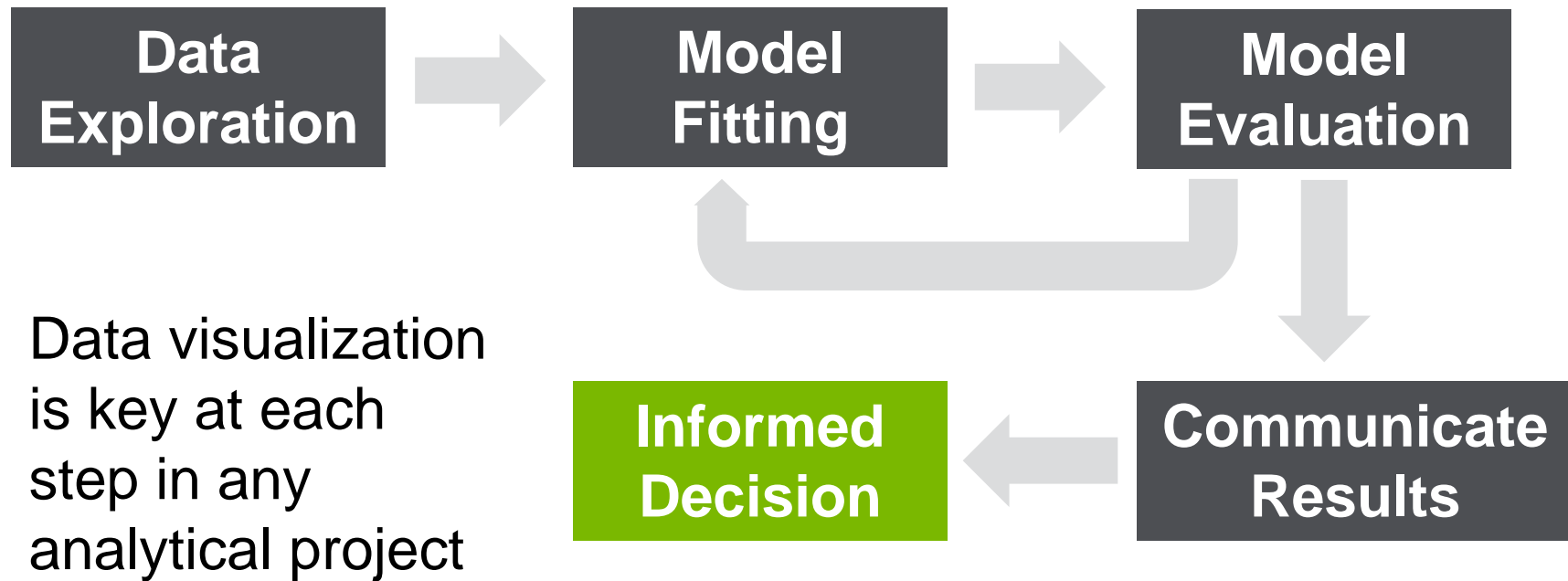
“Graphical excellence consists of complex ideas communicated with clarity, precision, and efficiency.”

- *Visual Display of Quantitative Information* pg. 51

“Graphical excellence requires telling the truth about the data.”

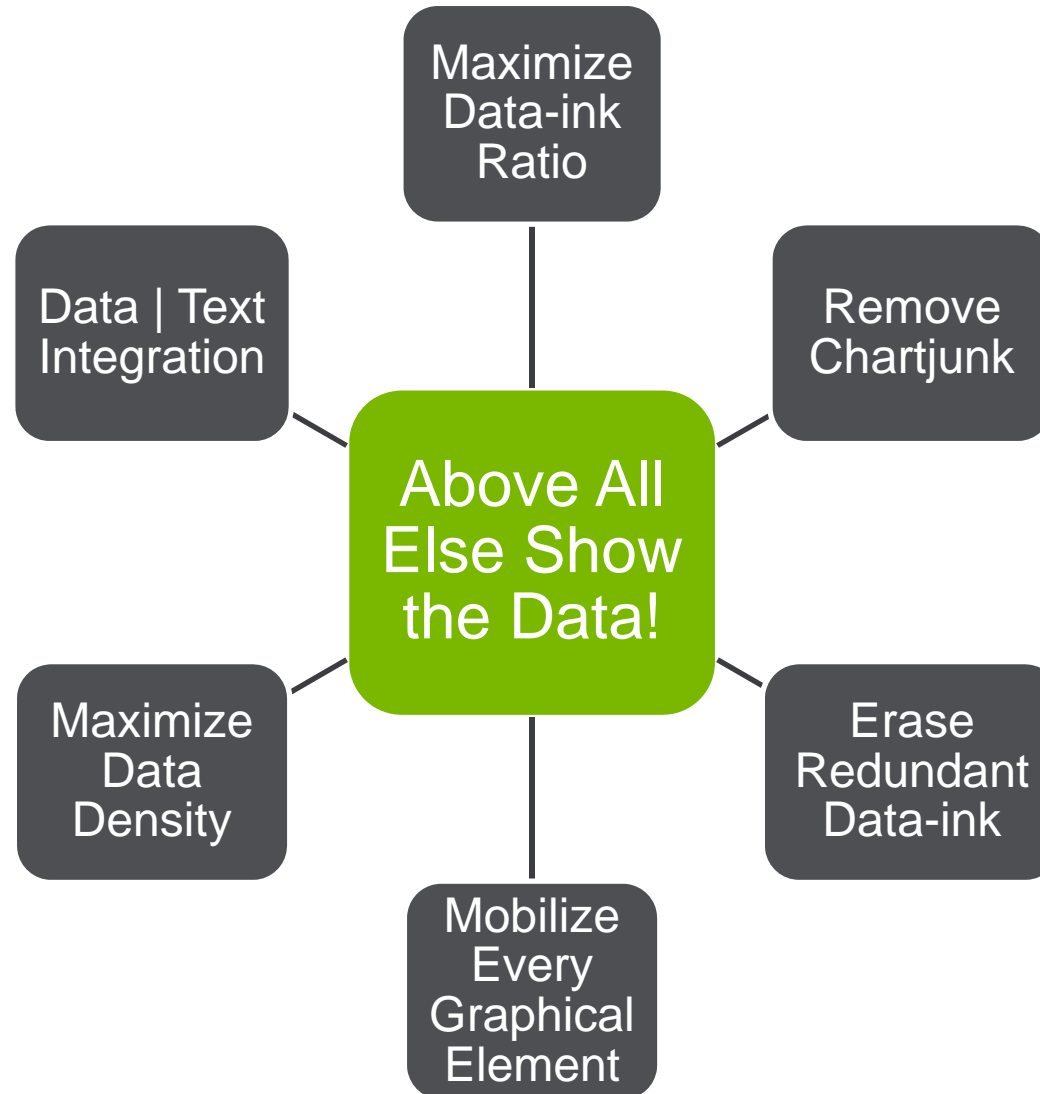
- *Visual Display of Quantitative Information* pg. 51

Why Should We Care?



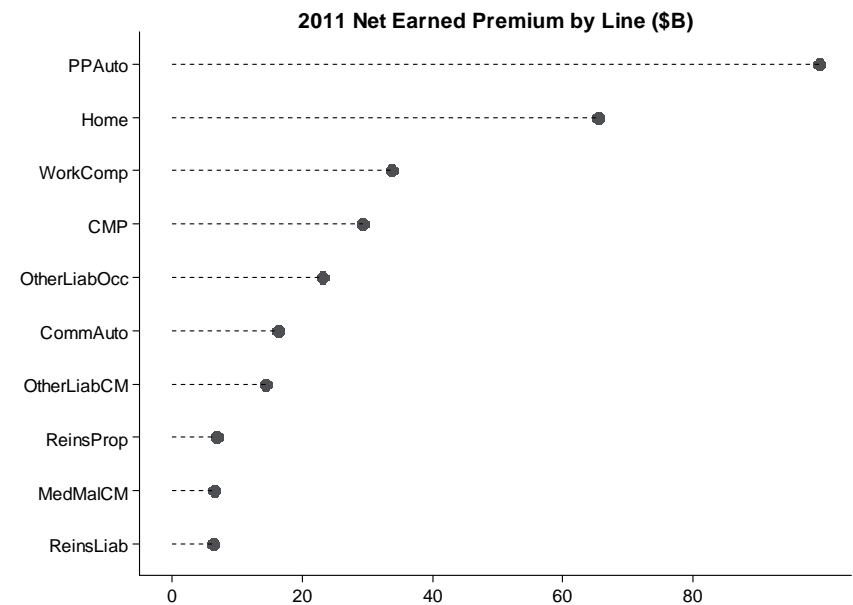
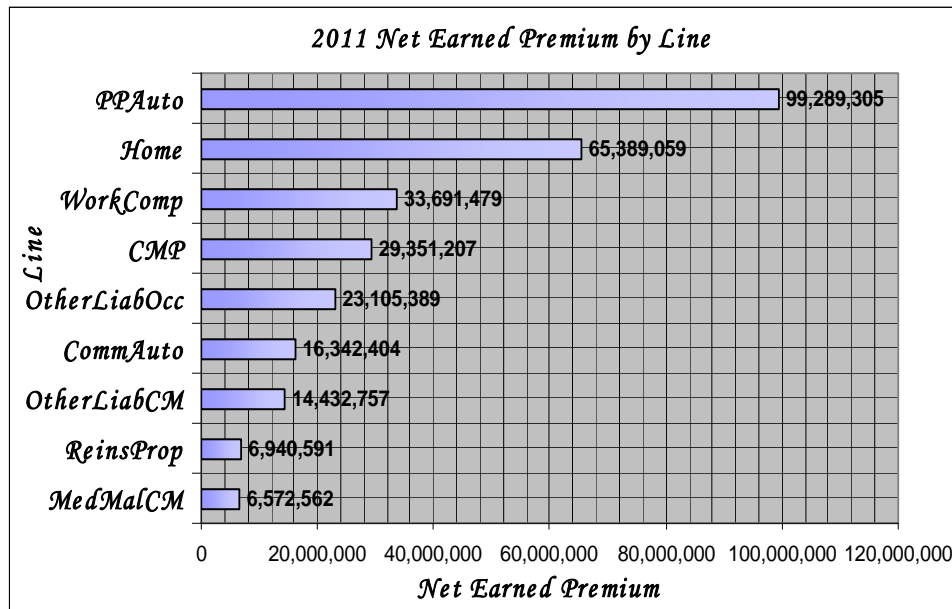
Section 2: Theory of Data Visualization

Principles of Graphical Excellence (Tufte)



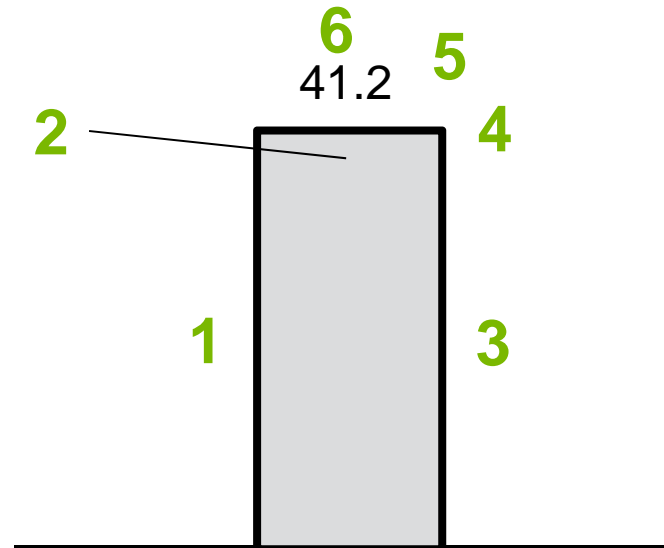
Maximize Data-Ink Ratio: Remove Chartjunk, Within Reason

- **Data-ink** is the non-erasable core of a graphic – i.e. the actual data
- **Data-ink ratio** = data-ink / total ink used to print the graphic
- **Chartjunk** is all ‘graphical decoration’, i.e. non-data ink



Maximize Data-Ink Ratio: Erase Redundant Data-Ink, Within Reason

- **Redundant data-ink** indicates the same number over and over
- How many ways can you determine the height of the below bar?



Mobilize Every Graphical Element

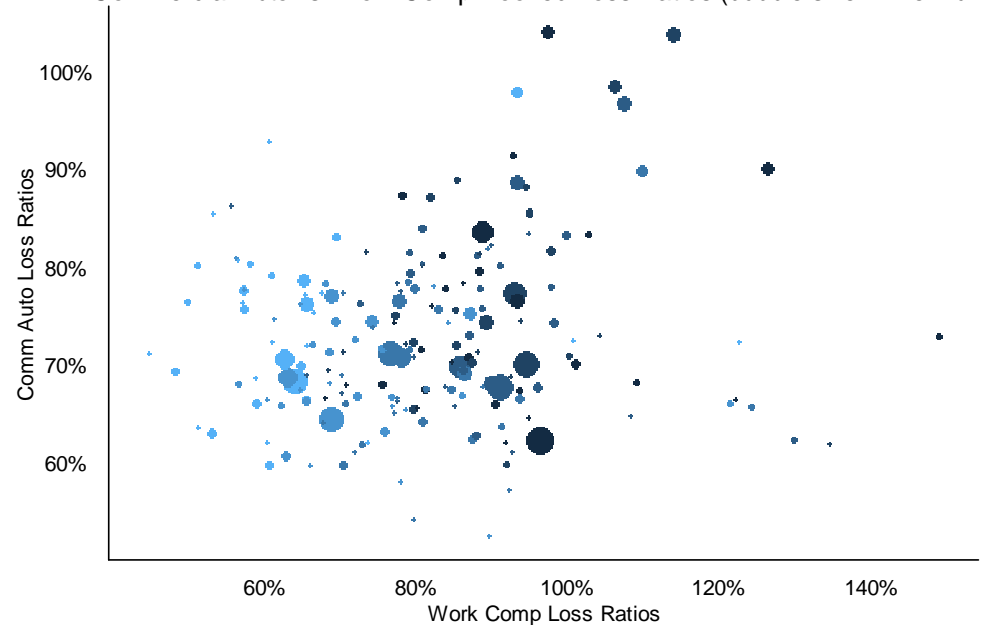
- Use every element available to show the data
 - Points in scatterplot, axis lengths, etc.

Stem and Leaf Plot of Work Comp Loss Ratios (1988-1993)

```
4 | 58
5 | 0113356677777899
6 | 00001112333455555555666678888889999
7 | 000001122233334455666777777888888999999
8 | 00000111111122234444455555666667777788888999999
9 | 000011122222333334444555556667888
10 | 0011346789
11 | 04
12 | 12346
13 | 04
14 | 9
```

The decimal point is 1 digit(s) to the left of the |

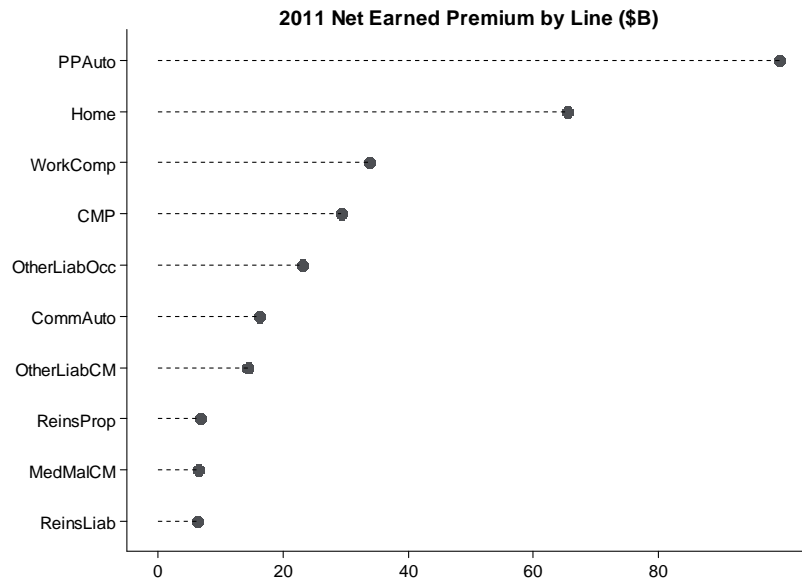
Commercial Auto vs. Work Comp Booked Loss Ratios (bubble size = Premium)



Maximize Data Density

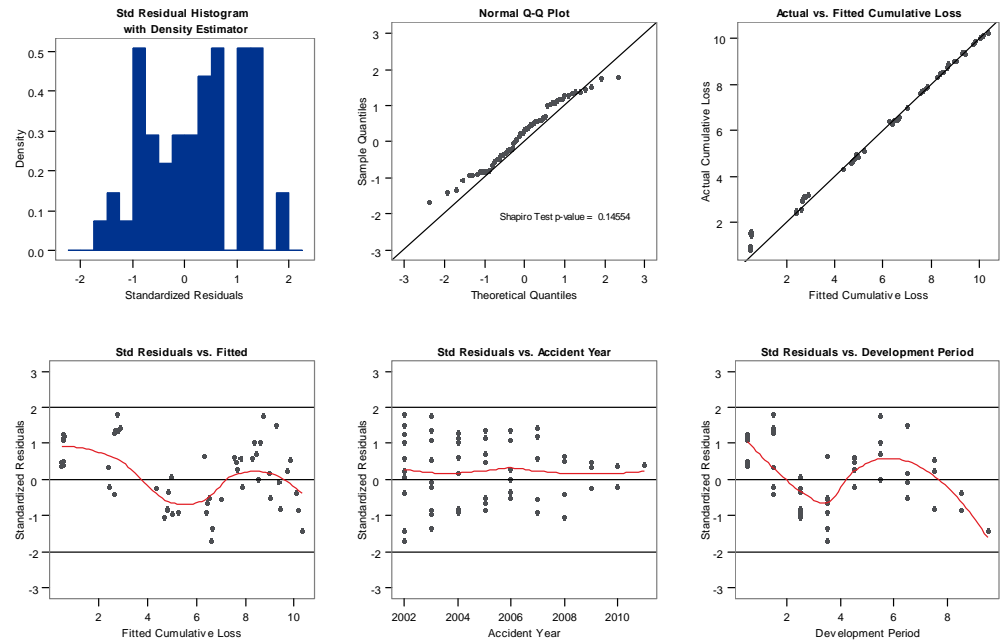
- **Data density** is the amount of data displayed in a graphic divided by the area of the graphic
- **Shrink Principle, Small Multiples**

Low Density

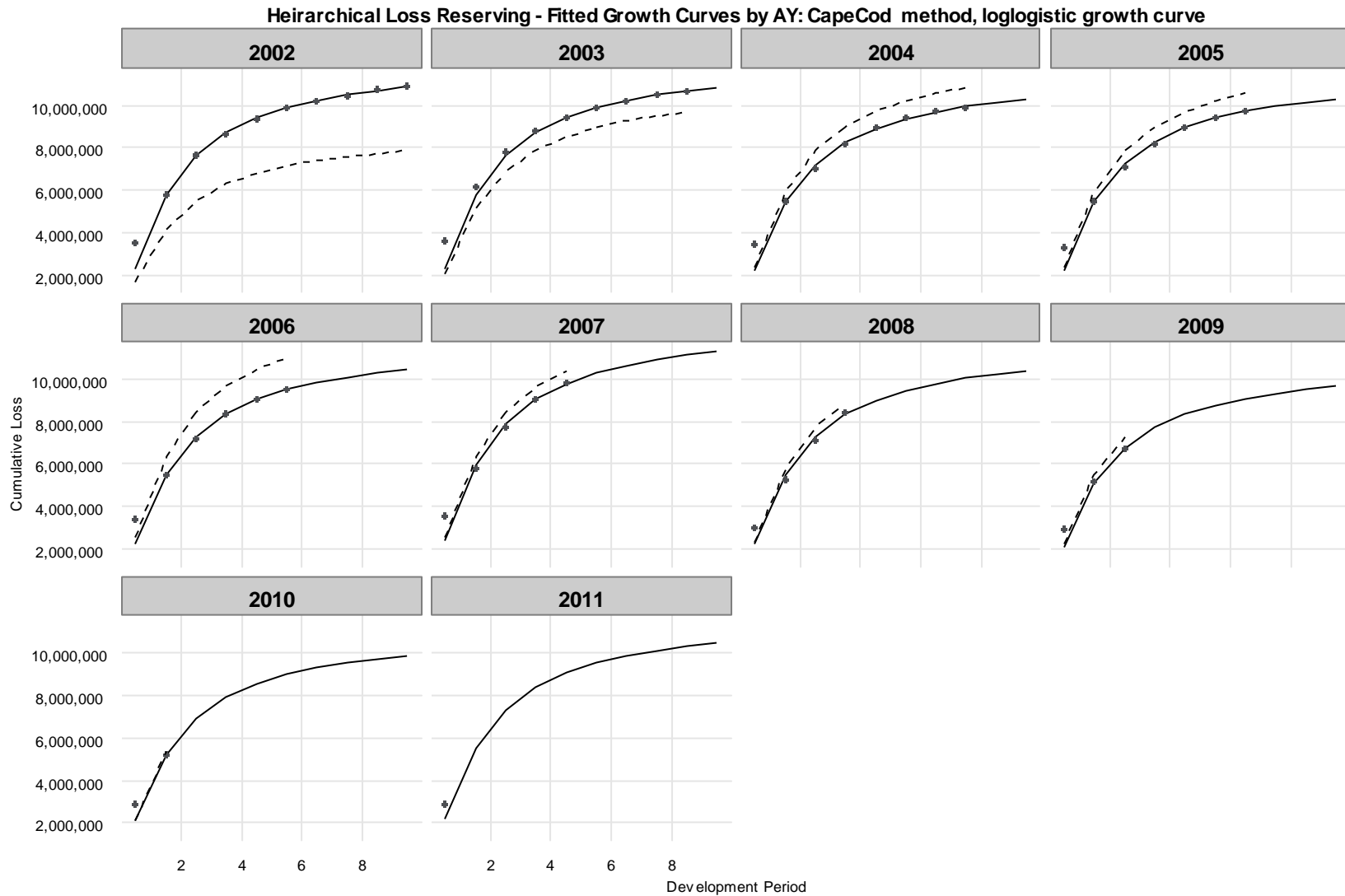


High Density

Hierarchical Loss Reserving: CapeCod method, logistic growth curve



Maximize Data Density: Small Multiples – Loss Triangle



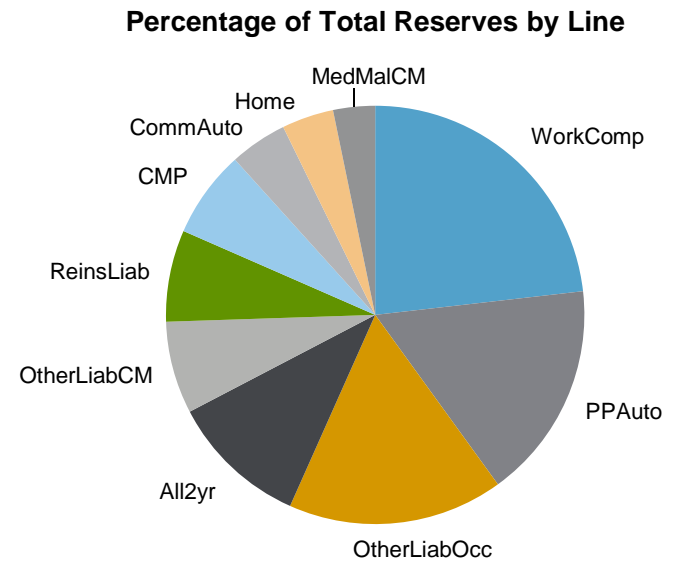
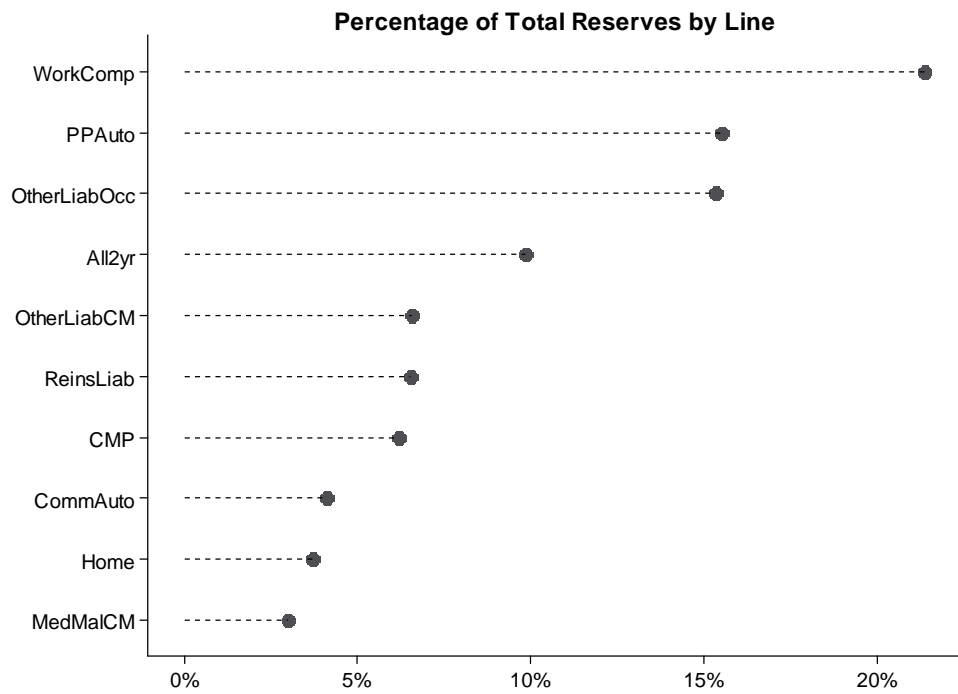
Data and Text Integration

- Basic structures for showing data: sentence, table, graph
- Serve the same purpose, so should be used together whenever possible
- Sparklines

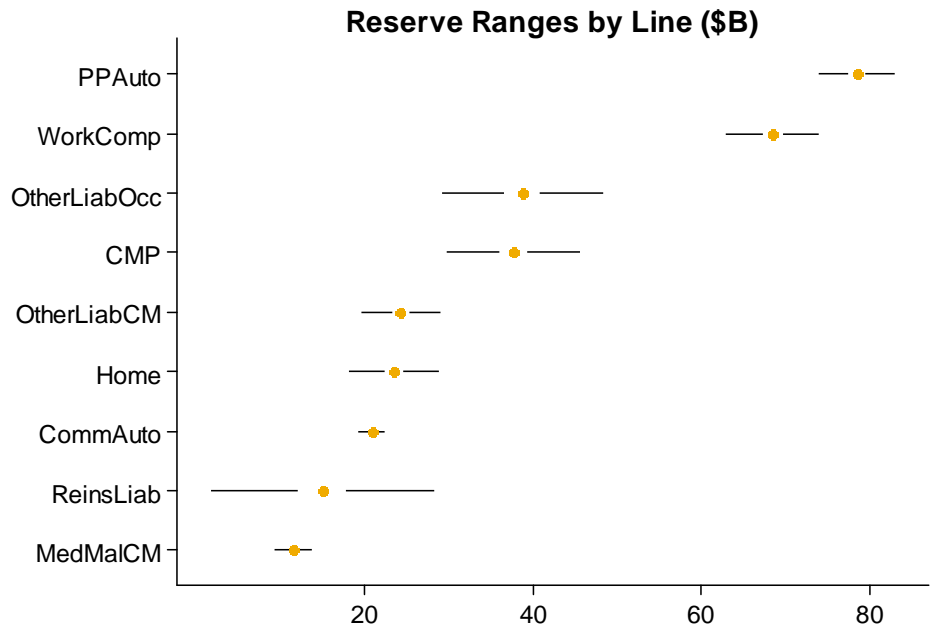
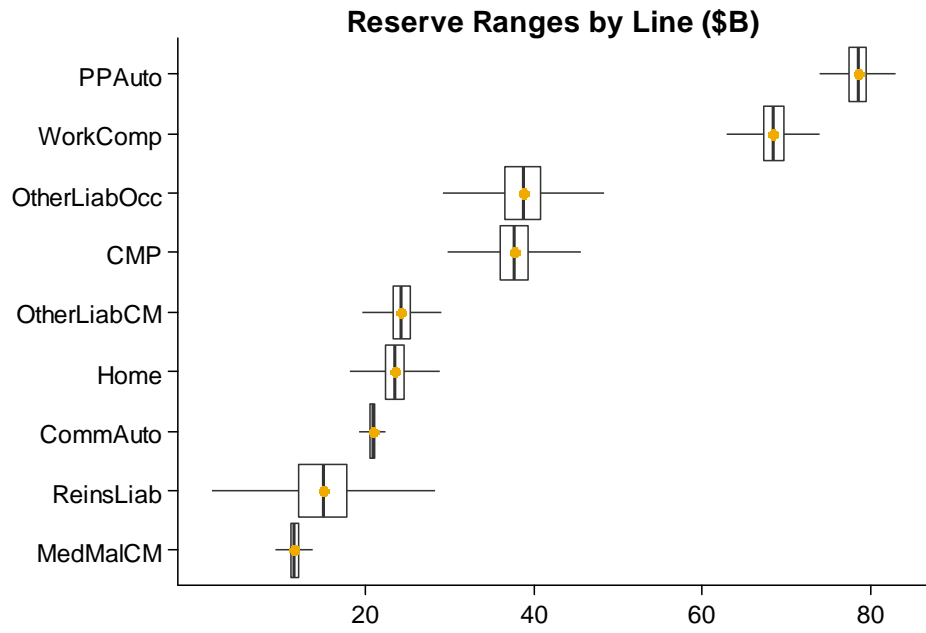


Section 3: Examples

Dot Plot vs. Pie Chart



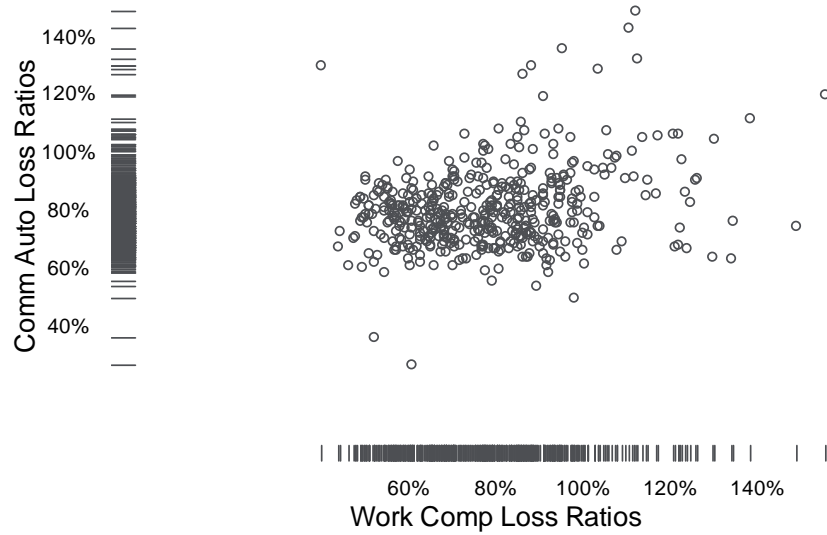
Box Plot (left) vs. Quartile Plot (right)



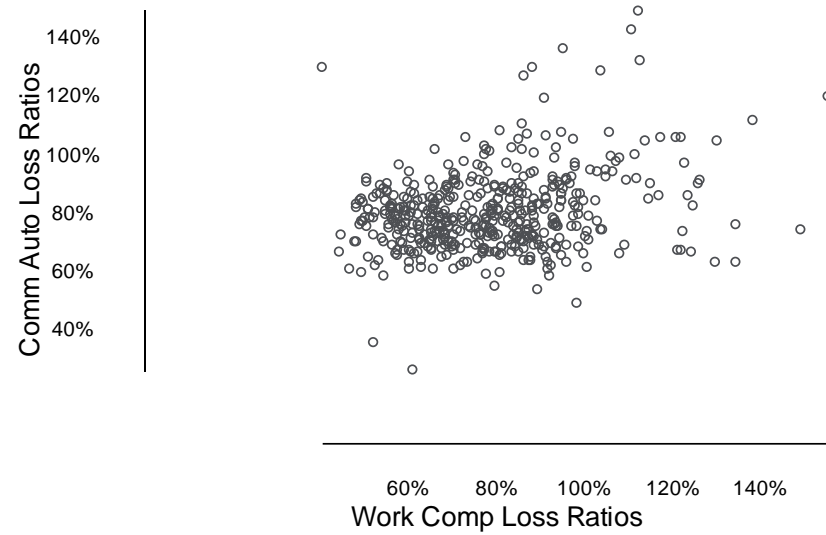
Scatterplot Alternatives

Dot-Dash Plot (left) and Range-Frame Plot (right)

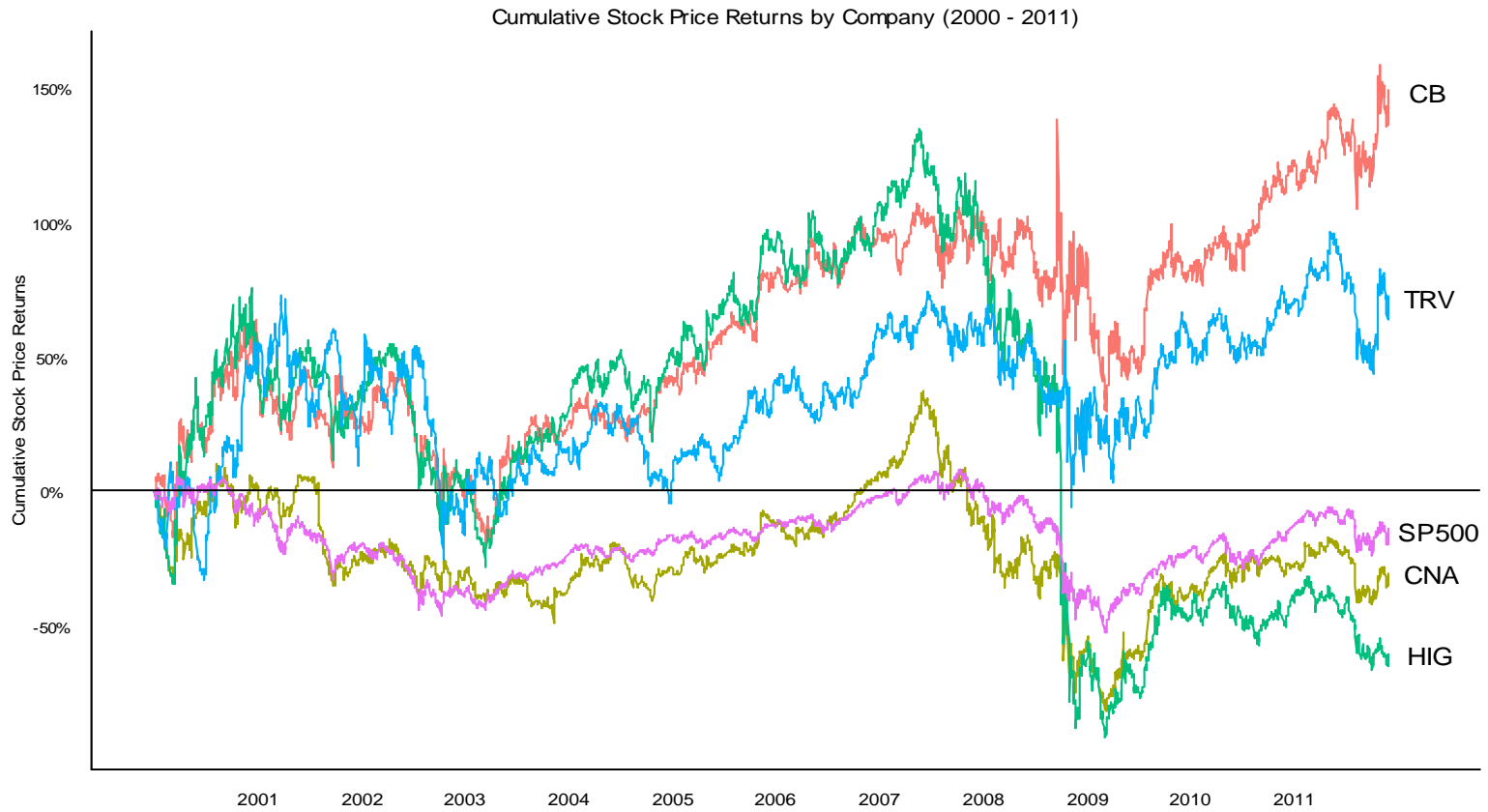
Commercial Auto vs. Work Comp Booked Loss Ratios



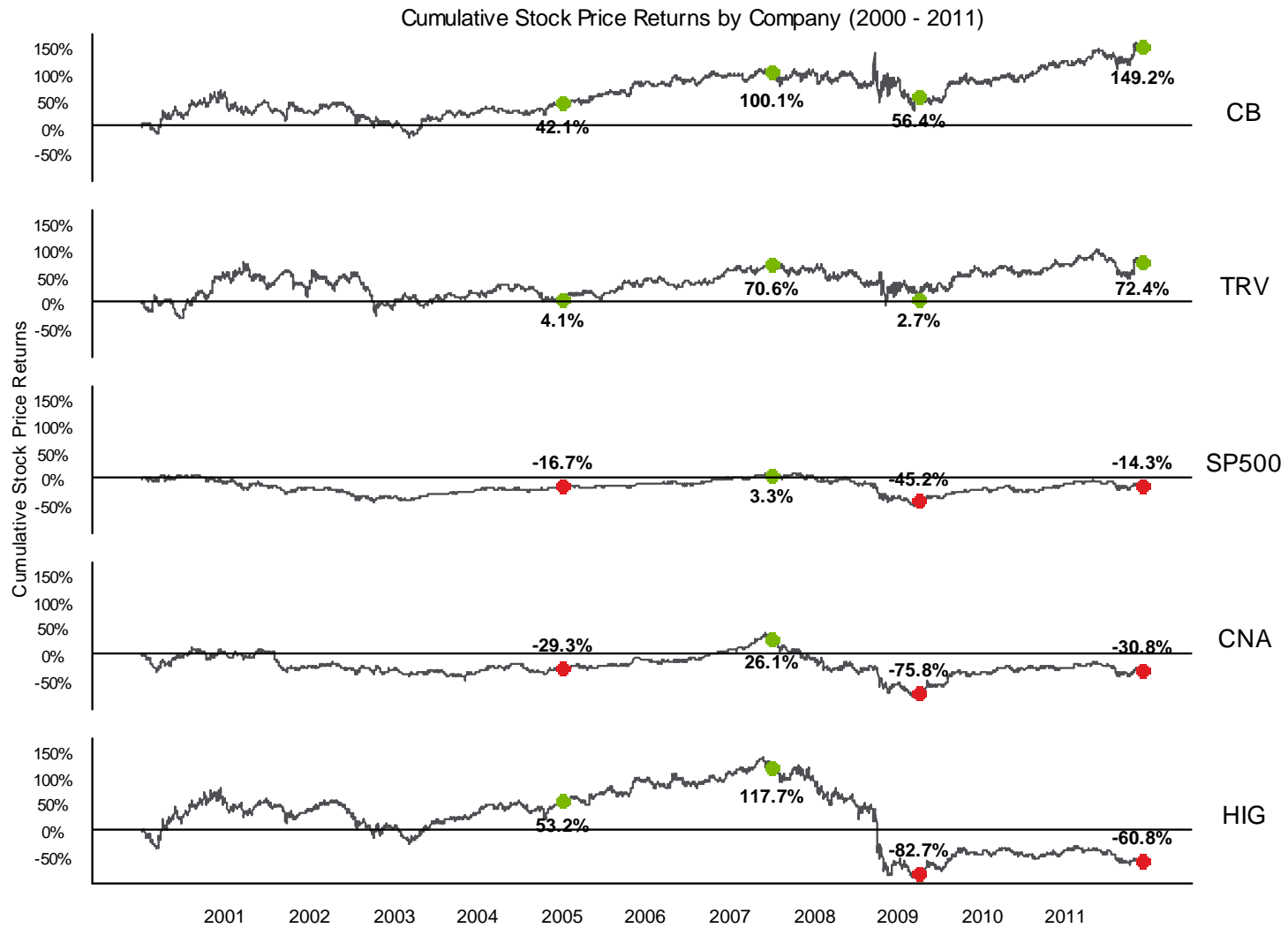
Commercial Auto vs. Work Comp Booked Loss Ratios



Cumulative Stock Price Returns in a Single Line Graph...

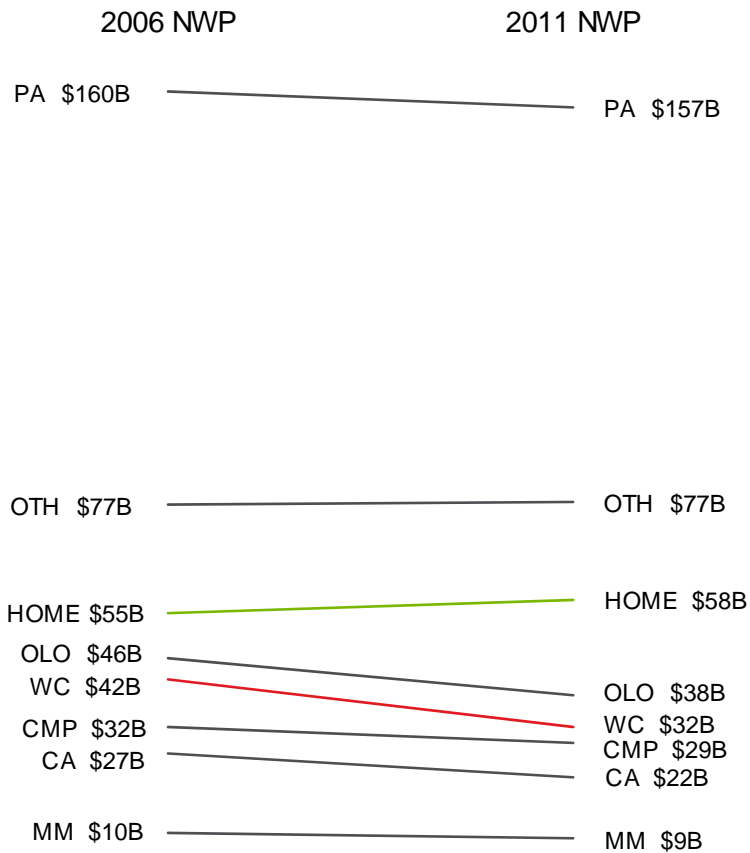


...vs. Separate Line Graphs (i.e. small multiples)

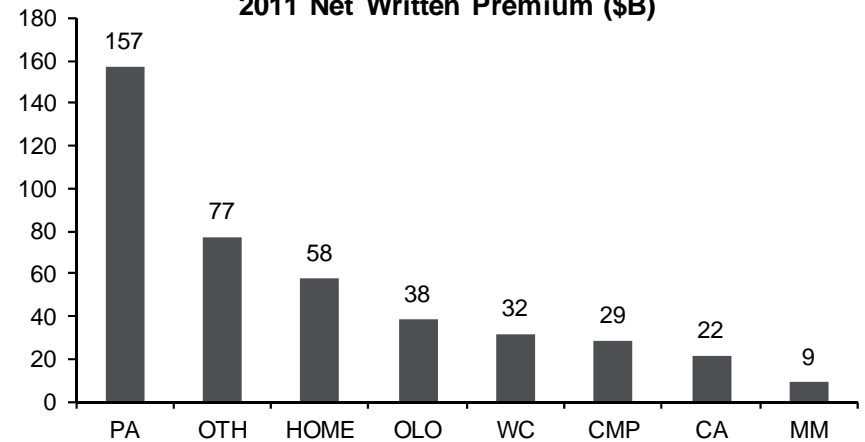


Slopegraph (left) vs. Column Graphs (right)

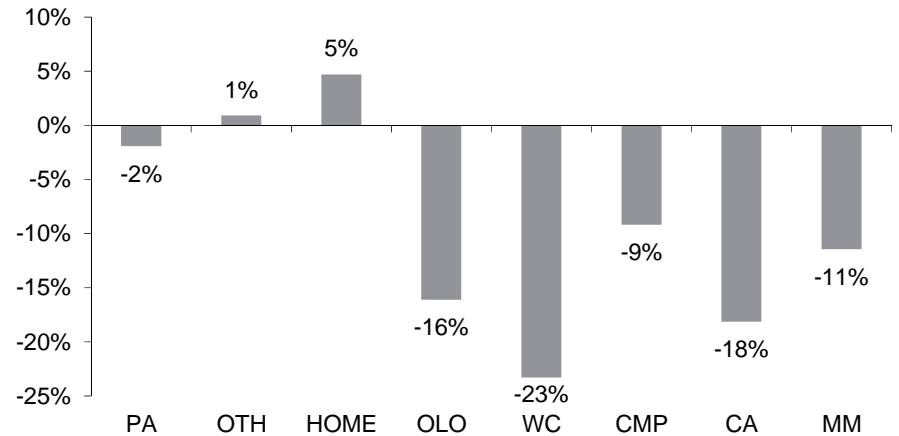
US P&C Industry NWP Change By LOB (2006 - 2011)



2011 Net Written Premium (\$B)

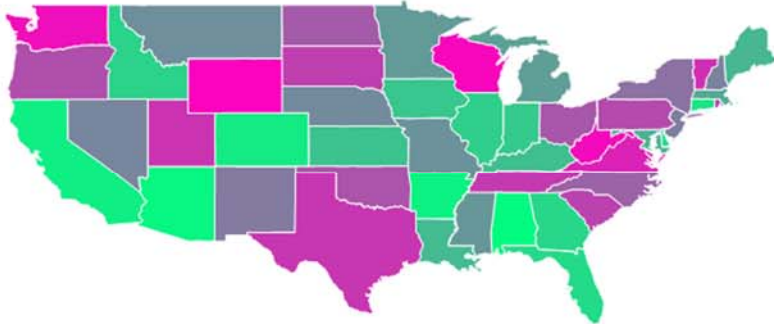


5 Year Net Written Premium Growth



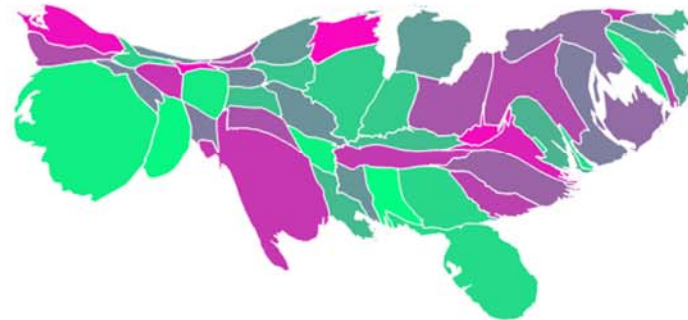
Mapping Alternative – Cartograms

Traditional Map: Area = Area



- Standard map projection
 - Shapes correspond to actual geography
 - Area on map proportional to land area
 - Highlights large, sparsely populated western states
- **Cartogram**
 - Substitute thematic variable, such as TIV or AAL density, for land area
- Equal area cartogram changes the focus from large geography to high-values of statistic of interest

Cartogram: Area = Your Statistic



- Example: an **equal area cartogram** based on population
 - Area on map proportional to population density
 - Rendered using population by county divided by land area, Census 2000 data
 - Highlights areas of with large populations
 - Long Island, SF Bay area, Chicago, Tampa area all appear much larger
 - Montana & western states appear much smaller
 - Shapes close to actual geography
- Other variables can be substituted for population

Wind and Earthquake Insurance Penetration Transformation

