



Open Source Committee work

Steve Berman
October 9, 2014

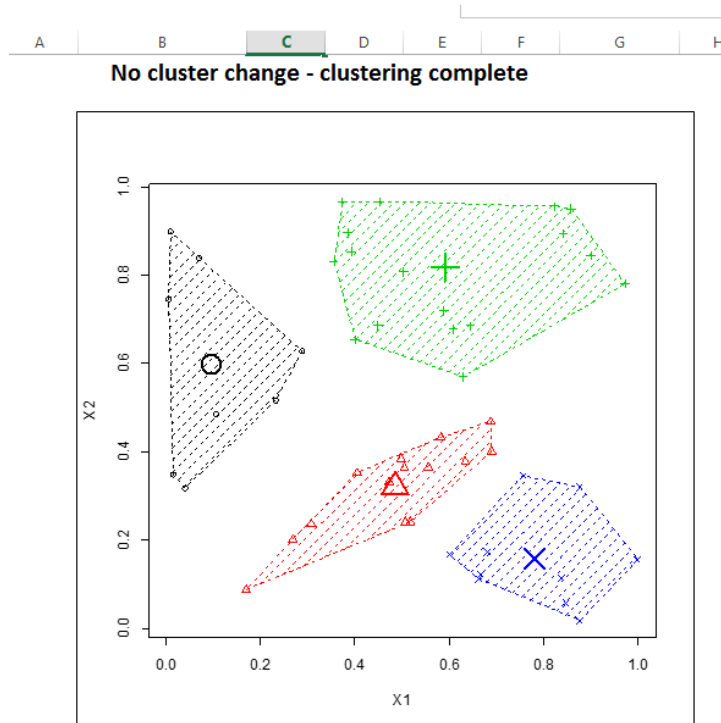


Agenda

Topic	Timing
Excel / R	5 minutes
MRMR	10 minutes
Loss Simulation Model	10 minutes

Integration of Excel and R

- Can use packages like StatConn to link R calculations to external applications like Excel
 - Handle calculations that are “more complex” than Excel can handle
 - Leverage prepackaged libraries
 - Gain speed efficiencies (ex: avoid Excel VLookups)

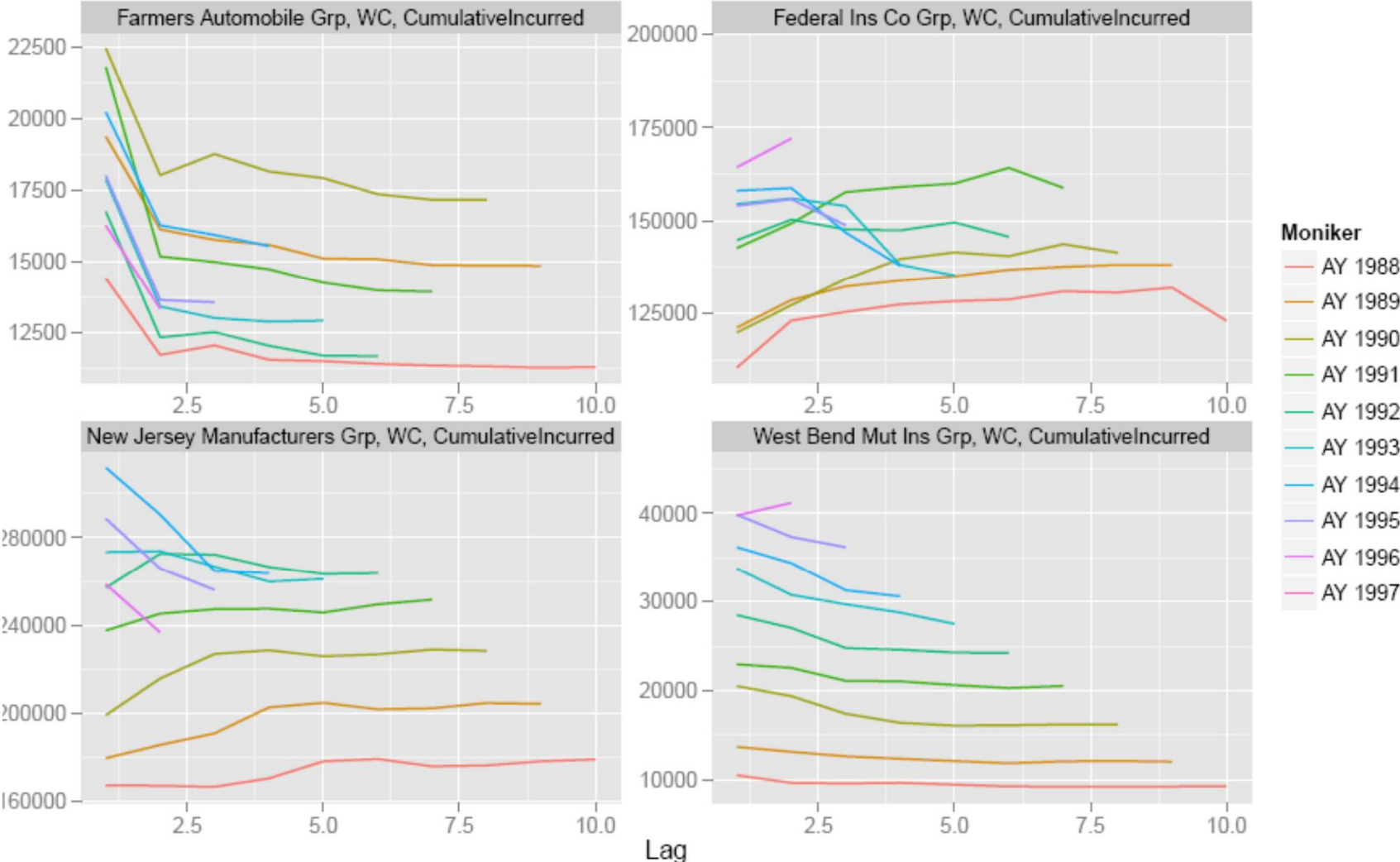


MRMR Package

- **Multivariate Regression Models for Reserving**
- Created by Brian Fannin, Redwoods Group
- One of several packages for actuarial use (chainladder, actuar)
- Flexible framework for reserving based on linear models (chain ladder, additive)
- Emphasis on:
 - Ease of use
 - Multi-dimensional treatment of data
 - Visualization (EDA, assessment of model fit)
- Multilevel (hierarchical) framework means that many business segments may be analyzed together (blended) or separately = loss reserving with credibility

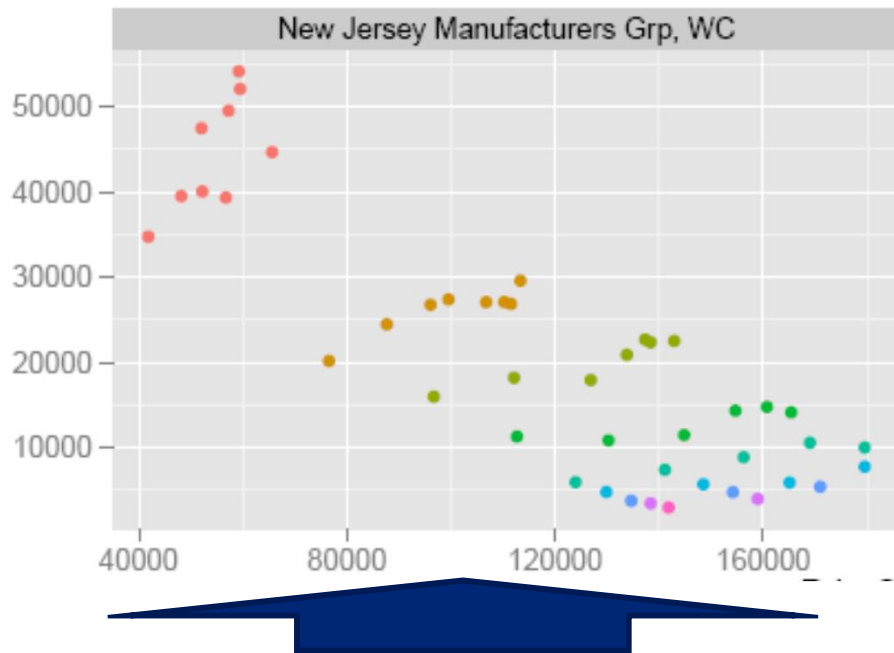
MRMR Package

Visualize history

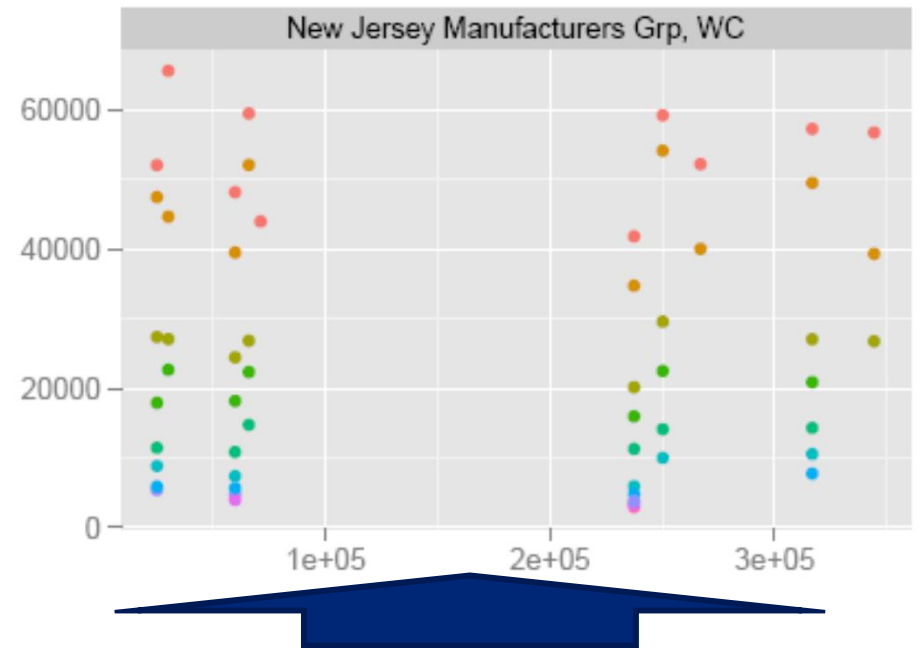


MRMR Package

Observe data as sample points to assess which variables best predict the actual data.



Could be a good linear fit



Not so much

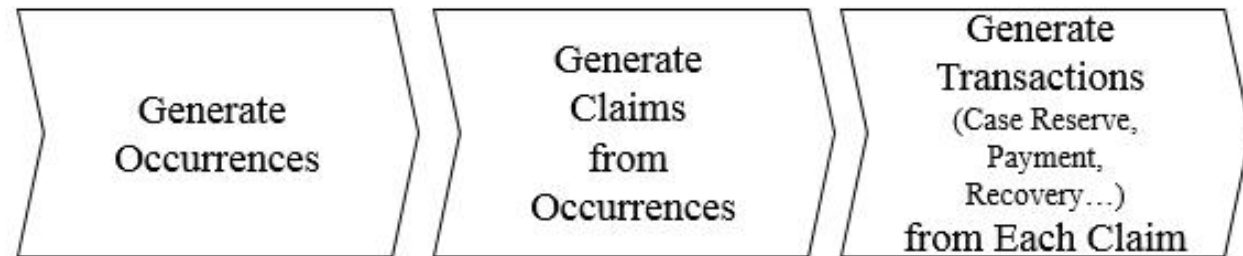
MRMR Package

Other features:

- Standard diagnostics
 - Residual plots
 - Statistical measures
 - Variability
 - RMSE
 - AIC
 - Log-likelihood
- Read of data from various sources
- Allows for non-standard evaluation periods

Loss Simulation Model

- Written in VB.NET
- Freely available for download, use and modification
- Integrated with R – leverages packages and functions useful to the model



Loss Simulation Model

- R engine is implemented as a global class instance
 - Code is sent to engine to be evaluated

```
Public Class R : Implements IDisposable
    Public Const GRAPHICDEVICE As String = "RGraphicDevice"
    'make the (single) r engine available to the whole environment
    Private Shared mRObj As IStatConnector

#Region "R Object initialization and finalization"

    Public Shared Sub drawMessage(ByRef scr As RGraphScreen, ByVal str As String)
        setGraphicDevice(scr)
        EvaluateNoReturn("plot(0:100, 0:100, type = ""n"", xlab = """", ylab = """, axes=FALSE)")
        EvaluateNoReturn("Text(50,50, "" & str & """)" 'centred
    End Sub
```

Loss Simulation Model

- Calculations done using R
 - Loss distributions
 - Simulation
 - Copulas (using copula package)

```
Public Function getPlotString() As String
    If (getDimension() = 2) Then
        Return "par(mfrow = c(1, 1)) " & vbCrLf & _
            "plot(rcopula(" & OBJECT_NAME & ", 1000), col=""blue"")"
    ElseIf getDimension() = 3 Then
        Return "par(mfrow = c(1, 1)) " & vbCrLf & _
            "scatterplot3d(rcopula(" & OBJECT_NAME & ", 1000), color=""blue"")"
    End If

    Return ""
End Function
```

```
.....
'CDF, it is distributed
.....
```

```
Public Overrides Function CDF(ByVal x As Double) As Double
    Return R.Evaluate("plnorm(" & x & ", meanlog =" & meanlog & ", sdlog=" & sdlog & ", log = FALSE)")
End Function
```

```
.....
'PURPOSE: computes the quantile (inverse of the cdf) at x
'.....
```

```
Public Overrides Function INV_CDF(ByVal p As Double) As Double
    Return R.Evaluate("qlnorm(" & p & ", meanlog =" & meanlog & ", sdlog=" & sdlog & ", log = FALSE)")
End Function
```

Loss Simulation Model

- Calculations done using R (continued)
 - Markov chains
 - Plotting of visualizations

Stage 1 Lognormal meanlog=11.1 sdlog=0.8

Stage 2 Weibull (shape=10.5, scale=100.5)

Stage Switching Frequency

Monthly Quarterly Yearly

Markov Chain Transition Matrix

Matrix Define How It Works

Stage 1 Persistency Value P11

Stage 2 Persistency Value P22

Transition Matrix P

$$\begin{pmatrix} 0.5 & 0.5 \\ 0.3 & 0.7 \end{pmatrix}$$

Steady Stage Probability (at Simulation Start Date)

$$\begin{pmatrix} 0.375 & 0.625 \end{pmatrix}$$

Monthly Stage Switching

CAS Open Source Committee

OPEN-SOURCE SOFTWARE COMMITTEE

The purpose of the Open-Source Software Committee is to make advanced open-source reserving, ratemaking and predictive modeling procedures available, accessible and of practical value to a wider audience. The Open-Source Software Research Committee will foster the development of tutorials, interfaces, procedures, and educational resources, and will liaise with the Professional Education committees to disseminate information to CAS members. The committee's Wiki with their research on R can be found here:

<http://opensourcesoftware.casact.org/start>

Welcome to the [CAS Open-Source Software Committee's](#) page. Our current focus is applying the [R programming language](#) to the field of actuarial science.

Wiki Table of Contents

[Useful Resources](#) - Big list of links

[Introduction to R](#) - Basic presentations and tutorials on R

[Text Mining](#) - Text mining tutorial

[Chain Ladder](#) - Tutorial on ChainLadder R package

[MRMR](#) - Multivariate Regression Model for Reserving

[actuar I - Loss Models](#) - A tutorial on loss distribution modeling. Part I of IV in a series on the actuar package

[Cloud](#) - The CAS Open Source Committee's virtual machine open source offerings

[Forums](#) - CAS Open Source Committee forums

[blogs](#) - Visit CAS Open Source Committee Blogs

Deloitte.

Copyright © 2012 Deloitte Development LLC. All rights reserved.

Member of
Deloitte Touche Tohmatsu