Physicians Professional Liability:

The Current State of the Market and Future Opportunities through Predictive Modeling

Prepared For: Casualty Actuarial Society
2008 Ratemaking Seminar

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Milliman

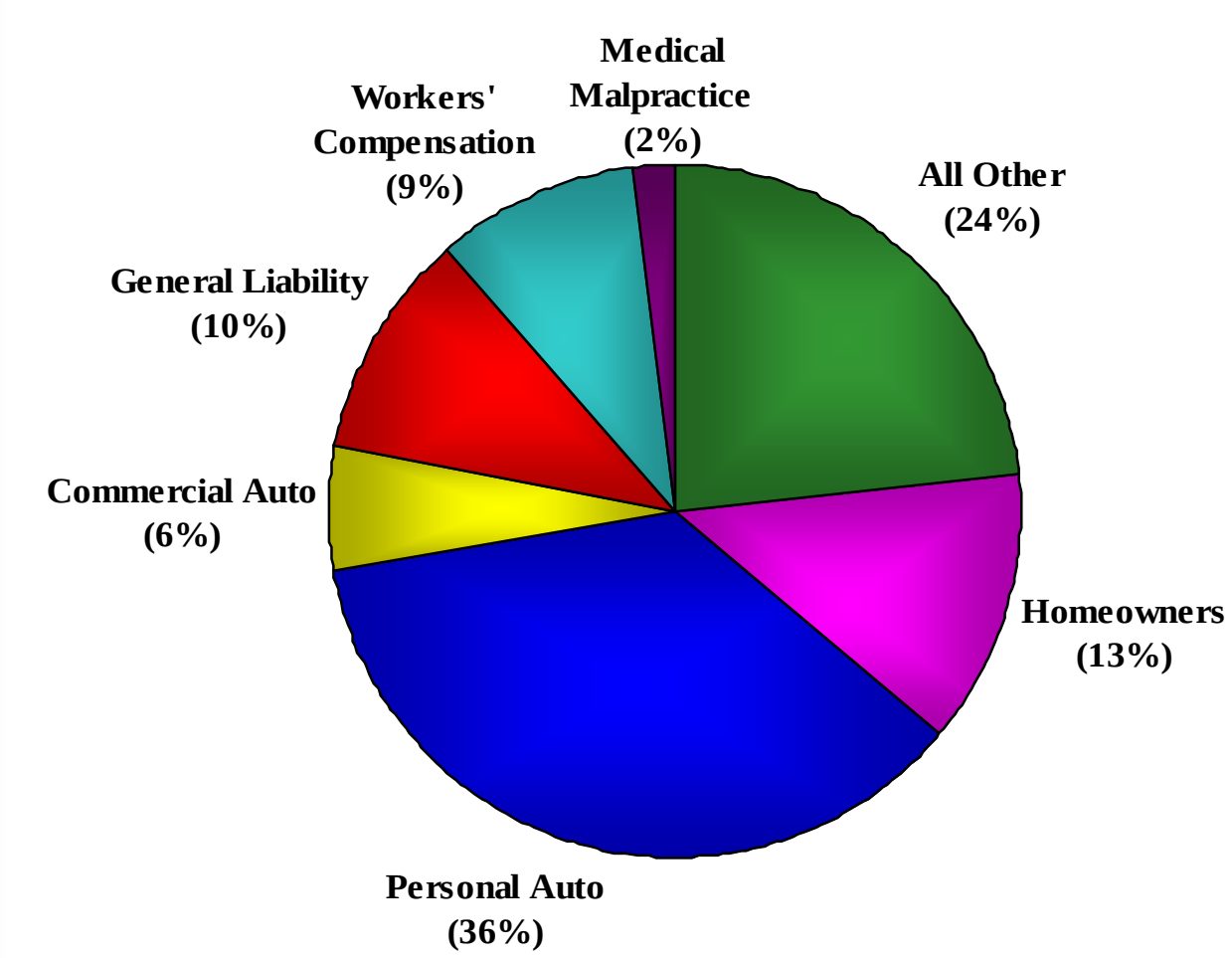
Overview of Presentation

- Overview of the Market
- Current Approach to Rating
- Predictive Modeling Background Information
- Case Study Discussion

Overview of the Market

National Market

2007 Direct Written Premium by Line of Business

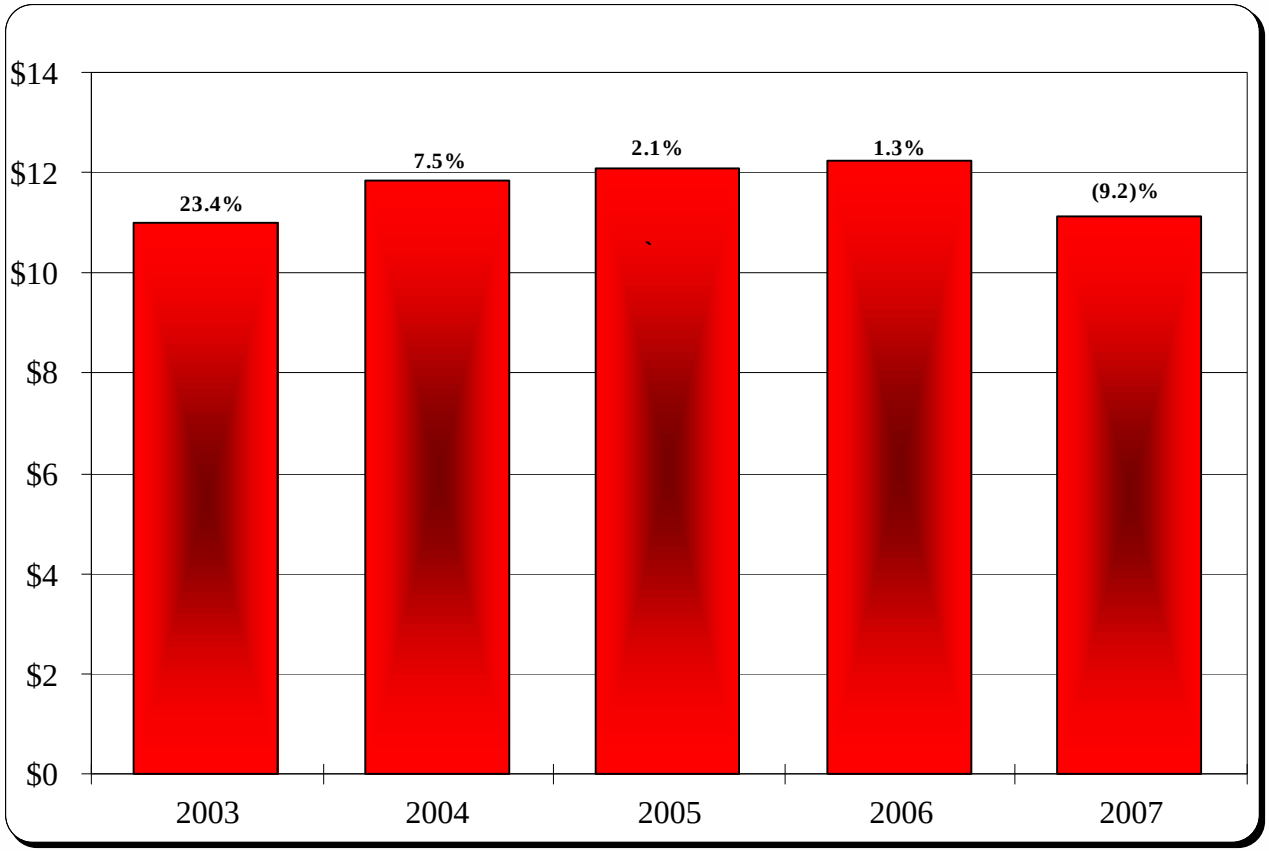


Source: A.M. Best – U.S. Property/Casualty – Review & Preview, January 2008

National Market

Growth in Direct Written Premium

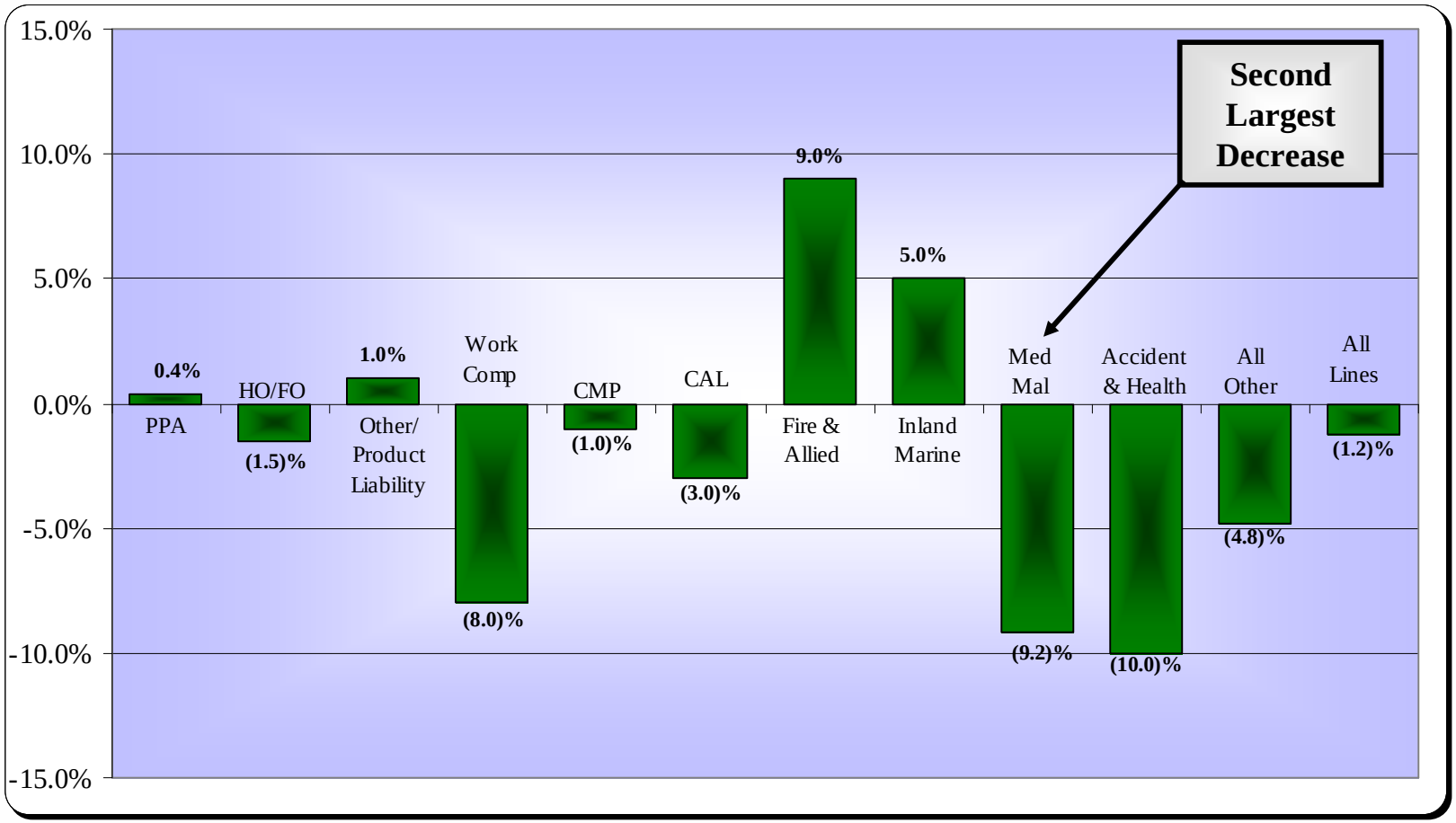
($Billions)



Note: 2007 Estimated from A.M. Best (2008 Review & Preview)
Source: National Underwriter Insurance Data Services from Highline Data

National Market

A.M. Best Estimated Change in 2007 Net Written Premium by Product Line



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National Market

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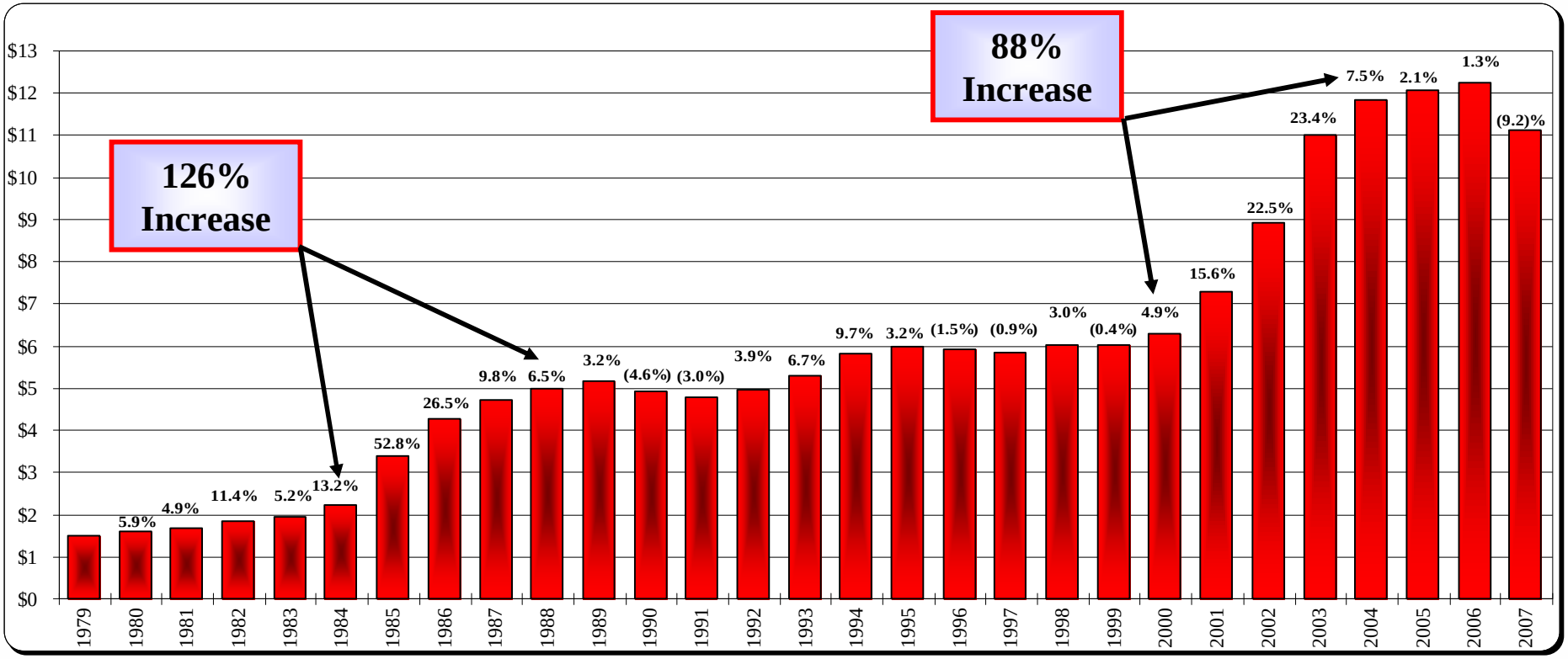


Note: 2007 Estimated from A.M. Best using change in net written premium (2008 Review & Preview)
Source: National Underwriter Insurance Data Services from Highline Data

National Market

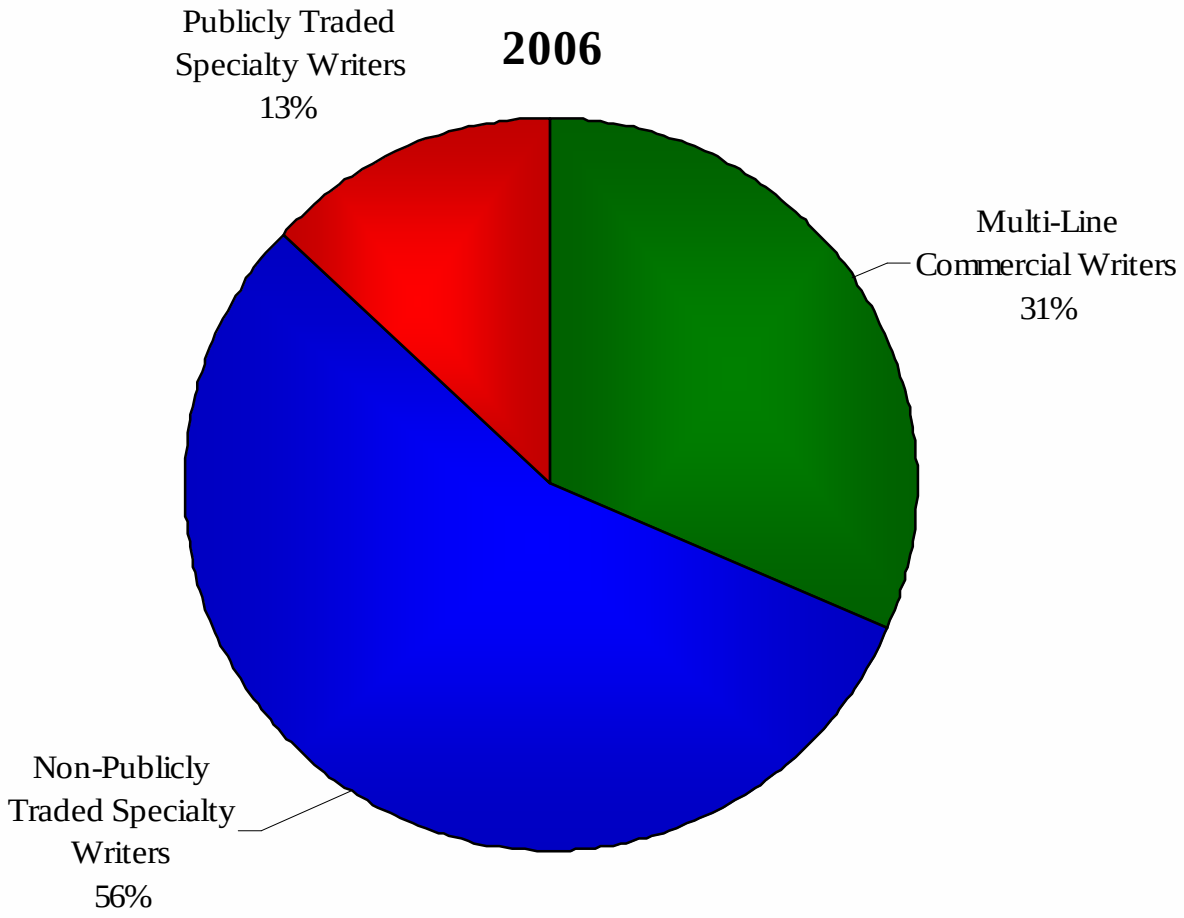
Top 20 Writers

Ranking		Company	2006 Direct Written Premium		Type of Company	2006 Market Share
2006	2005		($000's)	% Growth		
1	1	MLMIC Group	$945,445	8.5%	Specialty - Mutual	7.7%
2	2	American International Group	819,221	-4.4%	Multi-Line - Public	6.7%
3	3	Berkshire Hathaway	724,940	2.1%	Multi-Line - Public	5.9%
4	4	ProAssurance Corporation Group	616,160	0.6%	Specialty - Public	5.0%
5	5	CNA Insurance Group	578,206	10.5%	Multi-Line - Public	4.7%
6	6	Doctors' Company Group	531,823	7.6%	Specialty - Reciprocal	4.3%
7	7	ISMIE Group	385,714	-4.9%	Specialty - Mutual	3.1%
8	8	MAG Mutual Insurance Group	345,182	-3.0%	Specialty - Mutual	2.8%
9	9	Promutual Companies	334,992	-2.8%	Specialty - Mutual	2.7%
10	12	Physicians Reciprocal Insurers	331,691	14.1%	Specialty - Reciprocal	2.7%
11	10	Health Care Indemnity	311,243	-6.1%	Specialty - Captive	2.5%
12	11	Medical Group Holdings and Affiliates	300,750	1.0%	Specialty - Mutual	2.5%
13	14	State Volunteer Mutual Insurance Company	266,548	2.9%	Specialty - Mutual	2.2%
14	15	MCIC Vermont Incorporated, RRG	256,855	3.8%	Specialty - Captive	2.1%
15	13	FPIC Insurance Group	245,916	-12.0%	Specialty - Public	2.0%
16	17	Medical Insurance Group of Maryland	189,566	1.8%	Specialty - Mutual	1.5%
17	16	Zurich Group	181,728	-11.9%	Multi-Line - Public	1.5%
18	20	Mutual Insurance Company of Arizona	171,575	1.8%	Specialty - Mutual	1.4%
19	19	AP Capital Group	156,862	-10.3%	Specialty - Public	1.3%
20	18	Markel Corporation Group	153,158	-14.8%	Multi-Line - Public	1.3%
		Total Top 20	**$7,847,575**	**0.4%**		**64.1%**
		Total US	**$12,251,014**	**1.3%**		**100.0%**

Source: National Underwriter Insurance Data Services from Highline Data

National Market

Market Share: Commercial Carriers vs. Specialty Writers

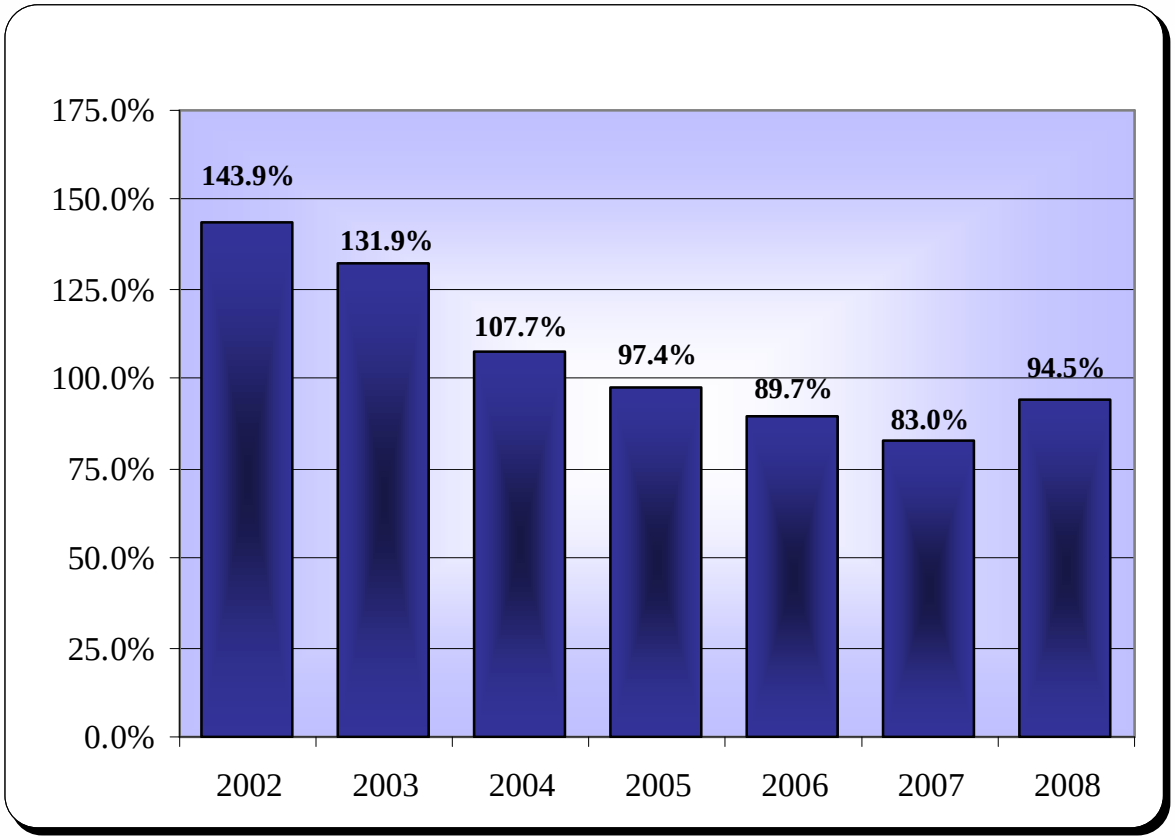


Source: National Underwriter Insurance Data Services from Highline Data

National Market

Historical Underwriting Results

Combined Ratio After Dividends



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National Market

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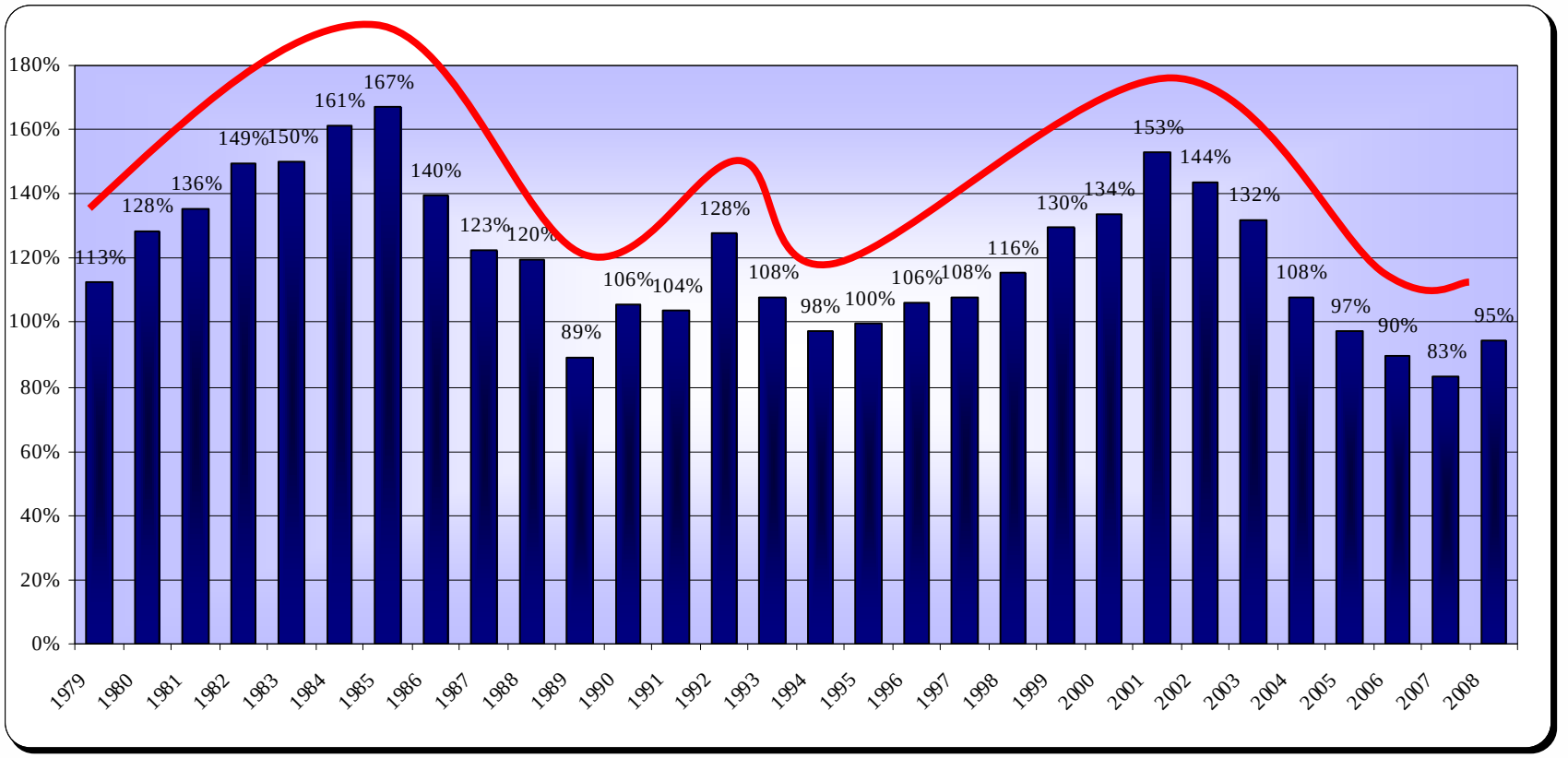

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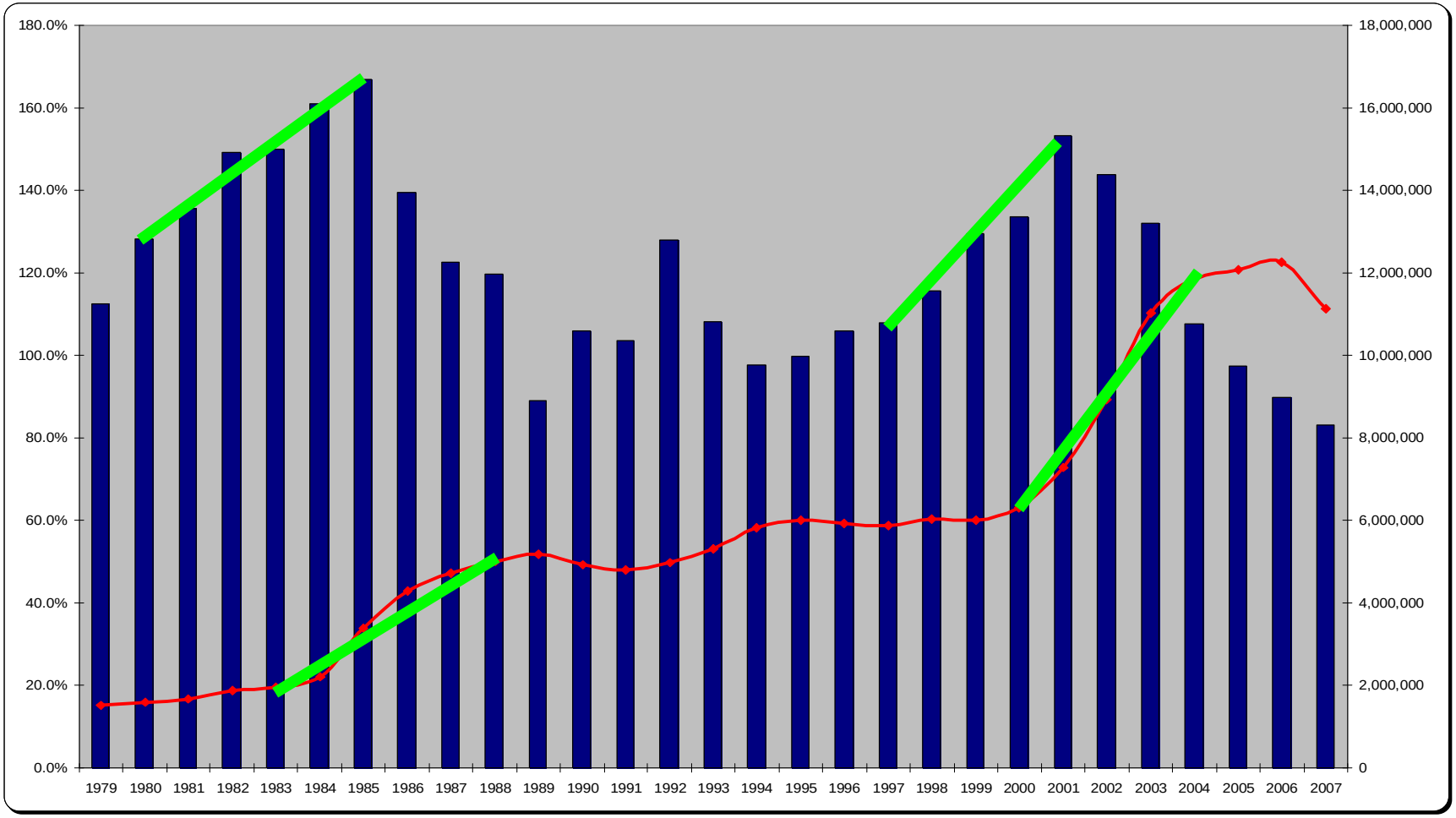
National Market

Direct Written Premium versus Combined Ratio

A Three Year Lag?



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Source: National Underwriter Insurance Data Services from Highline Data

Med Mal Start-Up Programs

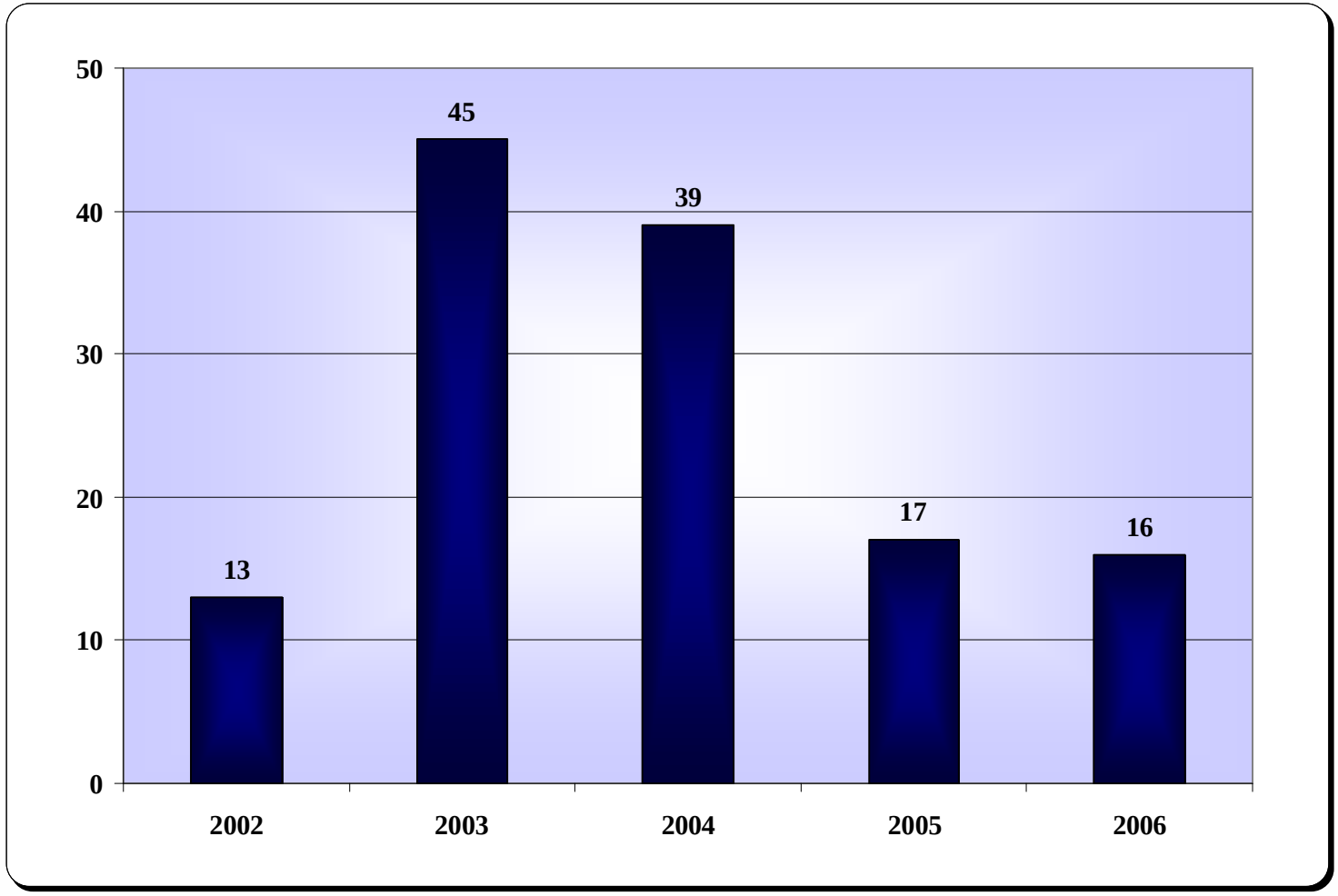
Characteristics of Universe

Item	Value
Number of Companies	130
Statutory Admitted Assets as of 12/31/06	$2,357,592,000
Statutory Surplus as of 12/31/06	$786,284,000
2006 Direct Written Med Mal Premium	$1,022,127,000
2006 Med Mal Market Share	8.3%

Source: National Underwriter Insurance Data Services from Highline Data

Med Mal Start-Up Programs

Profile by Year of Commencement

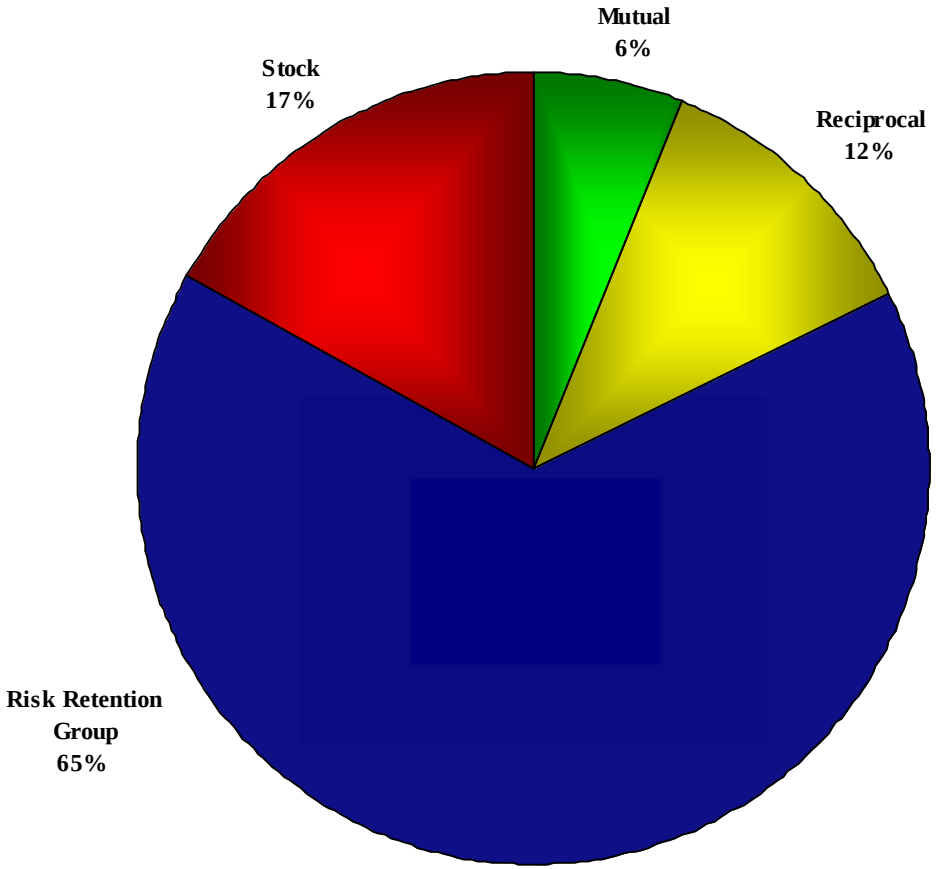


Source: National Underwriter Insurance Data Services from Highline Data

Med Mal Start-Up Programs

Profile by Business Type

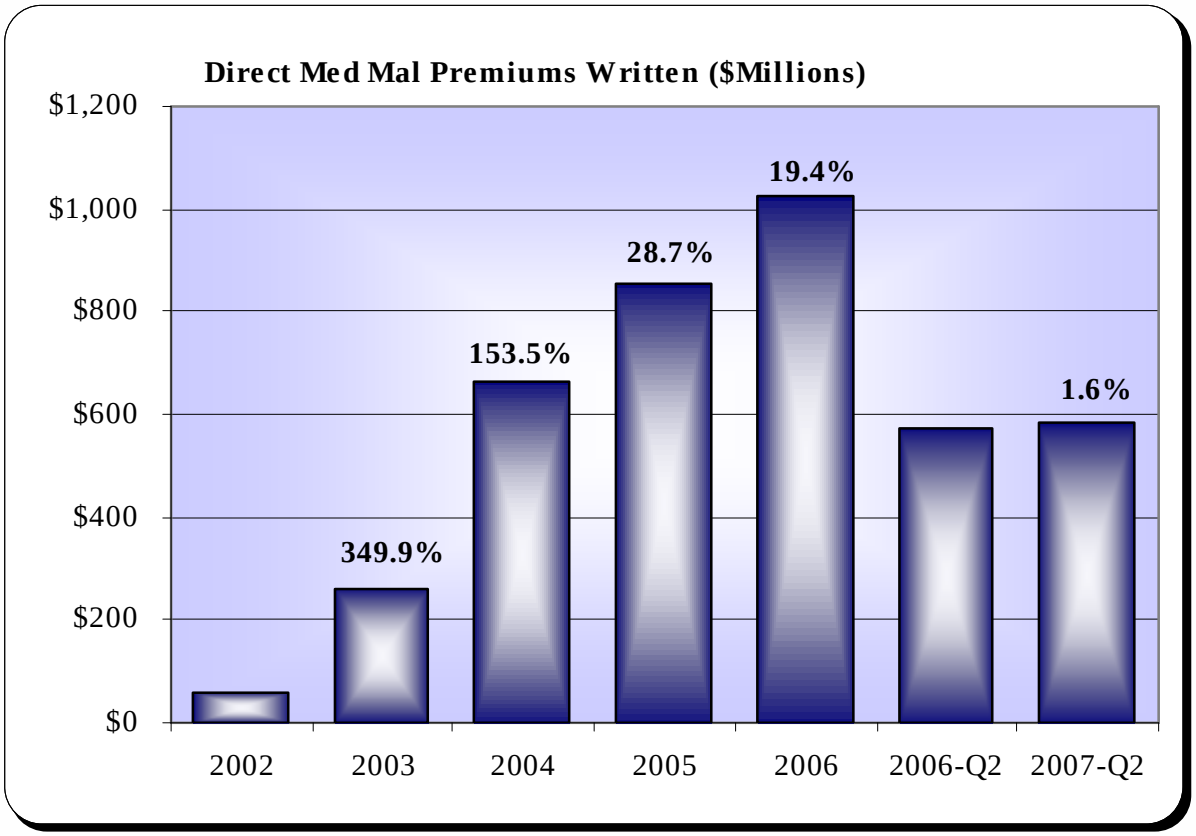
Based on 2006 Direct Written Med Mal Premium



Source: National Underwriter Insurance Data Services from Highline Data

Med Mal Start-Up Programs

Growth in Direct Written Med Mal Premium



Note: Second quarter values represent total direct written premiums

Source: National Underwriter Insurance Data Services from Highline Data

Med Mal Start-Up Programs

Profile of Market Penetration by State

Rank	State	2006 Med Mal Direct Written Premium ($000's)		Market Penetration
		Start-Up Programs	Med Mal Industry	
1	West Virginia	$61,940	$110,870	55.9%
2	Pennsylvania	279,199	741,717	37.6%
3	Nevada	39,958	108,721	36.8%
4	Missouri	74,252	238,513	31.1%
5	Montana	12,389	44,541	27.8%
6	Indiana	26,173	135,301	19.3%
7	Mississippi	10,408	56,212	18.5%
8	Kentucky	25,058	172,664	14.5%
9	Texas	49,803	487,663	10.2%
10	Florida	85,494	847,216	10.1%
	Total Top 10	**$664,674**	**$2,943,419**	**22.6%**
	Grand Total	**$1,022,128**	**$12,251,013**	**8.3%**

Source: National Underwriter Insurance Data Services from Highline Data

Current Approach to Rating

Current Approach to Rating

- Primary Rating Factors
  - Specialty
  - Territory – in some cases
- Additional Rating Factors may include
  - Claims-free credits/surcharges
  - Group discounts
  - Risk management credits
  - Other workload type adjustments
    - Part-time, New to Practice, Teaching, etc.
  - Other schedule rating adjustments
    - Risk peculiarities, CME, Billing practices, EMR

Current Approach to Rating

Comparison to Other Lines

- Medical professional liability with an average premium of $15,000 to $20,000, and upwards of $200,000, relies primarily on specialty and maybe territory
- Lawyers professional liability with an average premium of $2,000 to $4,000 relies on
  - Size of Firm
  - % of revenue coming from 20+ different Areas of Practice
  - Territory
- Personal Auto with an average premium of $1,000 to $5,000 relies on
  - Age
  - Gender
  - Credit Score
  - Zip Code
  - Type of Automobile
  - DMV Records

Alternative (Advanced?) Approach to Rating

- The concepts and approaches used to refine the personal lines rating plans can be applied to medical professional liability
  - Additional challenges exist due to the more volatile nature of this line
  - Significant opportunities also exist without having to completely overhaul the rating plan
- Slowly being embraced by some companies in the marketplace, though the traditional specialty/territory approach still dominates the market

Predictive Modeling Background Information

Definition of Predictive Modeling

Predictive Modeling is a Process …

- While the model building relies heavily on statistics, there is also judgment involved in interpreting the effects of the data on the model itself
- Develops understanding of data, rating variables, & subject line

… That Results in a Model

- The goal is to build a model to predict future outcomes
- All models are a simplification of reality

Uses of Predictive Modeling

Probability of …	**is a function of …**
Ø Disease	family history, age, race
Ø Baseball Wins	on-base %, ERA, slugging %
Ø Auto Accidents	age, sex, driving record
Ø Malpractice Claim	specialty, location, other factors?

- Predictive modeling attempts to convert these tendencies into a mathematical formula
  - Ø $y = b_o + b_1 * v_1 + \ldots. + b_n * v_n + error$
  - Ø $y = e^{(b_o + b_1 * v_1 + \ldots. + b_n * v_n + error)}$

Benefits of Predictive Modeling

- Better understand exposures and the interaction of various risk characteristics
- Assess pricing and/or underwriting factors more accurately and more scientifically
- Identify types of risks to more easily walk away from
- More precise rating plan reduces potential for adverse selection

Building a Predictive Model

- Data
  - Gather Data
  - Prepare Data
  - Segment Data
- Model
  - Create Model
  - Validate Model
- Implementation
  - Rating Variables / Rating Factors
  - Underwriting Decisions

Building a Predictive Model
Data Gathering

- Internal
  - Ø Underwriting / Policy Database
    - age, gender, territory, coverage, limits, etc.
  - Ø Claims Database
    - occurrence date, claim type, loss/ALAE amounts, etc.
  - Ø Application Data
- External
  - Ø Behavioral (DMV, third party scorecards, etc.)
  - Ø Demographic (AMA, state medical societies, etc.)
  - Ø Environmental (lawyers per capita, etc.)
  - Ø Financial (credit score, business practices, etc.)

Building a Predictive Model

Data Gathering

Personal Lines vs. Commercial Lines:

	Personal Lines	Commercial Lines
# of States	50	1
# of Years	4 (2003-2006)	13 (1994-2006)
# of Records	30,000,000	150,000
Variables per Record	400-500	80-90
Datasets Merged	Claim, Coverage, Credit, Insured, Policy, & Vehicle	Claim & Policy

- Both situations pose unique challenges …

Case Study Discussion

Case Study Discussion

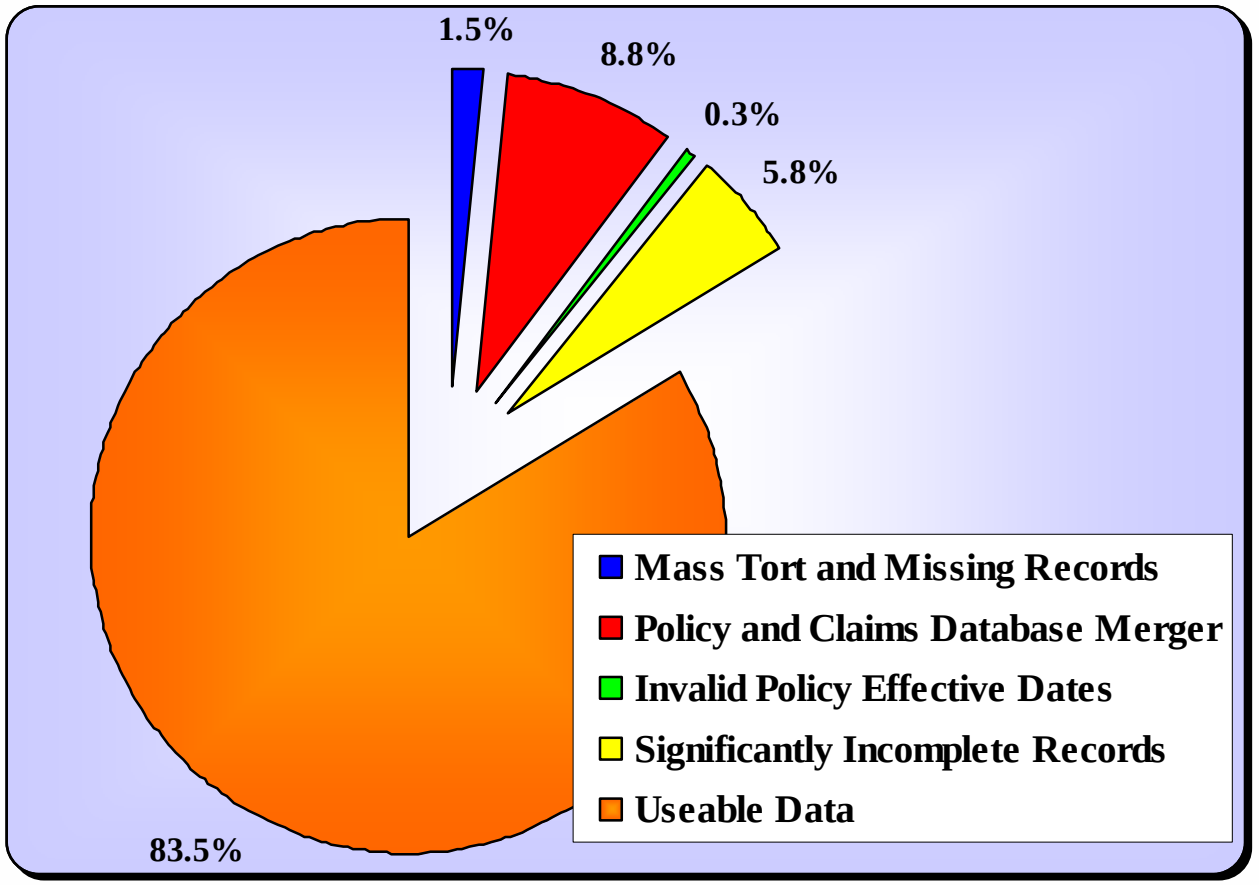
Background Information

- Company is the largest writer in a top 10 state
  - Ø 13 years of policy data; 145,000 policy records
  - Ø 28 years of claim data; 40,000 claims
  - Ø Over $1.5 billion of loss and ALAE payments
  - Ø Built model using 60% of the data; 40% used for validation
- Relied exclusively on the Company's internal policy and claims databases
  - Ø Final model based on relatively limited number of variables
  - Ø Examples include: Age, Gender, Coverage Type, Historical Claims Experience, Limit, Specialty, & Territory
  - Ø Claims data included claim status, loss/ALAE payments, & loss/ALAE case reserves

Case Study Discussion

Data Preparation

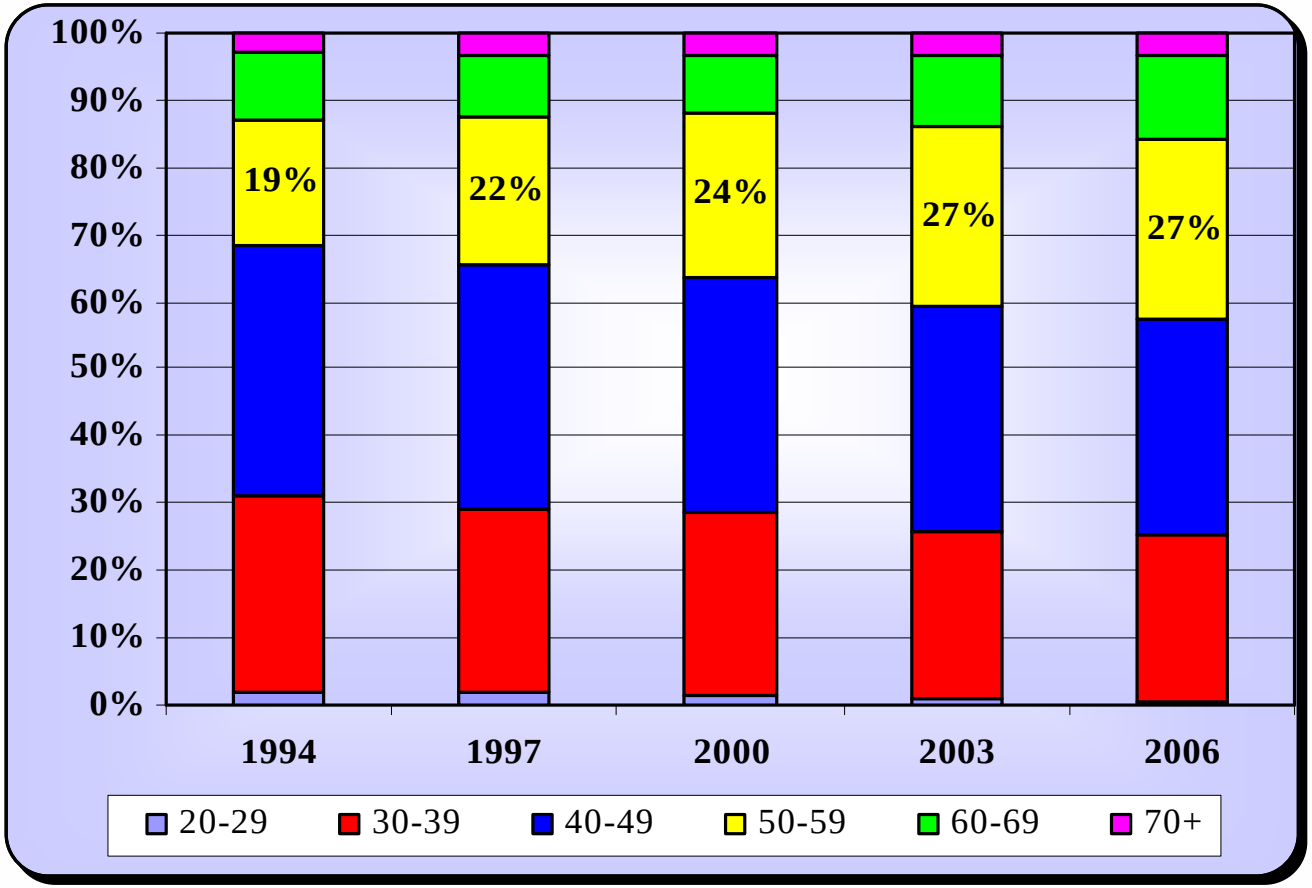
Losses Eliminated Through Data Cleansing



Case Study Discussion

Assessing Distribution Shifts Over Time

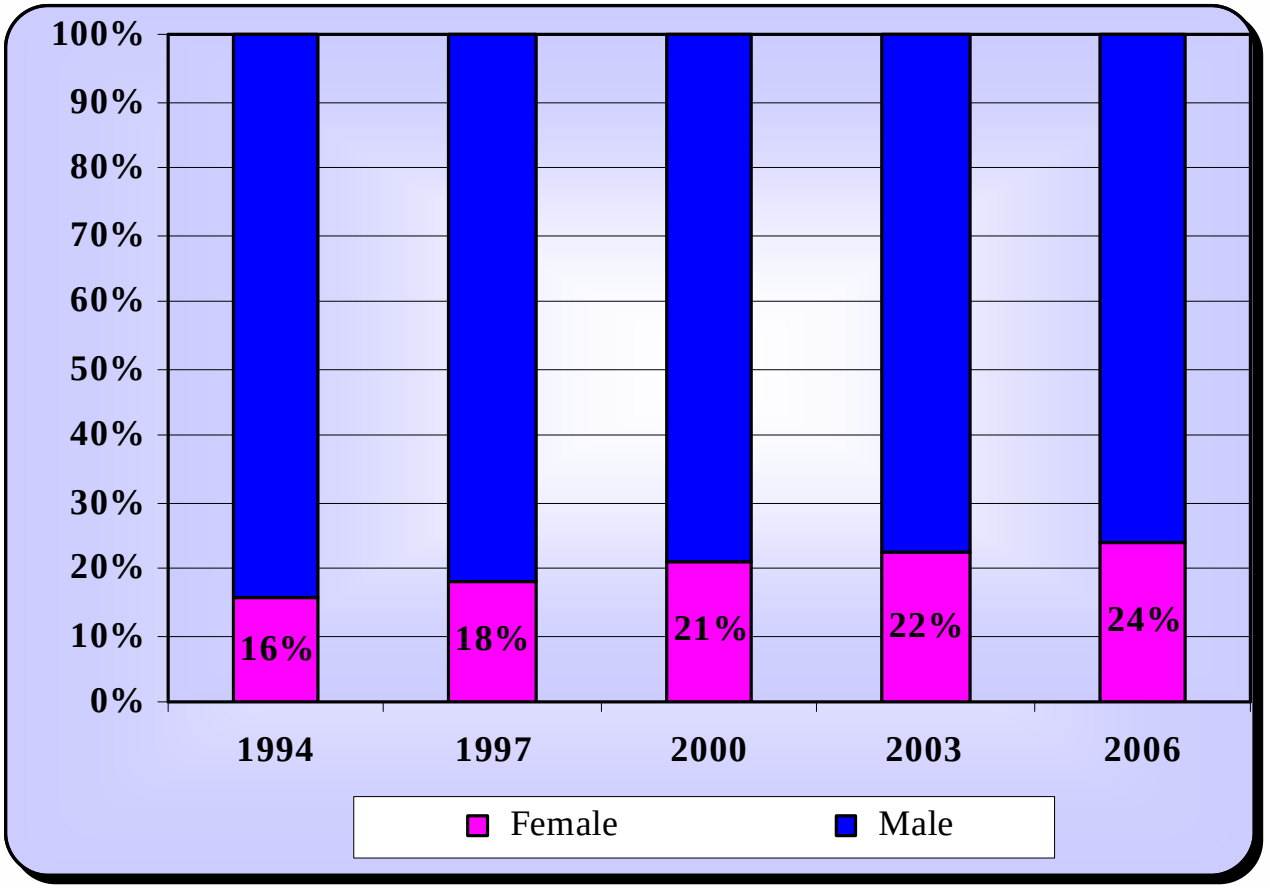
Distribution of Physician's Age by Year



Case Study Discussion

Assessing Distribution Shifts Over Time

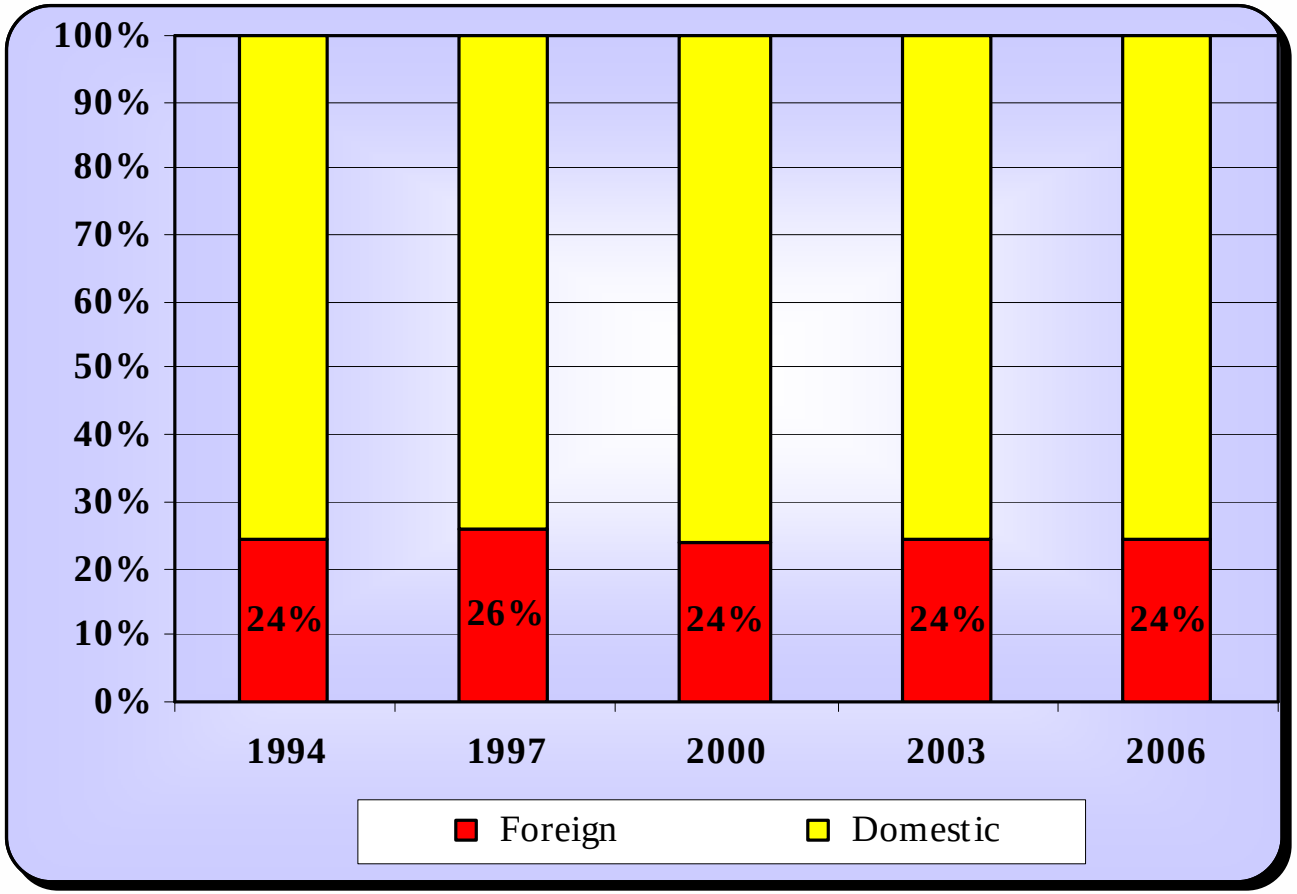
Distribution of Physician's Gender by Year



Case Study Discussion

Assessing Distribution Shifts Over Time

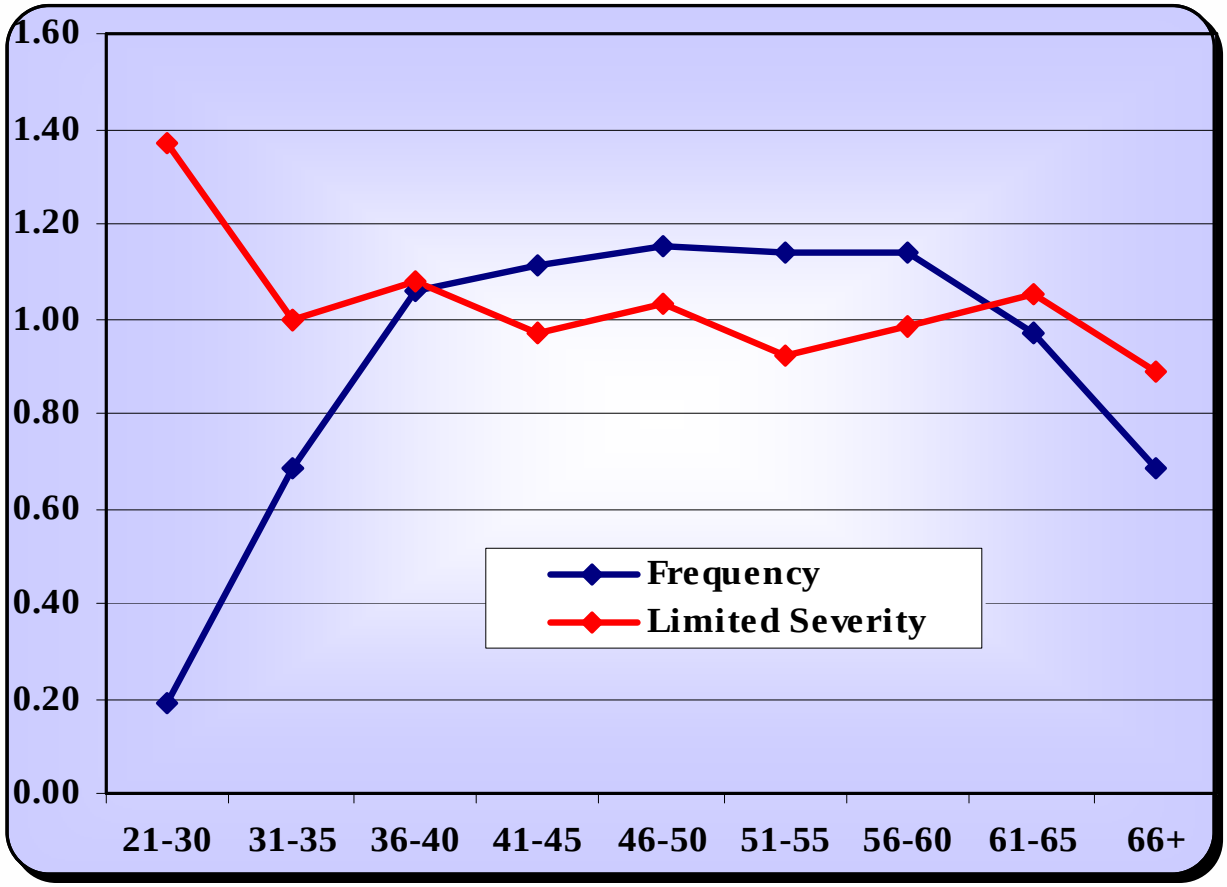
Distribution of Medical School Country by Year



Case Study Discussion

One-Way Analyses

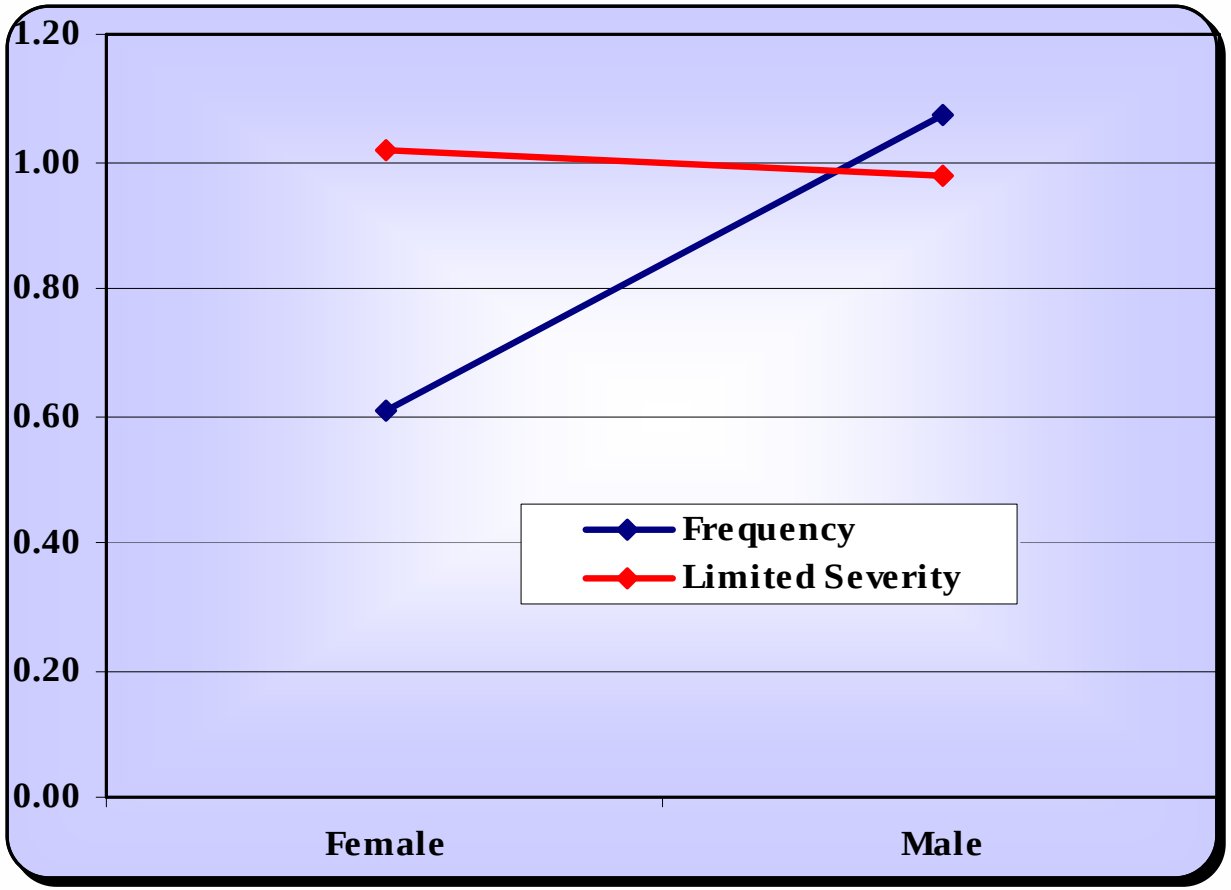
Claim Experience by Physician's Age



Case Study Discussion

One-Way Analyses

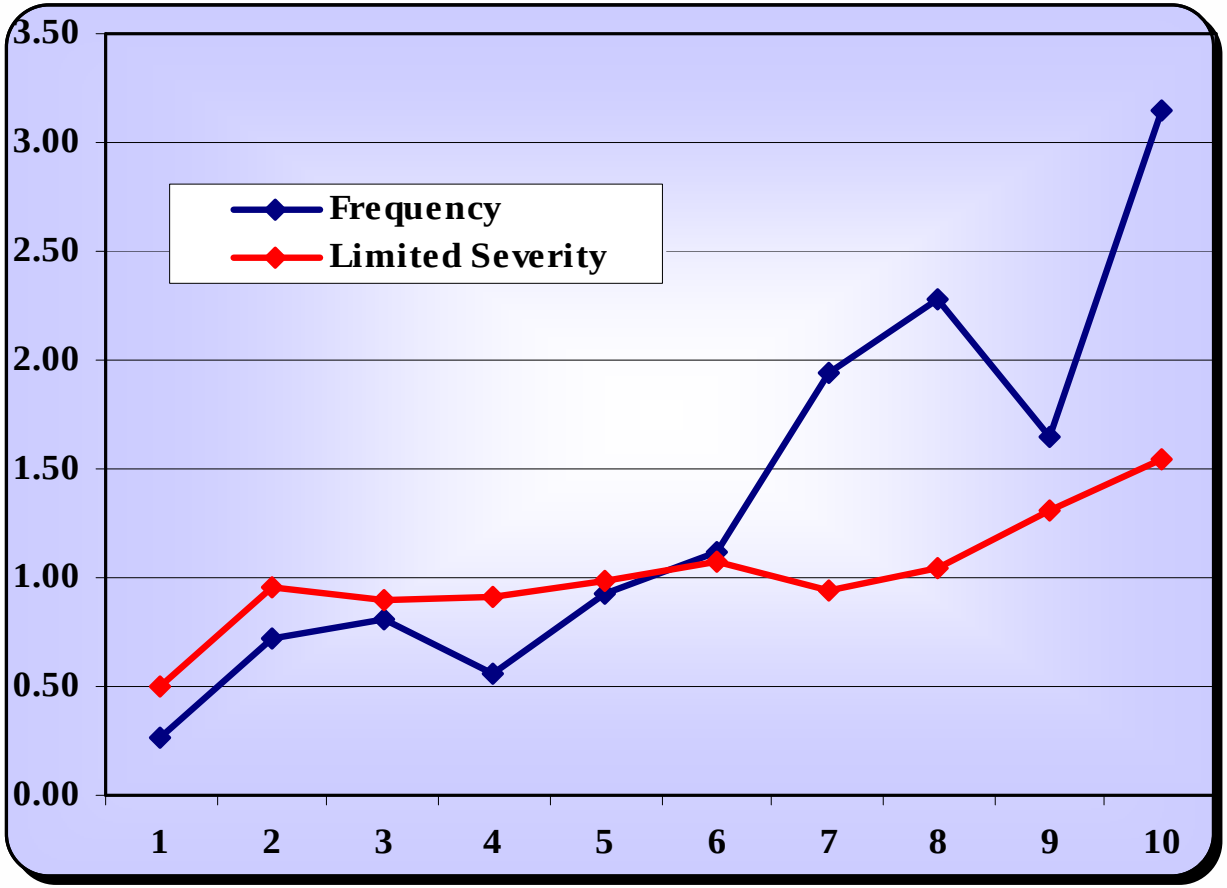
Claim Experience by Physician's Gender



Case Study Discussion

One-Way Analyses

Claim Experience by Physician's Class



Case Study Discussion

One-Way Analyses

- Using one-way analyses, the indicated rate for a 28-year old, Female Pediatrician would be …

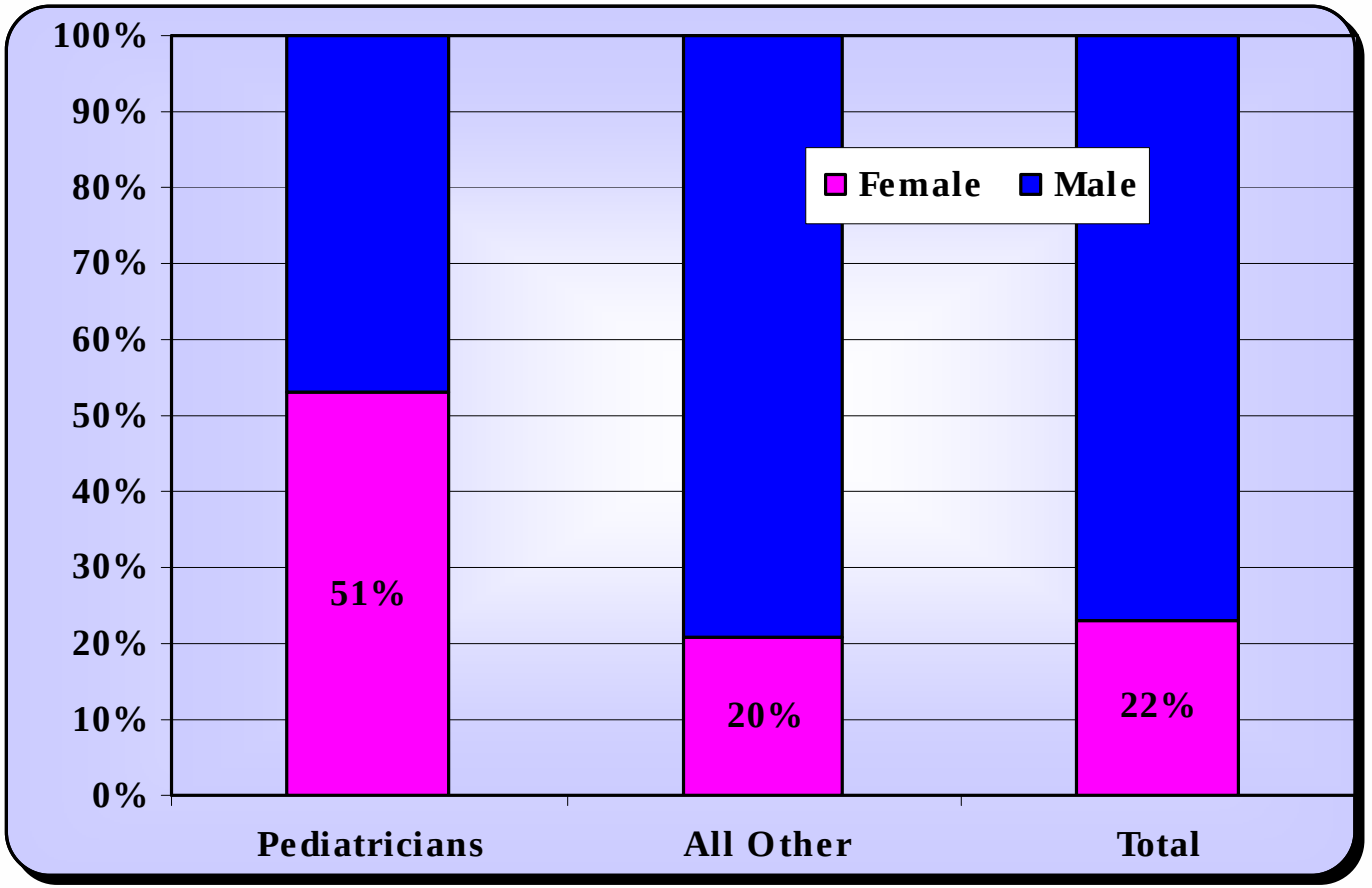
Rating Variable	Sample Insured	Indicated Rate Factor
Age	28	0.19
Gender	Female	0.61
Specialty	Pediatrician	0.26
Indicated Overall Rate Factor		0.03

- What if she …
  - ü works in a rural part of the state?
  - ü graduated from a domestic medical school?
  - ü has been claims-free?
  - ü requests first year claims-made coverage?

Case Study Discussion

Assessing Distributional Skewness

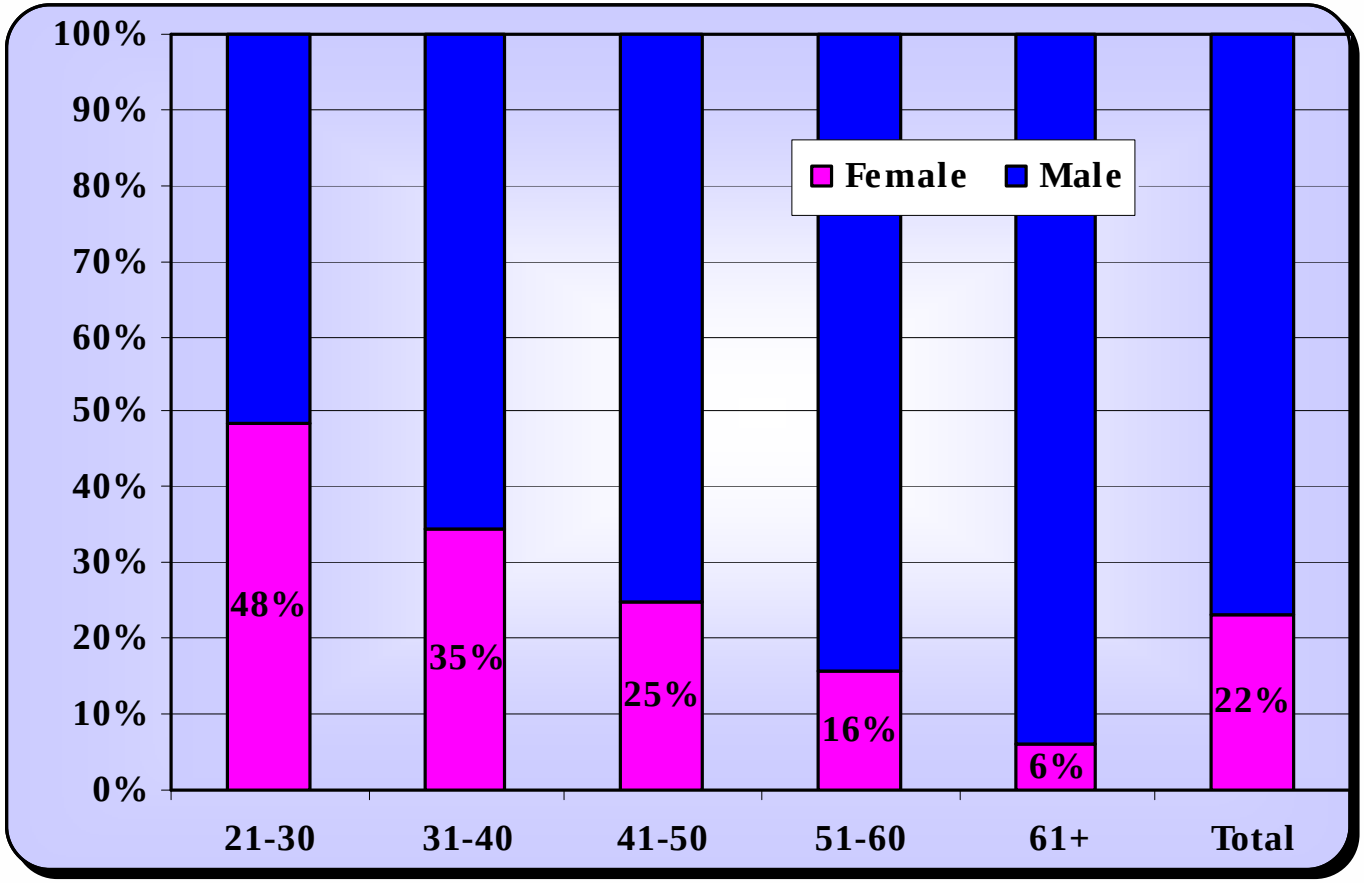
Distribution of Gender by Specialty



Case Study Discussion

Assessing Distributional Skewness

Distribution of Gender by Age



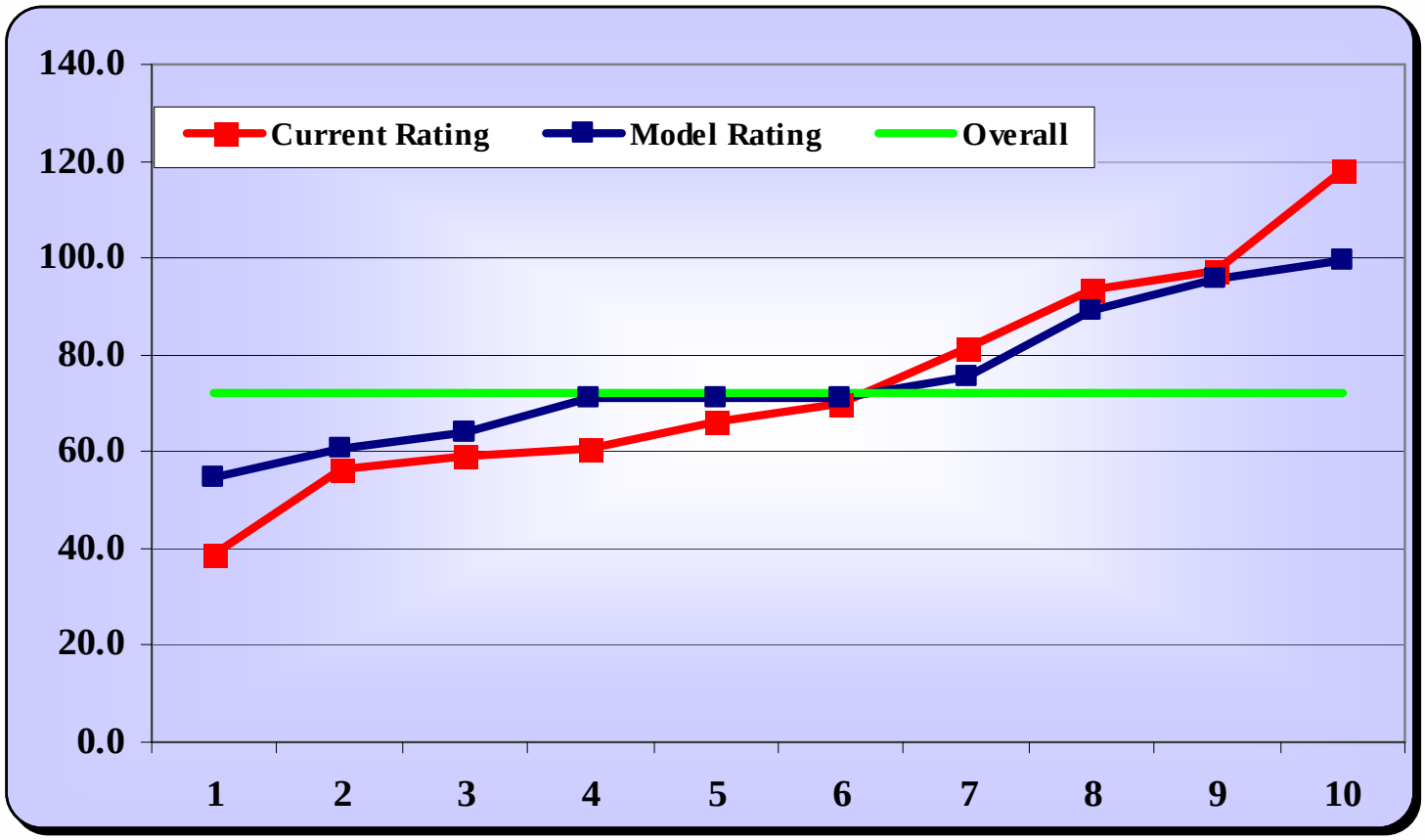
Case Study Discussion

Multivariate Analysis

- Multivariate approach evaluates the relationships between many variables simultaneously
  - Ø Controls for shifts in distributions over time
  - Ø Controls for skewness in distributions
  - Ø Eliminates the requirement that all input variables be totally independent and uncorrelated
- Results in a formula that best predicts the probability and size of claims

Case Study Discussion

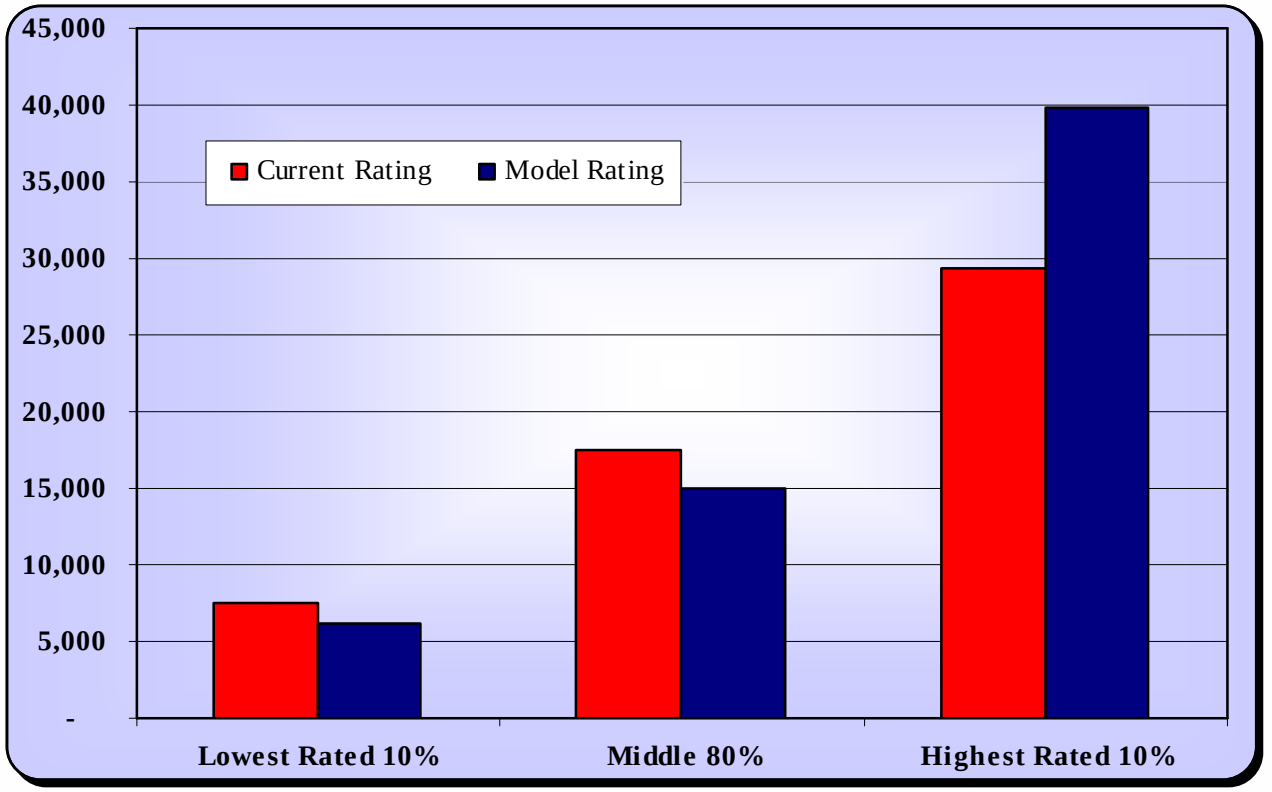
Model Validation: Expected Loss Ratio by Decile



- Results based on a preliminary Frequency-only model

Case Study Discussion

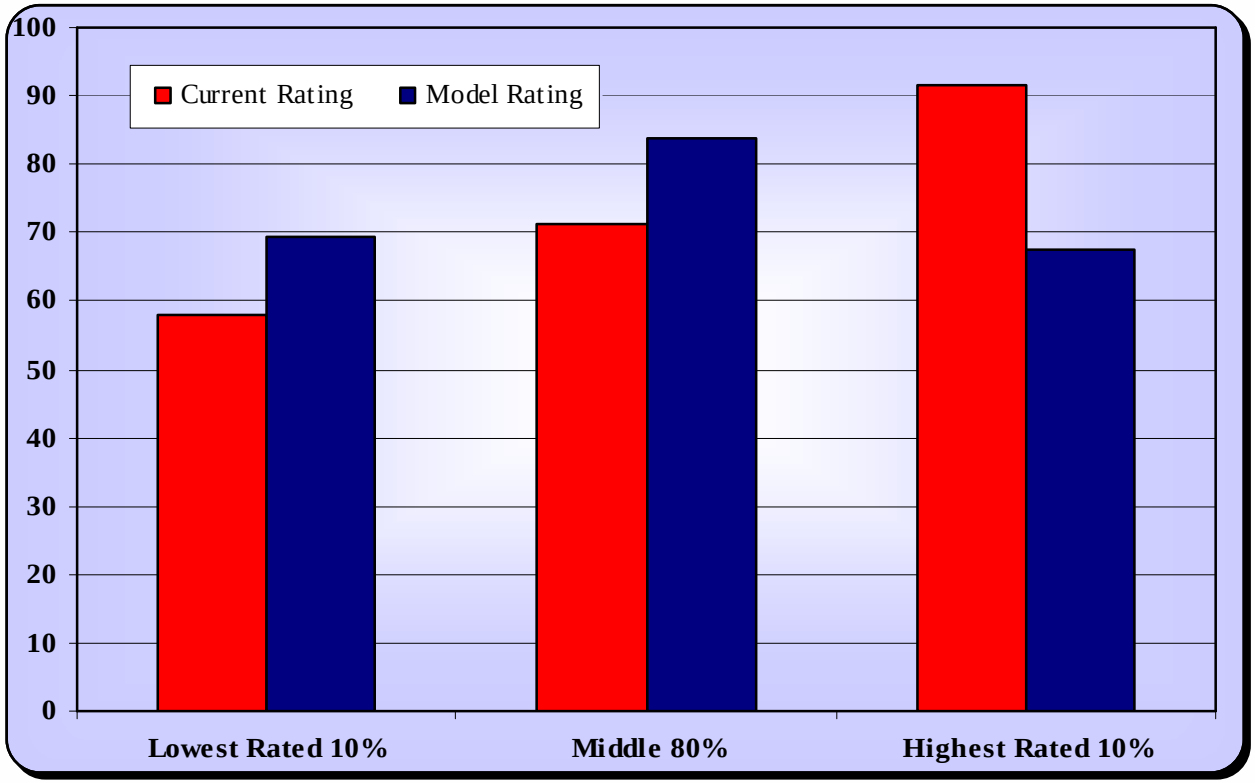
Model Validation: Average Premium by Class Group



- Ranked all Surgical Classes by their proposed premiums
- Model significantly increases rate spread

Case Study Discussion

Model Validation: Loss Ratios by Class Group



- Same groupings within the Surgical Classes
- Model reduces loss ratio variance by 40%

Case Study Discussion

Summary of Results

- Data preparation phase improved our overall understanding of the data and the subject line:
  - Ø Clarified the interaction between different variables
  - Ø Quantified the latest trends and/or distribution shifts
- Identified 3-5 new rating variables that were significant
  - Ø These could be added to the premium calculation process or could be used to improve Underwriting decisions

Questions?