**Massachusetts Workers' Compensation
Advisory Council**

**Review of
WC Ratemaking
Concepts and WCRIB
8/14/97 Filing**

≡ᴵ ERNST & YOUNG LLP

ERNST & YOUNG LLP

■ 200 Clarendon Street
Boston
Massachusetts 02116-5072

■ Phone: 617 266 2000
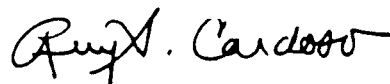Fax: 617 266 5843

September 15, 1997

Mr. Matthew A. Chafe
Executive Director
Massachusetts Workers' Compensation Advisory Council
600 Washington Street
Boston MA 02111

Dear Matt:

As the Council has requested, I have reviewed the August 14, 1997 filing of the Workers' Compensation Rating and Inspection Bureau of Massachusetts ("Bureau") for workers' compensation rates effective January 1ˢᵗ, 1998. As explained in additional detail in the attached document, the revisions to the actuarial methods employed by the Bureau throughout its filing are, in my professional opinion, reasonable and appropriate under current Massachusetts law. In addition, I have during the course of my work reviewed those actuarial methods that were not revised by the Bureau in the current filing and can say that those methods are also reasonable and appropriate under current Massachusetts law. Based on this review, I am able to conclude that the proposed rates are, in my professional opinion, consistent with the statutory criteria of M.G.L. c. 152 §53A(2); specifically, the proposed rates are "not excessive, inadequate, or unfairly discriminatory for the risks to which they respectively apply" and "fall within a range of reasonableness."

Please feel free to call me at 617-859-6427 if you have any questions on the attached document or if I can be of further service to the Council.

Sincerely,

Ruy A. Cardoso, FCAS, MAAA
Senior Consulting Actuary

Calculation of WCRIB Indicated Rate Change
Filing for 7/1/96 Effective Date

Introduction

While the calculation of indicated rate changes in the most recent filing of the Massachusetts Workers' Compensation Rating and Inspection Bureau is conceptually straightforward, the numerous details can obscure the calculation's simplicity. This document describes the major elements of the calculation while ignoring certain details that are not necessary to obtaining a basic understanding of how the WCRIB estimates needed rates.

Basic Ratemaking Formula

In essence, the method used by the WCRIB starts with a projected ratio of losses (and fixed expenses) to the premiums for some future period <u>assuming no change in rates</u>. This ratio is then compared to a corresponding ratio that will allow insurers to recover all of their variable expenses and still have enough money left to pay for losses and fixed expenses. If the projected ratio is higher than the allowable ratio, then rates need to be increased; if lower, then rates need to be decreased.

Slides 2 and 3 of the presentation give an example of how the calculation works. In this example, we have assumed that future losses will be $69.93, future fixed expenses will be $6.77, and future premiums will be $100.00 if there is no rate change. In addition, we have assumed that insurers require 8.9% of premiums to pay variable expenses (which are for the moment loosely defined). If there is no rate change, then insurers will need $8.90 (8.9% of $100.00) to pay these variable expenses. Adding in the money needed to pay losses ($69.93) and fixed expenses ($6.77) means that only $85.60 of the $100.00 in premiums is actually needed to pay losses and expenses. Premiums can therefore be decreased, in this case to $84.19, a value slightly lower than $85.60 because of the decrease in variable expenses. Of the $84.19 in premium, $7.49 will cover variable expenses (8.9% of $84.19), $69.93 will cover losses, and $6.77 will cover fixed expenses, leaving nothing left over.

The algebra of the method is displayed on the last page of this document.

Estimating Losses

Of course, the losses that will occur in the future are not currently known; they must be estimated. The approach used by the WCRIB, like most actuarial approaches, starts with past losses and projects them forward based on historical patterns. These historical patterns are of two types: **loss development** and **trend**. Loss development refers to the change over time of the losses corresponding to a fixed set of claims in a given **experience period**, for example, all claims arising from workplace accidents in 1994 ("accident year 1994"). Losses corresponding to a fixed set of claims tend to grow over time for several reasons: lags in reporting claims to the insurer, new medical information coming to light, changes in the procedures used by the insurer to pay or reserve claims, and the accumulation of indemnity payments.

Slides 5 and 6 illustrate in a triangular format how paid indemnity losses for the Massachusetts workers' compensation insurance industry have grown for claims in accident years 1990 through 1994. The "report" periods across the top of the exhibits indicate how long has elapsed since the beginning of the accident year. Each report occurs at 12-month intervals. For example, accident year 1990 at first report is being evaluated as of 12/31/90, at second report as of 12/31/91, and so on. The last WCRIB filing estimated the amount of loss development that would apply to two specific sets of claims: those arising from accidents in 1994, and those covered by policies written in 1993 ("policy year 1993"). (Note: The WCRIB filing includes corresponding estimates for premiums and expenses on two sets of policies, leading to two separate rate indications, which the WCRIB then averages to obtain its final indication.)

In order to avoid relying on just one estimate of developed losses, the WCRIB separately calculates the amount of development that will apply to **paid** losses and to **case incurred** losses (payments plus reserves on known cases). In addition, all of the calculations are applied separately to indemnity and medical losses. Further, individual insurers' data is also analyzed separately in order to avoid distortions that can arise when market shares change (Slide 9). Finally, there are some effects that will affect future loss development that are not reflected in past loss development, such as benefits escalation (Slide 10).

Once development has been applied to, say, losses for accident year 1994, we have an estimate of **ultimate** losses for the corresponding claims. But the claims that will be covered by 1996/97 premium are not occurring in 1994, they are occurring in 1996/97. As a result, it is necessary to trend the estimated ultimate losses by about three years. The application of a trend factor primarily accounts for two items: anticipated changes in claims **frequency** (number of claims per $100 of payroll) and anticipated changes in claims **severity** (average cost per claim). These changes arise because of economic shifts, medical cost inflation, and many other phenomena. The WCRIB estimates imply an annual change in **loss costs** (total cost of claims per $100 of payroll) of 7-8%. Slide 8 displays how development and trend act in different directions rather than overlap.

In practice, the WCRIB does not estimate loss trends directly. Instead, they estimate a value known as **net trend** (the excess of trends in losses over trends in payroll) and combine it with an estimate of payroll trend (Slide 13). It is, however, conceptually easier to think of the estimation of loss trends as being done directly.

Aside from historical patterns, there are known changes in statutory benefits that will affect the losses to be paid in the future. These changes can be split into two timeframes: between the beginning of the experience period and its most recent evaluation date (12/31/94), measured by **benefit level factors**, and subsequent to the most recent evaluation date, measured by **law amendment factors**. In the most recent WCRIB filing, the effects of these factors is relatively small (less than 1% for the benefit level factors and less than 2% for the law amendment factors). A small amount of additional information is displayed on Slides 14 and 15.

Estimating Premiums

The basic concepts used to estimate future losses have analogues in estimating future premiums. First, analogously to loss development, the WCRIB estimates ultimate premiums using premium development factors (which primarily reflect the results of payroll audits). Development in premiums, however, is much less than for losses. Second, analogously to loss trends, the WCRIB estimates trends in payroll using information on the state average weekly wage (Slide 12). In its most recent filing, the WCRIB estimated an annual payroll trend of just under 4%. Third, analogously to benefit level changes and law amendments, the WCRIB estimates the effects of known rate changes since the beginning of each experience period using **premium on-level factors** (Slides 16 and 17). Because of the large rate decreases at 1/1/94 and 1/1/95, these factors have a substantial (but straightforward) effect on the rate calculations.

Estimating Expenses

The estimation of expenses is even simpler than the estimation of premiums, involving only the collection of past expense data (for 1992-94 in the last filing) and the estimation of a trend factor. While the categorization of expenses is handled somewhat differently from insurer to insurer, the data is consistent with financial information produced for other regulatory purposes. Further, the expense trend factor is a weighted average of several different trend factors, making the calculations appear more involved than they actually are. Most of the trend, however, arises from anticipated changes in average weekly earnings for insurance company employees. Historical values produced by the Bureau of Labor Statistics are displayed on Slide 19 along with the WCRIB projection. Additional information on expenses is displayed on Slides 18 and 20.

There is one type of expense which more properly belongs in a discussion of the estimation of losses: loss adjustment expense. The basic approach to estimating this type of expense, however, is similar to that used for variable expenses. While other types of variable expenses are measured relative to premiums, loss adjustment expenses (which cover the costs directly associated with the settlement of claims) are measured relative to losses. As a result, these expenses are translated into a loading factor of 1.20 (+20%) that is applied to losses excluding loss adjustment expenses.

Estimating Underwriting Profit

While the loading for underwriting profit appears superficially to be another variable expense, it is in practice estimated based on a much different approach. Specifically, the WCRIB uses a model that calculates a profit provision implying the following condition:

Present Value (Premiums) = Present Value (Losses + Expenses + Dividends + Federal Income Taxes)

The resulting profit provision is a negative value (specifically -4.2%) because insurers on average collect premiums well before they pay out losses and expenses, allowing them to earn investment income. Incremental quarterly cash flows for premiums and losses are displayed on Slide 22. The specific model used in the filing assumes that insurance companies invest in risk-free instruments (Treasury bills and bonds) but also allows insurers to be compensated for the underwriting risk associated with insurance. While the details of the model are difficult to explain briefly, it is important to note that the same basic model has been used in the determination of workers' compensation rates in Massachusetts for many years.

Sensitivity of Indicated Rate Changes to Factors

Measuring the sensitivity of the indicated rate change to the various factors that determine it is in some ways a difficult exercise. While a small percentage change in the premium on-level factor has a large effect on the rate change, for example, there is generally very little dispute about how this factor should be calculated. As a result, the indicated rate change is in practice not sensitive to this factor. Loss trend factors, on the other hand, have a significant effect on rates and are subject to a fair amount of judgement. As a result, the indicated rate change is quite sensitive to this factor. For the purpose of this document, however, the following table uses as a measure of sensitivity the effect on the indicated rate change of a 1% increase in a given factor (for example, an increase from 3.00 to 3.03). Because the WCRIB prepares two separate indications (one based on AY94 and one on PY93), we have applied the changes to both indications at once in determining the effect on the rate change. The results should be interpreted with caution.

Sensitivity of Indicated Rate Change to a 1% Increase in Factors

Factor	Effect on Rate Change
Loss Development Factor: Indemnity	+0.28%
Loss Development Factor: Medical	+0.14%
Adjustment for Escalated Benefits	+0.28%
Benefit Level Factor	+0.81%
Law Amendment Factor	+0.81%
Loss Trend Factor	+0.81%
Loss Adjustment Expense Factor	+0.81%
Expense Trend Factor	+0.08%
Premium Development Factor	-0.88%
Premium On-Level Factor	-0.88%
Payroll Trend Factor	-0.88%
Variable Expense Ratio (+1% additive)	+0.99%

Classification Ratemaking

The basic idea behind classification ratemaking is to reflect classification information to the extent reasonable and to rely on other information to the extent necessary. The WCRIB filing uses three years of individual class data in its calculations, but most classifications still have insufficient experience to rely on completely.

The easiest way to understand the current procedure is through review of an example. As shown on Slide 25, the procedure begins with a calculation of separate pure premiums for serious, non-serious, and medical claims. Individual claims in the data are capped at $200,000 to obtain **primary** losses; development and benefit level factors are applied as above in order to place all three years of data on a consistent basis. Because each classification has some potential for larger losses, however, an **excess factor** is applied to the primary losses to obtain expected total losses. Payroll is also adjusted in order to place all three years on a consistent basis. Adjusted three-year losses are then divided by adjusted three-year premiums in order to obtain Massachusetts pure premiums for the classification.

As shown on Slide 26, these Massachusetts pure premiums are then weighted with two other quantities: countrywide pure premium for the class (generally as estimated by the NCCI) and the pure premiums underlying the current rates. The weighted average of these three quantities is referred to as **formula pure premium**. In general, the larger the

volume of data in a classification, the more weight it will receive and the less weight will be applied to the other two quantities.

Finally, as shown on Slide 27, the formula pure premiums for all three types of claims (serious, non-serious, medical) are summed and then converted to an average rate through application of a **rate factor**, which essentially loads the pure premium for expenses and profit. This average rate is then converted to a manual rate after considering the effects of merit rating, ARAP, the construction credit program, and other discount and surcharge programs. Final rates are subject to a variety of caps, although none apply in the example.

Appendix: Algebra of Basic Ratemaking Formula

Let L = future losses
     F = future fixed expenses
     P = future premium with no rate change
     V = the ratio of variable expenses to premium
and C = indicated percentage change in premium.

The "break-even" premium P_2 can be defined as the premium that will provide just enough to cover losses (L), fixed expenses (F), and variable expenses (V times P_2). In algebraic terms:

$$P_2 = L + F + (V \times P_2).$$

Some algebraic manipulation of this formula yields:

$$P_2 = (L + F) / (1 - V).$$

Since $C = (P_2 / P) - 1$ by definition, we can then substitute the above formula to obtain:

$$C = \{[(L + F) / (1 - V)]\} / P - 1,$$

which can be rearranged to yield:

$$C = \{[(L + F) / P] / (1 - V)\} - 1.$$

This formula is equivalent to the $C = (1 / A) - 1$ formula on Slide 3.

Calculation of WCRIB Indicated Rate Change
Filing for 7/1/96 Effective Date

	PY93 Data	AY94 Data
1A) Industry Paid Indemnity Losses at 1st Report	105,706,758	48,626,644
1B) Paid Loss Development Factor	3.306	6.868
1C) Adjustment for Escalated Benefits	1.059	1.059
1D) Implied Ultimate Indemnity Losses (1A) x (1B) x (1C)	370,049,011	353,686,687
2A) Industry Paid Medical Losses at 1st Report	89,214,599	47,473,976
2B) Paid Loss Development Factor	2.010	3.586
2C) Implied Ultimate Medical Losses (2A) x (2B)	179,361,248	170,232,834
3A) Industry Case Incurred Indemnity Losses at 1st Report	230,810,862	162,985,850
3B) Case Incurred Loss Development Factor	1.494	1.905
3C) Adjustment for Escalated Benefits	1.040	1.040
3D) Implied Ultimate Indemnity Losses (3A) x (3B) x (3C)	358,697,550	322,829,068
4A) Industry Case Incurred Medical Losses at 1st Report	142,974,392	114,695,608
4B) Case Incurred Loss Development Factor	1.215	1.406
4C) Implied Ultimate Medical Losses (4A) x (4B)	173,713,151	161,230,806
5A) Average Ultimate Indemnity Losses [(1D) + (3D)] / 2	364,373,280	338,257,877
5B) Average Ultimate Medical Losses [(2C) + (4C)] / 2	176,537,200	165,731,820
5C) Average Ultimate Total Losses (5A) + (5B)	540,910,480	503,989,697

Calculation of WCRIB Indicated Rate Change
Filing for 7/1/96 Effective Date

5C) Average Ultimate Total Losses from Page 1	540,910,480	503,989,697
6A) Benefit Level Factor to 1/1/95	1.009	1.004
6B) Law Amendment Factor	1.017	1.017
6C) Loss Trend Factor to 7/1/97	1.298	1.254
6D) Factor to Adjust for Large Deductible Policies	0.988	0.988
6E) Loss Adjustment Expense Factor	1.200	1.200
6D) Trended Ultimate Losses (5C) x (6A) x (6B) x (6C) x (6D) x (6E)	**854,181,966**	**765,089,165** [L]
7A) Fixed Expenses	61,380,930	60,547,670
7B) Expense Trend Factor	1.252	1.224
7C) Trended Fixed Expenses	**76,848,924**	**74,110,348** [F]
8A) Standard Earned Premium plus ARAP Premium at 1st Report	1,356,684,328	1,241,283,812
8B) Adjustments for Various Offbalances and Insolvency Fund	0.937	1.007
8C) Premium Development Factor	1.012	1.000
8D) Premium Level Factor to 1/1/95	0.742	0.781
8E) Payroll Trend Factor to 7/1/97	1.139	1.121
8F) Trended Ultimate Premium (8A) x (8B) x (8C) x (8D) x (8E)	**1,087,435,144**	**1,094,125,243** [P]
9A) Acquisition and Field Supervision Expense Ratio	5.4%	5.4%
9B) Premium Tax Ratio	2.2%	2.2%
9C) Premium Discount	5.5%	5.5%
9D) Underwriting Profit Provision	-4.2%	-4.2%
9D) Variable Expense Ratio including Profit (9A) + (9B) + (9C) + (9D)	**8.9%**	**8.9%** [V]
10) Indicated Loss and Fixed Expense Ratio [(6D) + (7C)] / (8F)	**85.6%**	**76.7%** [I]
11) Allowable Loss and Fixed Expense Ratio [1 - (9D)]	**91.1%**	**91.1%** [A]
12) Indicated Rate Change [(10) / (11)] - 1	**-6.0%**	**-15.8%** [C]

Workers' Compensation Ratemaking Concepts

Presented to the Massachusetts Workers'
Compensation Advisory Council

April 9, 1997

Ernst & Young LLP

Basic Ratemaking Formula

L = Losses in effective period

F = Fixed expenses in effective period

P = Premium in effective period (if no rate change)

V = Variable expenses in effective period as a % of premium

I = Indicated ratio in effective period = $(L + F) / P$

A = Allowable ratio in effective period = $1 - V$

C = Rate change = $(I / A) - 1$

Note: V includes underwriting profit provision

Basic Ratemaking Formula: Numerical Example

L = $ 69.93

F = $ 6.77

P = $100.00

V = 8.9%

$$I = (69.93 + 6.77) / 100$$
$$= 76.7\%$$

$$A = 1 - 8.9\%$$
$$= 91.1\%$$

$$C = (76.7 / 91.1) - 1$$
$$= -15.8\%$$

Key Ratemaking Concepts

- Loss and Premium/Payroll Development and Trend

- Law Amendment and On-Level Factors

- Fixed and Variable Expenses

- Profit Loading

- Other Adjustments

Development and Trend:
Industry Indemnity Paid Losses ($M)

Evaluation Date ("Report")

| AY	1st	2nd	3rd	4th	5th
90	141	415	618	739	801
91	117	324	479	565	
92	69	182	260		
93	57	151			
94	49				

Development and Trend:

Paid Loss Development Factors ("Link Ratios")

Evaluation Dates

AY	1st - 2nd	2nd - 3rd	3rd - 4th	4th - 5th
90	2.94	1.49	1.20	1.08
91	2.77	1.48	1.18	
92	2.64	1.43		
93	2.65			

Development and Trend: Causes

- Processing lags

- Changes in company procedures

- Premium audits (standard + ARAP)

- Emerging medical information

- Changes in claim frequency/severity

Development and Trend: Illustration (Industry Indemnity)
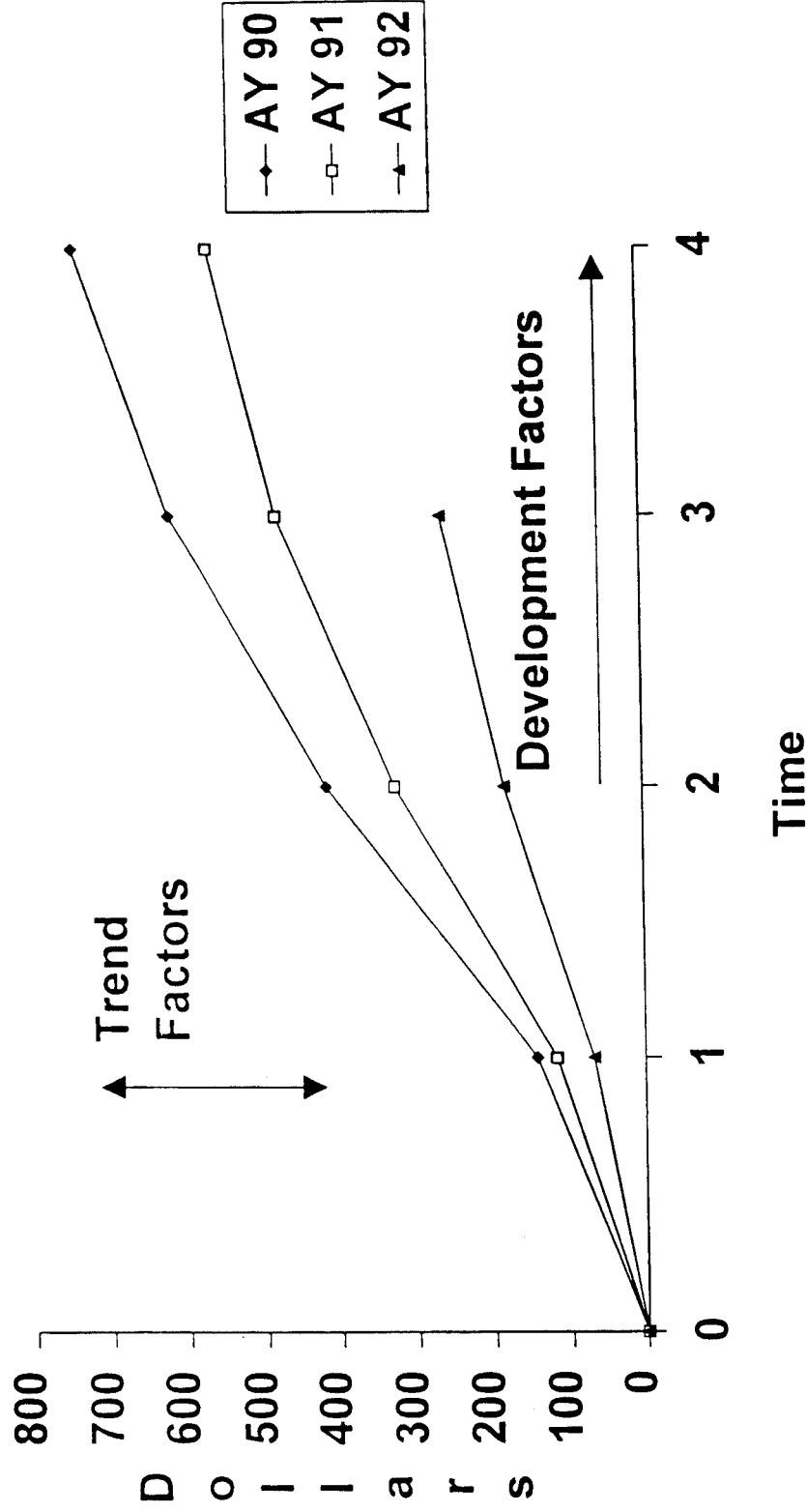
Loss and premium development factors based on two-year averages

Development:
Effect of Changes in Mix (Hypothetical Values)

Evaluation Date ("Report")

Co #1		
AY	1st	2nd
90	100	150
91	150	225

DF = 1.5

Co #2	
1st	2nd
100	180
50	90

DF = 1.8

Total	
1st	2nd
200	330
200	315

DF = ???

Development:
Benefits Escalation

- Escalation began 12/23/91 under c. 398 and 10/01/86 under c. 572

- Loss development factors calculated for older years do not completely reflect future development attributable to escalation

- Adjustment of +5.9% applied to AY94 data and +4.0% to PY93 data

Loss and Payroll Trend

- WCRIB estimates payroll trend and "net trend", then calculates loss trend

- Last selected estimate of annual net trend (7/96 filing) was 3.8% for indemnity/medical combined

- Selected estimates were based on data prior to c. 572 and c. 398, NCCI estimates for fee schedule states, and an econometric model

- Estimates were calculated separately by injury type and weighted to determine overall estimates
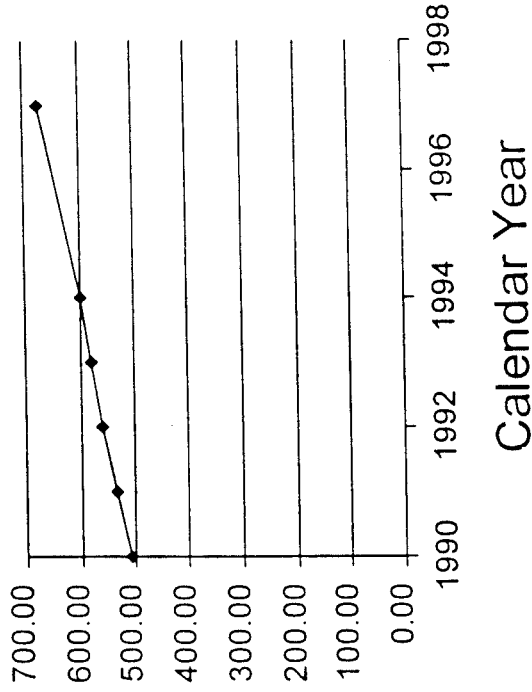
Payroll Trend

State Average
Weekly Wage

Payroll trend factor =
projected SAWW
divided by
experience period SAWW

SAWW for AY94 = $599.44

Projected SAWW = $672.07

Factor = 1.121

Calendar Year

1990 1992 1994 1996 1998

0.00 100.00 200.00 300.00 400.00 500.00 600.00 700.00

Loss Trend: Example

- Annual net trend of 3.8% implies a net trend factor of 1.118 from 7/1/94 (midpoint of AY94) to 7/1/97 (midpoint of PY96/97)

- Payroll trend factor for same period is 1.121

- Implied loss trend factor for the same period is the product of 1.118 and 1.121, or 1.254

Law Amendment Factor

- Reflects benefit level changes subsequent to evaluation date of losses used in calculation (12/31/94)

- Minor changes occurred or will occur at 2/1/95, 10/1/95, 10/1/96, and 10/1/97

- Changes at 10/1/XX are solely due to increases in state average weekly wage

- Cumulative effect is to increase losses by factor of 1.017 (+1.7%)

Benefit Level Factors

- Similar to law amendment factor

- Reflect benefit changes between beginning of experience periods (PY93 as of 1/1/93 and AY94 as of 1/1/94) and 12/31/94

- Increase PY93 losses by 0.9% and AY94 losses by 0.4%

Premium On-Level Factors

- Reflect effects that subsequent rate changes would have had on premiums for PY93 and AY94

- Include rate changes listed at right

- Reduce PY93 premiums by 25.8% and AY94 premiums -21.9%

Recent Rate Changes

|	
1/1/93:	+6.24%
1/1/94:	-10.20%
1/1/95:	-16.50%

Premium On-Level Factor:
PY93 Example

- Average rate 12/31/92: $100.00 (illustrative)
- Average rate 1/1/93: $106.24 (effective all of PY93)
- Average rate 1/1/95: $ 79.66 (product of changes)

- "Current" rate of $79.66 = 0.750 x average rate in PY93

- Effect of expense constants reduces ratio to 0.742

Fixed Expenses

- Loading in rates based on fixed expenses from 1992-94 trended to appropriate date

- Trend factors based on weighted average of several indices produced by Bureau of Labor Statistics

- Projected annual expense trend equals 6-7%

- Estimated fixed expenses equal about $75 million for PY96/97, or about 7.8% of WCRIB indicated premiums for the same period

Trend in Average Weekly Earnings: Fire, Marine, and Casualty Insurers

Projected Index

700
600
500
400
300
200
100
0

1980   1985   1990   1995   2000

Ernst & Young LLP
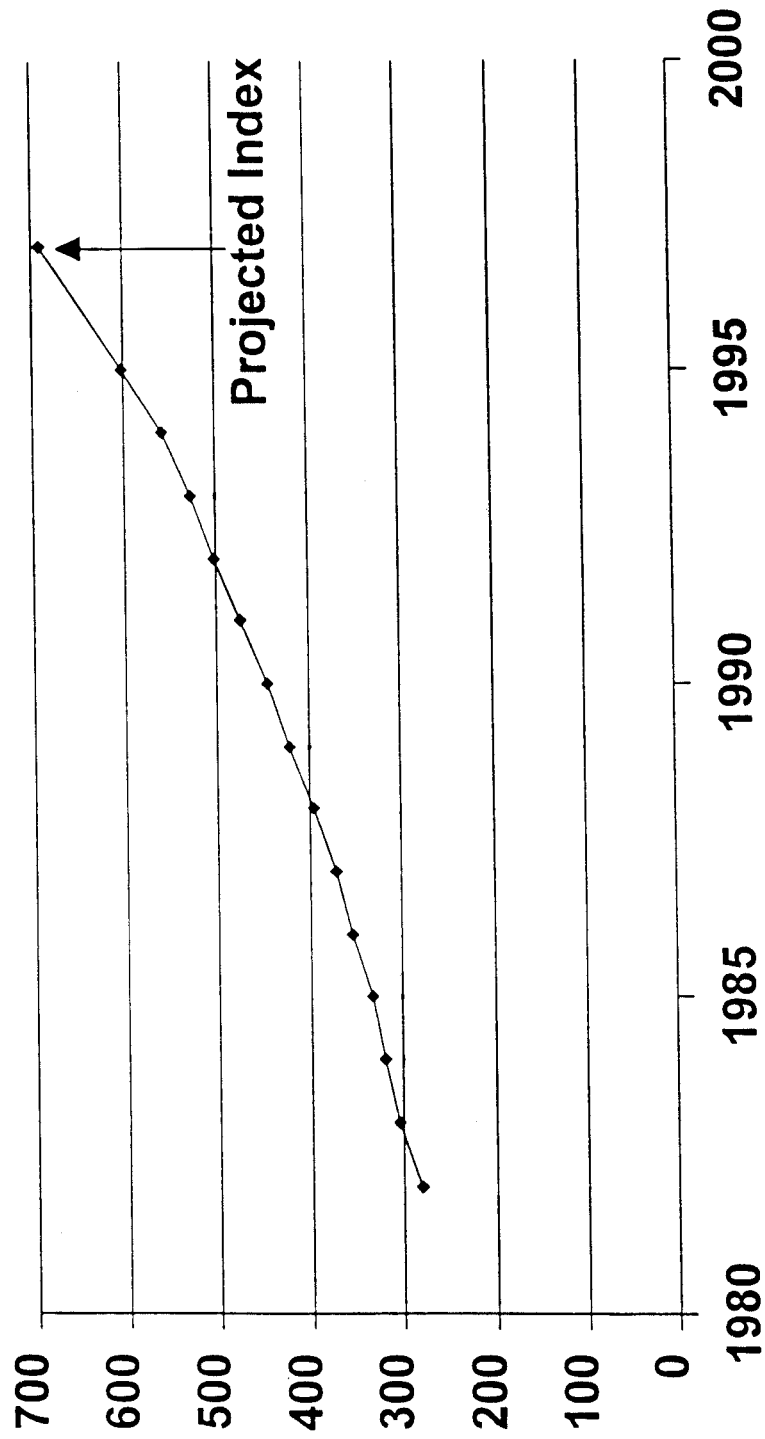
Variable Expenses
(Primarily Based on 1992-94 Data)

Type of "Expense"	% of Premium
Commission	3.8%
Other Acquisition	1.6%
Premium Taxes	2.2%
Premium Discount	5.5%
Loss Adj Expense*	20.0%

*As a percent of losses

Underwriting Profit

- Model sets profit provision so that present value of premiums equals present value of losses, expenses, policyholder dividends, and federal income taxes

- Reflects investment income at risk-free rates (Treasury bills and bonds)

- Includes adjustments for underwriting risk

- Rates do not includes provision for policyholder dividends (c. 398 requirement)

- Indicated profit provision is -4.2% of premium

Premium and Loss Cash Flows
First Five Years

Prem
Loss

%of Ultimate

Quarter

25.0% 20.0% 15.0% 10.0% 5.0% 0.0%

0   5   10   15   20
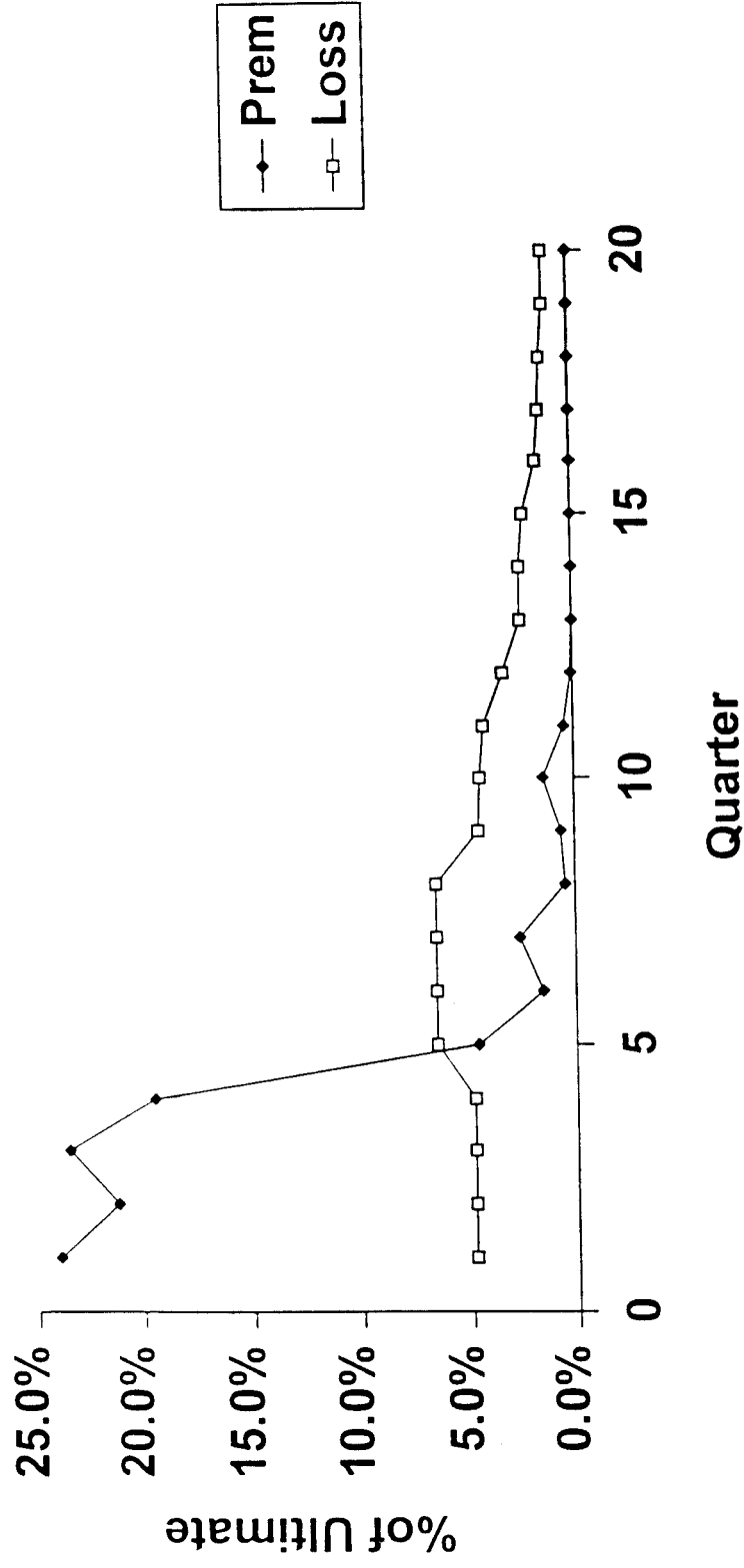
Other Adjustments

- Expense Constants
- Premium Discounts
- Large Deductible Policies
- Experience Rating
- Change in ARAP Offset
- Change in Construction Credit Offset
- Insolvency Fund Recoupment Loading

Ernst & Young LLP

Classification Rates

- Based on three years of data

- Certain calculations done separately by industry group, injury type, hazard group

- Actual large losses capped at $200,000; expected large losses loaded with factor

- Procedure gives weight to MA data, countrywide data, and existing rates

Classification Example

Class 5222 (Concrete Construction: Bridges/Culverts)

	Serious	NonSerious	Medical
Primary Ult Loss	1,408,120	231,379	439,158
XS Factor	1.0871	1.0048	1.1010
Exp Total Loss	1,530,767	232,490	483,513
Payroll	17,244,211	17,244,211	17,244,211
MA Pure Prem	8.88	1.35	2.80

Classification Example Continued

	Serious	NonSerious	Medical
MA Pure Premium	$8.88	$1.35	$2.80
Credibility Weight	26%	63%	63%
CW Pure Premium	$12.28	$2.65	$4.31
Credibility Weight	37%	19%	19%
Current Pure Premium	$11.62	$1.74	$2.88
Credibility Weight	37%	18%	18%
Formula Pure Premium	$11.15	$1.67	$3.10

Classification Example Continued

Formula Pure Premium	$15.92
Rate Factor	1.302
Average Rate	$20.73
Offset Factors*	1.051
Manual Rate	$19.72

*Includes offsets for merit rating, ARAP, etc. See p. 1031R.

Young LLP

Massachusetts Workers' Compensation Rates
Losses and Profits

Introduction

While the calculation of indicated rate changes for Massachusetts workers' compensation rates is a detailed process with many components, two of its most important underlying elements are the estimation of future losses (which primarily depend on benefit structure, utilization of benefits, and inflation in medical costs) and the determination of a corresponding underwriting profit provision. While the calculation of the underwriting profit provision also depends on many other values (expenses, tax rates, and interest rates, for example), it has a strong relationship to estimated losses and in particular to the timing of those losses.

After the fact, however, actual losses will never be identical to estimated losses. As a result, actually realized profits will differ from what the profits intended in the rate calculation. Further complicating matters is the fact that after-the-fact profits can be measured in multiple ways.

In the rest of this document, we:

1) describe some of the phenomena affecting the estimation of losses,
2) explain the derivation of the underwriting profit provision in rates,
3) discuss several different measures of after-the-fact profit, and
4) show how changes in benefit levels and inflation can affect after-the-fact profit.

Estimating Losses

When rates are determined, the losses that will occur in the future are not yet known; they must be estimated. The approach used by the WCRIB, like most actuarial approaches, starts with past losses and projects them forward based on historical patterns. These historical patterns are of two types: loss development and trend. Loss development refers to the change over time of the losses corresponding to a fixed set of claims in a given experience period, for example, all claims arising from workplace accidents in 1994 ("accident year 1994"). Losses corresponding to a fixed set of claims tend to grow over time for several reasons: lags in reporting claims to the insurer, new medical information coming to light, changes in the procedures used by the insurer to pay or reserve claims, and the accumulation of indemnity payments.

Slide 1 illustrates in a triangular format how paid indemnity losses for the Massachusetts workers' compensation insurance industry have grown for claims in accident years 1990

through 1994. The "report" periods across the top of the exhibits indicate how long has elapsed since the beginning of the accident year. Each report occurs at 12-month intervals. For example, accident year 1990 at first report is being evaluated as of 12/31/90, at second report as of 12/31/91, and so on.

While the WCRIB uses more than one estimate of future losses in its rate filing, we focus in this document solely on how paid losses behave since it is the timing of loss payments that dictates how long insurers will be able to hold and invest the cash arising from premiums. For purposes of illustrating some of the phenomena that affect loss payments, we have built two models of past incremental loss payments for the entire Massachusetts workers' compensation industry, one for indemnity losses and one for medical losses. These models are based on several items: payroll, benefit levels and structure, and wage and medical inflation.

The basic components of the indemnity model are as follows:

1) payment patterns for losses as if they were unaffected by inflation or payroll changes, with a different pattern for each of the three periods affected by significantly different benefit structures (1978-86, 1987-91, and 1992-94);

2) a past inflation index for each calendar year based on changes in the state average weekly wage; and

3) a constant for each year based on payroll.

For example, the payment pattern for accident year 1991 indemnity losses is:

16% in first year,
28% in second year,
20% in third year,
12% in fourth year,
8% in fifth year,
5% in sixth year,

with the remaining 11% spread out over nineteen more years.

The wage inflation index for the first few years after 1979 is:

1979   1.000
1980   1.093
1981   1.205
1981   1.307
1982   1.396

and so on for more recent years, with each year's index equal to the previous year's value times the change in the state average weekly wage for the year.

The estimate of paid losses for any combination of accident year and calendar year (e.g., accident year 1991 losses paid in 1994) is then given by the following formula:

Paid loss = Constant x appropriate payment percentage x appropriate inflation factor.

For accident year 1991 indemnity loss payments in 1994, for example, the estimated loss using this model equals:

	Constant:	$431M
x	Payment Percentage:	12%
x	Inflation Factor:	2.497
=	Estimated Incremental Loss:	$129M

We can then accumulate all of the estimated incremental loss payments to obtain estimates of cumulative loss payments.

The basic components of the medical model are almost identical to those of the indemnity model, except that we have used medical cost inflation instead of wage inflation. Further, the constants and payment percentages are of course somewhat different from those for indemnity losses.

Calculating the Underwriting Profit Provision

In its rate recommendation, the WCRIB uses a profit provision expressed as a percentage of premium (specifically, -4.2% in the most recent filing). This percentage is obtained using a formula that satisfies the following condition:

Present Value (Premiums) = Present Value (Losses + Expenses + Dividends + Federal Income Taxes).

The resulting profit provision is a negative value because insurers on average collect premiums well before they pay out losses and expenses, allowing them to earn investment income. The specific model used in the filing assumes that insurance companies invest in risk-free instruments (Treasury bills and bonds), that they hold a gradually decreasing amount of surplus to cover losses greater than expected, and that they should be compensated for the underwriting risk associated with being in the insurance business. The same basic model has been used in the determination of Massachusetts workers' compensation rates for many years.

In order to illustrate the basic idea behind this formula, suppose that expenses, dividends, and federal income taxes are all zero. (In practice, all of these items have significant effects, but we ignore them here for the purpose of this explanation.) In this case, the above condition becomes:

$$\text{Present Value (Premiums)} = \text{Present Value (Losses)}.$$

Suppose as well that all premiums are collected immediately but that losses are paid over the course of the next three years: 50% one year from now, 30% two years from now, and 20% three years from now. Finally, suppose that the interest rate appropriate for use in the calculation is 3%. In this case, the present value of losses equals:

$$\frac{50\%}{1.03} \quad + \quad \frac{30\%}{(1.03 \times 1.03)} \quad + \quad \frac{20\%}{(1.03 \times 1.03 \times 1.03)}$$

or 95.12% of ultimate losses. In other words, for every $100.00 of losses, we only need to charge $95.12 in premiums in order to satisfy the condition above. We can now calculate the underwriting profit corresponding to these premiums and losses as follows:

Underwriting Profit	=	Premiums	-	Ultimate Losses
	=	$95.12	-	$100.00
	=	-$ 4.88		
	=	-5.1% of premium.		

The underwriting profit provision in this extremely simplified case is -5.1% of premium.

As noted above, the actual calculation of the profit provision depends on many other items: expenses, dividends, federal income taxes, actual interest rates, the appropriate amount of surplus to be held by insurers, and the appropriate compensation for the risk of being in the insurance business. Further, the cash flows do not extend over three years, as in the simple example above; they extend for more than fifty years, although the dollars involved eventually get very small. For example, the WCRIB's most recent calculation of profit provisions assumed that losses for the policy period beginning 7/1/96 would be paid out in the percentages displayed in the table on the next page.

Payment Period	Percentage Paid
7/1/96-6/30/97	19.2%
7/1/97-6/30/98	26.2%
7/1/98-6/30/99	16.4%
7/1/99-6/30/00	8.8%
7/1/00-6/30/01	5.3%
7/1/01-6/30/02	3.5%
7/1/02-6/30/03	2.8%
7/1/03-6/30/04	1.8%
7/1/04-6/30/05	1.9%
7/1/05-6/30/06	1.2%
7/1/06-6/30/07	0.8%
7/1/07-6/30/08	0.9%
7/1/08-6/30/09	0.9%
7/1/09-6/30/10	0.9%
7/1/10-6/30/11	1.0%
7/1/11-ultimate	8.4%
Total	100.0%

In broad terms, however, all of these items can be captured by appropriate measurement of cash inflows and outflows along with the determination of appropriate interest rates. As a result, the simple example above will suffice for most of the rest of this document.

Measuring After-The-Fact Profit

Suppose an insurance company begins operating on 1/1/97 and writes a sufficient number of policies on that day so that it expects to pay out $100 million in ultimate losses on those policies. If we remain consistent with the simple example above, then the company will collect $95,120,000 in premium on 1/1/97 and pay out the losses in three pieces: $50 million on 12/31/97, $30 million on 12/31/98, and $20 million on 12/31/99. Finally, suppose as well that the company begins its operations with $50 million in assets. What is the company's profit in 1997?

Depending on the purpose of its measurement, profit can be calculated several different ways: excluding or including investment income, before or after taxes, and so on. In the remainder of this section, we calculate profit four different ways:

1) excluding investment income but before taxes ("underwriting profit"),
2) including investment income but before taxes ("pre-tax statutory net income"),
3) as calculated by the IRS for tax purposes ("taxable net income"), and

4) including investment income and after taxes ("after-tax statutory net income").

Underwriting profit is defined simply as earned premiums minus incurred losses and expenses. Incurred losses are in turn defined as the total of loss payments and changes in loss reserves during the year.

Earned premiums	=	$ 95,120,000
Paid losses	=	$ 50,000,000
Year-end reserves	=	$ 50,000,000 (remaining payments of $30M and $20M)
Beginning reserves	=	$ 0 (company started 1/1/97)
Incurred losses	=	$100,000,000 ($50M plus $50M minus $0)
Incurred expenses	=	$ 0 (no expenses in this example)
Underwriting profit	=	-$ 4,880,000 (premiums minus incurred losses)

Pre-tax statutory net income is defined as underwriting profit plus investment income. If we assume that the company made 5% on its invested assets (higher than the 3% value used in discounting the losses; the 2% difference can be thought of as the compensation for the risk of being in the insurance business), then we obtain the following result.

Underwriting profit	=	-$4,880,000 (from above)
Investment income on initial assets	=	$2,500,000 (5% of $50,000,000)
Investment income on invested premiums	=	$4,756,000 (5% of $95,120,000)
Pre-tax statutory net income	=	$2,376,000

Taxable income as calculated by the IRS includes the difference between premiums and discounted incurred losses (incorporating the change in discounted reserves rather than the change in undiscounted reserves) as well as investment income. Discount factors are published annually by the IRS, but for our example we will use a factor consistent with the 5% interest rate and ignore the fact that premiums would be different in the presence of taxes. The calculation is as follows.

Earned premiums	=	$ 95,120,000
Paid losses	=	$ 50,000,000
Year-end reserves	=	$ 46,712,000 (discounted remaining payments)
Beginning reserves	=	$ 0 (company started 1/1/97)
Incurred losses	=	$ 96,712,000 ($50M plus $46.7M minus $0)
Incurred expenses	=	$ 0 (no expenses in this example)
Underwriting profit	=	-$ 1,592,000 (premiums minus incurred losses)
Investment income	=	$ 7,256,000 (from above)
Taxable net income	=	$ 5,664,000

The federal tax rate applied to insurance companies is 35%. As a result, we can calculate taxes as 35% of taxable net income, or $1,982,400. This leads to the fourth calculation of profit.

Pre-tax statutory net income	=	$2,376,000 (from above)
Federal income tax	=	$1,982,400 (35% of taxable net income)
After-tax statutory net income	=	$ 393,600

We can now summarize the four profit calculations.

Underwriting profit	=	-$ 4,880,000
Pre-tax statutory net income	=	$2,376,000
Taxable net income	=	$5,664,000
After-tax statutory net income	=	$ 393,600

As the summary indicates, "profit" can mean many things. As a result, any statement concerning insurance company profits should be interpreted with caution, at least until the source of the underlying numbers is specified precisely.

The Effect of Loss Reserve Revisions

All four profit measures above presumed that future loss payments were known precisely and that year-end reserves were therefore accurate. In practice, however, reserves are constantly revised since estimates of future loss payments constantly change. These revisions can be substantial when, for example, a significant benefit change occurs. The effects of such a change can be very hard to predict, particularly if it tends to affect more severe claims, and it may be several years before a company's reserve estimates fully reflect the effect of the change. According to the insurance accounting rules, however, these revisions in estimates increase profit (however measured) if the revisions are downward and decrease profit if the revisions are upward.

The table on the next page illustrates the calculation of underwriting profit in 1997 and 1998 under two situations. In the first case, the company estimates its year-end 1997 and year-end 1998 reserves perfectly. In the second case, the company's estimate of year-end 1997 reserves is $10 million too high, but the estimate of year-end 1998 reserves is accurate.

	Case 1		Case 2	
	1997	1998	1997	1998
Earned premiums	$95,120,000	$0	$95,120,000	$0
Paid losses	$50,000,000	$30,000,000	$50,000,000	$30,000,000
Year-end reserves	$50,000,000	$20,000,000	$60,000,000	$20,000,000
Beginning reserves	$0	$50,000,000	$0	$60,000,000
Incurred losses	$100,000,000	$0	$110,000,000	-$10,000,000
Underwriting profit	-$4,880,000	$0	-$14,880,000	$10,000,000

For the two years combined, underwriting profit is the same in both cases, but the timing between the two years is different since the over-reserving in Case 2 is corrected in 1998.

Sensitivity of After-the-Fact Profits

Using the loss models described earlier, we can measure the sensitivity of profits to changes in some of the phenomena affecting losses. For example, a permanent 1% increase in the inflation rate has the effect of increasing next year's loss payments by about 1%, those in the following year by about 2%, and so on. As a result, the longer that it takes payments to be made, the bigger the potential effect of a change in the inflation rate. Using the models we have developed, we estimate that a permanent 1% increase in the inflation rate has the effect of increasing losses by about 5%. Since the last WCRIB profit provision was about -4.2%, this change would have the effect of generating an underwriting profit of about -9.4%, or more than double the originally anticipated value.

Similarly, we can estimate the effect of a permanent 1% increase in effective benefit level (through, for example, a 1% increase in claims frequency). In this case, losses would presumably rise by about 1%, which would have the effect of changing the after-the-fact underwriting profit to about -5.3% from the originally anticipated -4.2%.

Workers' Compensation Losses and Profits

Presented to the Massachusetts Workers'
Compensation Advisory Council

July 9, 1997

Ernst & Young LLP

Phenomena Affecting Losses

- Payroll
- Benefit Level
- Benefit Structure (Payment Pattern)
- Wage and Medical Inflation

Actual Industry Paid Losses ($M)

Indemnity

AY	1st	2nd	3rd	4th	5th
90	141	415	618	739	801
91	117	324	479	565	
92	69	182	260		
93	57	151			
94	49				

Medical

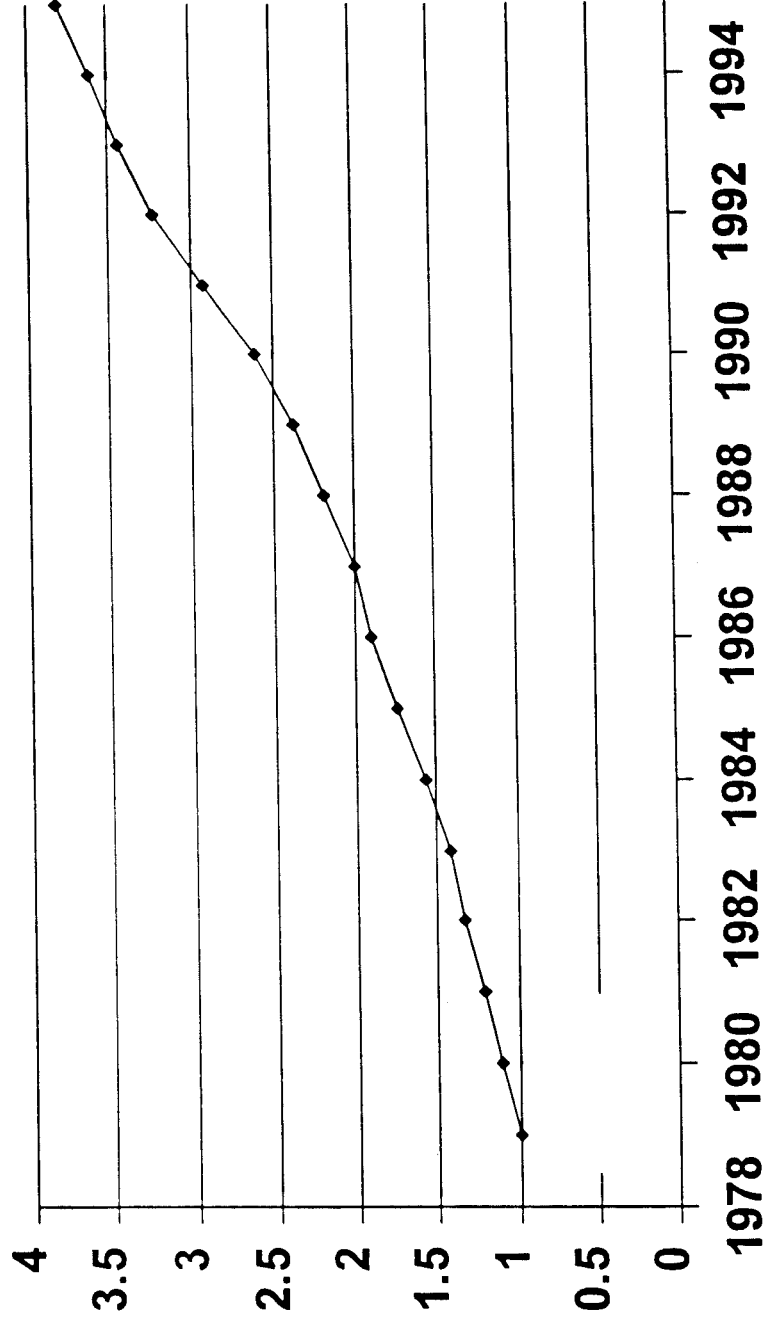|	1st	2nd	3rd	4th	5th
	74	168	206	224	233
	71	158	189	203	
	60	125	145		
	56	112			
	47				

Benefit Levels and Structures

- Major changes occurred in late 1986 and late 1991

- Both changes increased medical

- 1991 change reduced indemnity to 60% of SAWW from 66-2/3%

- 1991 changes reduced length of time most indemnity benefits would be paid

State Average Weekly Wage Index
(1979 = 1.00)
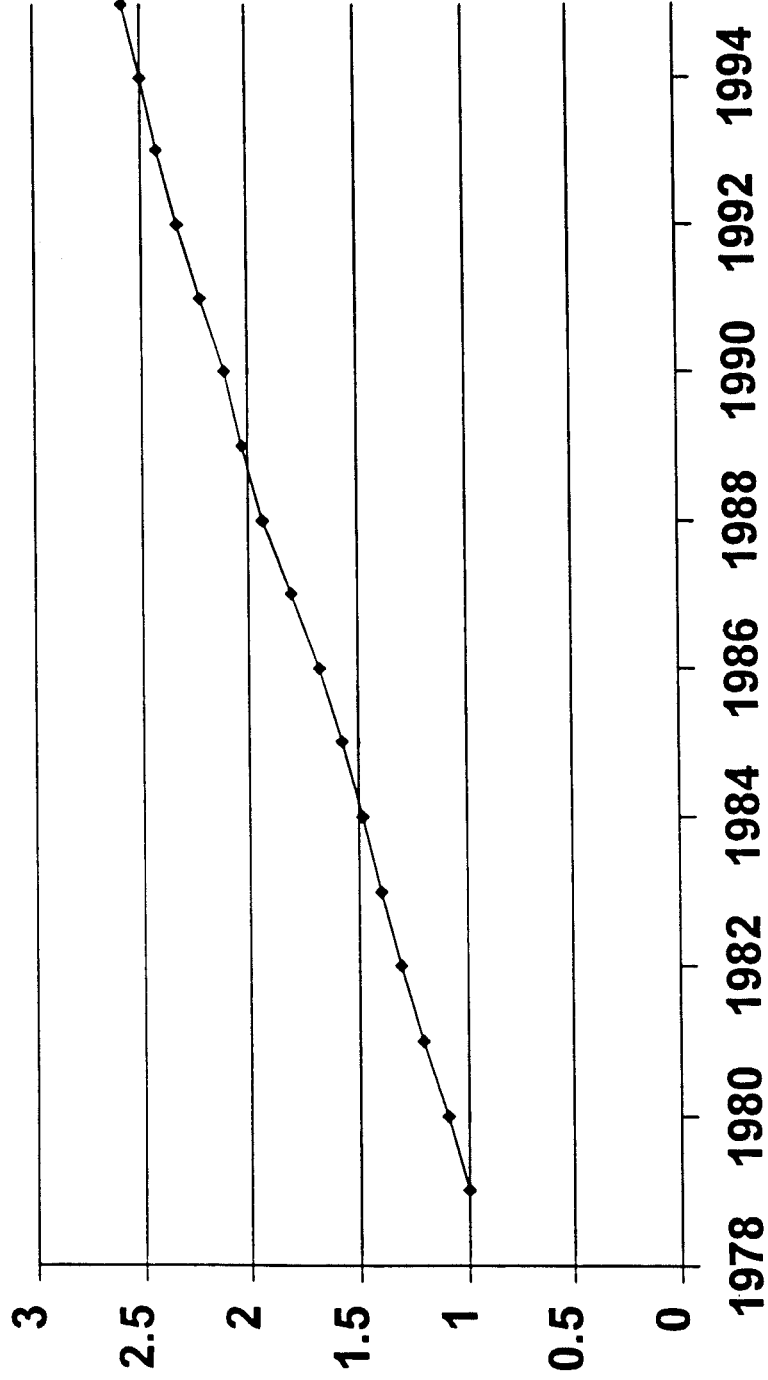
Boston Medical Care Index
(1979 = 1.00)

Modeled Industry Paid Losses ($M)

Indemnity

AY	1st	2nd	3rd	4th	5th
90	136	385	573	690	765
91	153	432	641	770	
92	51	147	223		
93	57	162			
94	59				

Medical

	1st	2nd	3rd	4th	5th
	51	122	153	172	183
	61	145	181	201	
	73	171	212		
	83	193			
	87				

Underwriting Profit

- Model sets profit provision so that present value of premiums equals present value of losses, expenses, policyholder dividends, and federal income taxes

- Reflects investment income at risk-free rates (Treasury bills and bonds)

- Includes adjustments for underwriting risk

- Rates do <u>not</u> include provision for policyholder dividends (c. 398 requirement)

- Indicated profit provision is -4.2% of premium

Underwriting Profit: Simplified

- No expenses, dividends, or taxes; $100M in losses

- Premiums collected immediately

- 50% of losses paid one year later

- 30% of losses paid two years later

- 20% of losses paid three years later

- Appropriate interest rate of 3%

- Initial assets of $50M

Underwriting Profit: Simplified

- Present value of premiums equals present value of losses

  = $50M / 1.03 + $30M / (1.03^2) + $20M / (1.03^3)

  = $48.54M + $28.28M + $18.30M

  = $95.12M

- Charge $95.12 of premiums for each $100.00 of losses

- Underwriting profit equals premiums minus losses

  = $95.12 - $100.00

  = -$ 4.88, or -5.1% of premium

After-the-Fact Profit: Four Measures

- Underwriting profit

  – excludes investment income; before taxes

- Pre-tax net income

  – includes investment income; before taxes

- Taxable net income (as calculated by IRS)

- After-tax net income

  – includes investment income; after taxes

Underwriting Profit and Pre-Tax Net Income

- Premiums = $ 95.12M
- Incurred losses = $100.00M
- * Underwriting profit = -$ 4.88M

- Investment income on assets = $ 2.50M
- Investment income on prem = $ 4.76M
- * Pre-tax net income = $ 2.38M

Taxable Net Income and After-Tax Net Income

- Taxable underwriting profit = -$1.59M
- Investment income = $7.26M
- * Taxable net income = $5.67M

- Pre-tax net income = $2.38M
- Federal income taxes (35%) = $1.98M
- * After-tax net income = $0.40M

Effect of Reserve Revisions

- Calendar year incurred losses

  = paid losses + ending reserve - beginning reserve

- Subsequent correction of overstated reserve shifts underwriting income into correction year

- Reserve adequacy lags benefit changes

Sensitivity of Profits to Change in Inflation Rate

- Initial loss equals $104.20

- Initial premium equals $100.00

- 1% increase in inflation rate

- Ultimate losses rise by about 5%

- Underwriting loss goes from -$4.20 to -$9.41

Sensitivity of Profits to Benefit Levels

- Initial loss equals $104.20

- Initial premium equals $100.00

- 1% increase in effective benefit level

- Ultimate losses rise by 1%

- Underwriting loss goes from -$4.20
  to -$5.25

Calculation of WCRIB Indicated Rate Change
Changes in Methods and Data
Filing for 1/1/98 Effective Date vs. Filing for 7/1/96 Effective Date

Introduction

In its most recent filing, the WCRIB requested an average rate decrease of 11.1% but partitioned this average into two components: an average rate decrease of 12.2% for voluntary market risks and an average rate decrease of 3.5% for residual market risks. The primary purpose of this document is to describe the major changes in ratemaking methods employed by the WCRIB in that filing and to quantify the effects of those changes on indicated rates.

As it turns out, there have been very few significant changes in methods in the Bureau filing this year. Rates are nonetheless indicated to change significantly. We have therefore attempted to quantify the effects of the most recent data on indicated rates. It is important to emphasize, however, that these data effects follow directly from the selected methods; they do not in and of themselves indicate that any particular methods are actuarially inappropriate.

Changes in Methods

While there are always several minor technical adjustments in any WCRIB filing, there are fortunately only two significant changes to the Bureau's methods in the filing for rates effective January 1, 1998. The more important of these changes is the introduction of a 10% residual market surcharge. Under this proposed surcharge, the recommended average rates for voluntary market risks are about 1.2% lower than they would have been in the absence of the surcharge. Similarly, the recommended average rates for residual market risks are about 8.5% higher than they would have been in the absence of the surcharge.

While the introduction of any cost-based rate change (including a residual market surcharge) is actuarially reasonable, the effects it will have on the workers' compensation market are difficult to assess in advance. It is likely, however, that introducing such a surcharge will be less disruptive when the residual market is small than when it is large. Since the residual market is currently relatively small, this is at the least a reasonable time to introduce the surcharge, especially at the modest level the Bureau has proposed.

While the basic effect of the surcharge is easy to understand, there are some related effects that arise from the proposal. For example, the Bureau calculates an adjustment factor to reflect the impact of large dollar deductible (LDD policies) that is affected by the proposed surcharge. Under the Bureau formula for this adjustment factor, ultimate

losses are adjusted by a factor of 0.996 in the current filing (i.e., based on a 10% surcharge). Had the Bureau not proposed the residual market surcharge, this factor would instead be 0.992 if all else were held constant (although other parameters in the formula would also change in the absence of the surcharge). We believe, however, that these related effects are reasonably small.

The second important change is the use of commission and other acquisition expense ratios that are higher than the average ratio over the most recent available three years. Under the new approach, the Bureau's estimated acquisition expense ratio is 8.0%. Had the Bureau continued with the use of the three-year average, this ratio would have been approximately 6.2%, which in turn would have generated a rate change indication of about -12.9% instead of the filed -11.1% (again, with all else held constant).

The Bureau cites three reasons for moving away from the three-year average approach:

1) the ongoing depopulation of the residual market, with a resulting movement away form the relatively low commission rates for risks in the residual market;

2) the recent shift from direct writers to agency companies, implying that more recent data is likely to be more indicative of the actual acquisition expense ratios in 1998; and

3) the ongoing declines in manual rates, with a corresponding increase in acquisition expense ratios under the assumption that acquisition expense dollars decline less rapidly than rates have declined.

We believe that all of these reasons have some validity and together serve as reasonable justifications for the Bureau's change in method. We note, however, that it would be important to apply the same approach if the shifts in the market were going in the opposite directions. If, for example, the residual market began to increase substantially then it would be appropriate to reflect the movement towards its relatively low commission rates. Similarly, a hypothetical series of increases in manual rates would presumably generate a decline in acquisition expense ratios that would also be appropriate to reflect.

Finally, we note a minor change: the Bureau's separate inclusion of pool administrative expenses this year, which has a small effect (+0.3%) on the indicated rate change. It is unclear from the filing whether these expenses have not been included before or whether they have simply not been separately identified in prior filings.

Changes in Data

Even with no changes in methods, the Bureau filing would indicate that some rate change was needed just based on the use of more recent data. We have quantified the effect of these changes in data in the following way:

1) Starting with the previous rate filing (rates effective 7/1/96), we change each rate component in succession. Reported losses, development factors, trend factors, and expense ratios are all examples of rate components.

2) After each change, we calculate what the 7/1/96 rate indication would have been had more recent data been used.

3) Finally, we calculate the difference between what the rate indication would have been using the more recent data and what is was before using the more recent data. This difference is a reasonable measure of the effect of using the more recent data.

Using reported losses, for example, the calculation goes as follows:

1) The 7/1/96 filing had an indicated rate change of -10.9%.

2) Substituting policy year 1994 losses and accident year 1995 losses, which are used in the 1/1/88 filing, for policy year 1993 losses and accident year 1994 losses, which are used in the 7/1/96 filing, changes the 7/1/96 rate indication to -19.5%.

3) The difference between -19.5% and -10.9% is -8.6%, which is the value of using the more recent reported losses.

In other words, the decline in reported losses of nearly 11% from PY93/AY94 to PY94/AY95 translates to an 8.6% decline in indicated rates, even with no change in the methods used to calculate reported losses. Of course, reported premiums also declined by about 11% over the same period, the effect of which roughly offsets the effect of the decline in reported losses.

Table 1 on the next page lists the values measured in this way for each rate component other than the introduction of the residual market surcharge.

Table 1: Values of Changes to Individual Rate Components

Rate Component	Change in Method	Effect of Change in Method	Effect of Change in Data	Total Value
Reported Losses	None	+0.0%	-8.6%	-8.6%
Reported Premiums	None	+0.0%	+10.1%	+10.1%
Reported Expenses	Pool admin exp	+0.3%	-0.7%	-0.4%
Loss Development	None	+0.0%	-0.5%	-0.5%
Premium Development	None	+0.0%	+0.0%	+0.0%
Benefits/Law Changes	None	+0.0%	+0.9%	+0.9%
Premium Level Factor	None	+0.0%	+0.8%	+0.8%
LDD Adjustment	None	+0.0%	+0.6%	+0.6%
LAE Factor	None	+0.0%	+0.7%	+0.7%
Off-Balance Factors	None	+0.0%	-8.0%	-8.0%
Loss Trend Factors	None	+0.0%	+2.1%	+2.1%
Payroll Trend Factors	None	+0.0%	-0.7%	-0.7%
Expense Trend Factors	None	+0.0%	-0.6%	-0.6%
Acq Expense Ratio	> 3-yr average	+1.8%	+0.7%	+2.5%
Premium Tax	None	+0.0%	-0.1%	-0.1%
Premium Discount	None	+0.0%	+1.3%	+1.3%
Underwriting Profit	None	+0.0%	-0.3%	-0.3%

A few additional comments on some of the values in Table 1 are appropriate.

First, the values for each component assume that every component listed above it in the table has already been changed. As a result, calculating the values in a different order would have generated somewhat different results, although the small effects would probably have remained small and the large effects would have remained large. It is likely that all of the values in Table 1 would remain within 1% of the displayed values regardless of the order in which the calculations were performed.

Second, some of the effects are better considered on a combined basis rather than individually, particularly since method changes are not a large issue in this filing. For example, all of the loss effects (reported losses, loss development, benefits/law changes, LDD adjustment, LAE factor, and loss trend factors) could be combined into a single number, which would be -4.8% in this case. On the premium side, the previous rate change affects several rate components: reported premiums, the premium level factor, and the premium discount factor. Combining values in this way into other broad categories leads to the Table 2 on the following page. We have included off-balance factors and payroll trend factors in the premium category and premium tax is included in the expense category.

Table 2: Values of Changes to Grouped Rate Components

Rate Component	Change in Method	Effect of Change in Method	Effect of Change in Data	Total Value
Losses	None	+0.0%	-4.8%	-4.8%
Premiums	None	+0.0%	+3.5%	+3.5%
Expenses	Pool admin exp; > 3-yr avg	+2.1%	-0.7%	+1.4%
Underwriting Profit	None	+0.0%	-0.3%	-0.3%

Third, the measured effect of the change in trend factors is partly overstated since the trend period used in the 1/1/98 filing is (appropriately) six months longer than that used in the 7/1/96 filing. This longer trend period arises because of the longer time between the average dates in the filing data and the time period for which rates will be effective. In the 7/1/96 filing, for example, the accident year data had an average accident date of 7/1/94 while the average accident date underlying the then-proposed rates was 7/1/97, a difference of 36 months. In the current filing, on the other hand, the accident year data has an average accident date of 7/1/95 while the average accident date underlying the proposed rates is 1/1/99, a difference of 42 months. The annualized trend factors, however, are similar in both filings.

Fourth, the effect of the change in off-balance factors is large (relative to the effects of the other rate components) and merits some additional examination. The table below displays the individual off-balance factors from both the 7/1/96 and 1/1/98 filings.

Table 3: Off-Balance Factors

Off-Balance Factor	7/1/96 Filing Value		1/1/98 Filing Value	
	PY93	CY94	PY94	CY95
Experience Rating	0.991	1.020	1.048	1.038
All-Risk Adjustment Program	0.961	0.993	1.022	1.004
Construction Credit Program	0.989	0.996	1.004	1.003
Insolvency Fund	0.995	0.998	1.001	1.001
Product of All Factors	0.937	1.007	1.075	1.046

As the table indicates, the biggest changes are in the policy year experience rating and ARAP factors, which each increase by about 6%. The change in experience rating factor follows directly from the change in the average experience modification factor from +2.4% in policy year 1993 to -3.7% in policy year 1994 (for comparison, the average experience modification factor in policy year 1992 was +5.3%). Since the Bureau is filing rates that are intended to be consistent with an average experience modification factor of 0.0%, it adjusts the reported premiums by an amount that offsets the experience modification factor underlying those premiums. Similar logic applies to the remaining factors. While the swings that occur are an indication of the difficulty of balancing the

various discount/surcharge programs in advance, they do not arise from any change in the method used by the Bureau to account for the effects of these programs, nor does their magnitude indicate that the method used to calculate these factors is inappropriate.

Conclusion

The <u>average</u> rate indication in the Bureau's 1/1/98 filing is driven primarily by changes in data, not by changes in methods. The few method changes that affect average rates primarily concern expenses and only affect indicated rates by about 2%. Further, even those limited changes are actuarially reasonable, presuming that they would also be applied in a time of increasing manual rates rather than just in the current environment. While the effects of the data changes are more substantial, these effects follow directly from the selected methods.

The introduction of a residual market surcharge, which affects voluntary and residual market rates separately but which has no effect on overall average rates, is also actuarially reasonable. But the effects it will have on the workers' compensation market are difficult to assess in advance. As discussed earlier, introducing the surcharge when the residual market is relatively small is likely to be less disruptive than would be doing so when the residual market is large. Whether or not any disruption that occurs is too much or too little is a matter for non-actuarial discussion.

While the primary purpose of this document has been to describe changes between the current and prior Bureau filings, we note that our review of the filings also allows us to judge the actuarial reasonableness of the various methods employed by the Bureau throughout its calculations. Based on our review, we have concluded that the rates proposed by the WCRIB in its filing of August 14, 1997 appear to satisfy the statutory criteria of M.G.L. c. 152 §53A(2); that is, the proposed rates are "not excessive, inadequate, or unfairly discriminatory for the risks to which they respectively apply" and "fall within a range of reasonableness."

Calculation of WCRIB Indicated Rate Change
Comparison of Rate Components: 7/1/96 Filing vs 1/1/98 Filing

	PY93 Data	AY94 Data
Starting Point: 7/1/96 Filing		
1A) Industry Paid Indemnity Losses at 1st Report	105,706,758	48,626,644
1B) Paid Loss Development Factor	3.306	6.868
1C) Adjustment for Escalated Benefits	1.059	1.059
1D) Implied Ultimate Indemnity Losses (1A) x (1B) x (1C)	370,049,011	353,686,687
2A) Industry Paid Medical Losses at 1st Report	89,214,599	47,473,976
2B) Paid Loss Development Factor	2.010	3.586
2C) Implied Ultimate Medical Losses (2A) x (2B)	179,361,248	170,232,834
3A) Industry Case Incurred Indemnity Losses at 1st Report	230,810,862	162,985,850
3B) Case Incurred Loss Development Factor	1.494	1.905
3C) Adjustment for Escalated Benefits	1.040	1.040
3D) Implied Ultimate Indemnity Losses (3A) x (3B) x (3C)	358,697,550	322,829,068
4A) Industry Case Incurred Medical Losses at 1st Report	142,974,392	114,695,608
4B) Case Incurred Loss Development Factor	1.215	1.406
4C) Implied Ultimate Medical Losses (4A) x (4B)	173,713,151	161,230,806
5A) Average Ultimate Indemnity Losses [(1D) + (3D)] / 2	364,373,280	338,257,877
5B) Average Ultimate Medical Losses [(2C) + (4C)] / 2	176,537,200	165,731,820
5C) Average Ultimate Total Losses (5A) + (5B)	540,910,480	503,989,697

Calculation of WCRIB Indicated Rate Change
Comparison of Rate Components: 7/1/96 Filing vs 1/1/98 Filing

	PY93 Data	AY94 Data	
Starting Point: 7/1/96 Filing			
5C) Average Ultimate Total Losses from Page 1	540,910,480	503,989,697	
6A) Benefit Level Factor to 1/1/95	1.009	1.004	
6B) Law Amendment Factor	1.017	1.017	
6C) Loss Trend Factor to 7/1/97	1.298	1.254	
6D) Factor to Adjust for Large Deductible Policies	0.988	0.988	
6E) Loss Adjustment Expense Factor	1.200	1.200	
6D) Trended Ultimate Losses (5C) x (6A) x (6B) x (6C) x (6D) x (6E)	854,181,966	765,089,165	L
7A) Fixed Expenses	61,380,930	60,547,670	
7B) Expense Trend Factor	1.252	1.224	
7C) Trended Fixed Expenses	76,848,924	74,110,348	F
8A) Standard Earned Premium plus ARAP Premium at 1st Report	1,356,684,328	1,241,283,812	
8B) Adjustments for Various Offbalances and Insolvency Fund	0.937	1.007	
8C) Premium Development Factor	1.012	1.000	
8D) Premium Level Factor to 1/1/95	0.742	0.781	
8E) Payroll Trend Factor to 7/1/97	1.139	1.121	
8F) Trended Ultimate Premium (8A) x (8B) x (8C) x (8D) x (8E)	1,087,435,144	1,094,125,243	P
9A) Acquisition and Field Supervision Expense Ratio	5.4%	5.4%	
9B) Premium Tax Ratio	2.2%	2.2%	
9C) Premium Discount	5.5%	5.5%	
9D) Underwriting Profit Provision	-4.2%	-4.2%	
9D) Variable Expense Ratio including Profit (9A) + (9B) + (9C) + (9D)	8.9%	8.9%	V
10) Indicated Loss and Fixed Expense Ratio [(6D) + (7C)] / (8F)	85.6%	76.7%	I
11) Allowable Loss and Fixed Expense Ratio [1 - (9D)]	91.1%	91.1%	A
12) Indicated Rate Change [(10) / (11)] - 1	-6.0%	-15.8%	C

OVERALL INDICATED RATE CHANGE   -10.9%

Calculation of WCRIB Indicated Rate Change

Comparison of Rate Components: 7/1/96 Filing vs 1/1/98 Filing

	PY94 Data	AY95 Data	
Ending Point: 1/1/98 Filing			
1A) Industry Paid Indemnity Losses at 1st Report	94,762,047	43,577,870	Changed
1B) Paid Loss Development Factor	3.259	6.771	Changed
1C) Adjustment for Escalated Benefits	1.060	1.060	Changed
1D) Implied Ultimate Indemnity Losses (1A) x (1B) x (1C)	327,366,112	312,777,094	
2A) Industry Paid Medical Losses at 1st Report	81,489,958	46,755,803	Changed
2B) Paid Loss Development Factor	1.885	3.367	Changed
2C) Implied Ultimate Medical Losses (2A) x (2B)	153,644,752	157,430,903	
3A) Industry Case Incurred Indemnity Losses at 1st Report	198,817,019	136,960,032	Changed
3B) Case Incurred Loss Development Factor	1.566	2.072	Changed
3C) Adjustment for Escalated Benefits	1.040	1.040	Changed
3D) Implied Ultimate Indemnity Losses (3A) x (3B) x (3C)	323,726,706	295,106,510	
4A) Industry Case Incurred Medical Losses at 1st Report	128,770,835	109,734,039	Changed
4B) Case Incurred Loss Development Factor	1.154	1.290	Changed
4C) Implied Ultimate Medical Losses (4A) x (4B)	148,555,701	141,548,790	
5A) Average Ultimate Indemnity Losses [(1D) + (3D)] / 2	325,546,409	303,941,802	
5B) Average Ultimate Medical Losses [(2C) + (4C)] / 2	151,100,227	149,489,847	
5C) Average Ultimate Total Losses (5A) + (5B)	476,646,636	453,431,649	

Calculation of WCRIB Indicated Rate Change
Comparison of Rate Components: 7/1/96 Filing vs 1/1/98 Filing

Ending Point: 1/1/98 Filing

	PY94 Data	AY95 Data	
5C) Average Ultimate Total Losses from Page 1	476,646,636	453,431,649	
6A) Benefit Level Factor to 1/1/96	1.010	1.004	Changed
6B) Law Amendment Factor	1.028	1.028	Changed
6C) Loss Trend Factor to 1/1/99	1.337	1.284	Changed
6D) Factor to Adjust for Large Deductible Policies	0.996	0.996	Changed
6E) Loss Adjustment Expense Factor	1.210	1.210	Changed
6D) Trended Ultimate Losses (5C) x (6A) x (6B) x (6C) x (6D) x (6E)	797,420,023	724,183,107	L
7A) Fixed Expenses	57,958,055	57,897,458	Changed
7B) Expense Trend Factor	1.166	1.126	Changed
7C) Trended Fixed Expenses	67,579,092	65,192,538	F
8A) Standard Earned Premium plus ARAP Premium at 1st Report	1,188,383,378	1,122,413,134	Changed
8B) Adjustments for Various Offbalances and Insolvency Fund	1.075	1.046	Changed
8C) Premium Development Factor	1.012	1.000	Changed
8D) Premium Level Factor to 5/1/96	0.724	0.789	Changed
8E) Payroll Trend Factor to 1/1/99	1.152	1.127	Changed
8F) Trended Ultimate Premium (8A) x (8B) x (8C) x (8D) x (8E)	1,078,633,557	1,044,286,939	P
9A) Acquisition and Field Supervision Expense Ratio	8.0%	8.0%	Changed
9B) Premium Tax Ratio	2.1%	2.1%	Changed
9C) Premium Discount	6.8%	6.8%	Changed
9D) Underwriting Profit Provision	-4.5%	-4.5%	Changed
9D) Variable Expense Ratio including Profit (9A) + (9B) + (9C) + (9D)	12.4%	12.4%	V
10) Indicated Loss and Fixed Expense Ratio [(6D) + (7C)] / (8F)	80.2%	75.6%	I
11) Allowable Loss and Fixed Expense Ratio [1 - (9D)]	87.6%	87.6%	A
12) Indicated Rate Change [(10) / (11)] - 1	-8.5%	-13.7%	C

OVERALL INDICATED RATE CHANGE   -11.1%

Changes in Methods and Data: 1/1/98 Workers' Compensation Rate Filing

Rate Filing

Presented to the Massachusetts Workers'
Compensation Advisory Council

September 10, 1997

Ernst & Young LLP

Basic Ratemaking Formula

L = Losses in effective period

F = Fixed expenses in effective period

P = Premium in effective period (if no rate change)

V = Variable expenses in effective period as a % of premium

I = Indicated ratio in effective period = $(L + F) / P$

A = Allowable ratio in effective period = $1 - V$

C = Rate change = $(I / A) - 1$

Note: V includes underwriting profit provision

Changes in Rate Components
7/1/96 to 1/1/98

Rate Element	7/1/96 Filing	1/1/98 Filing
L (Ult Loss)	$810M	$761M
F (Fixed Exp)	$75M	$66M
P (Ult Prem)	$1,091M	$1,061M
V (Var Exp)	8.9%	12.4%
I (Indic Ratio)	81.2%	77.9%
A (Allowed)	91.1%	87.6%
C (Change)	-10.9%	-11.1%

Changes in Methods

- Development: None
- Trend: None
- Benefit Levels/Law Changes: None
- Pool Adminsitrative Expenses Add
  - Worth +0.3%
- Acq Expense Ratios >3Yr
  - Worth +1.8%; three reasons

Changes in Methods

- Underwriting Profit   None
- Other Adjustments/Off-Balances   None
- Residual Market Surcharge   +10%
  - Increases residual market rates by ~8.5%
  - Decreases voluntary market rates by ~1.2%

Measuring Effect of Changes

- Start with 7/1/96 filing

- Change rate components one at a time and determine new indication

- Calculate incremental effect by comparing new indication to indication before change

Value of Individual Rate Components: Page 1

Component Changed	Value
Reported Losses	-8.6%
Reported Premiums	+10.1%
Reported Expenses*	-0.4%
Subtotal	+1.1%

* Pool admin expense is +0.3% of total

Value of Individual Rate
Components: Page 2

Component Changed	Value
Development Factors*	-0.5%
Benefits/Law Changes	+0.9%
Premium Level Factor	+0.8%
LDD Adjustment	+0.6%
LAE Factor	+0.7%

* No change in premium development

Value of Individual Rate Components: Page 3

Component Changed	Value
Off-Balance Factors	-8.0%
Loss Trend	+2.1%
Payroll Trend	-0.7%
Expense Trend	-0.6%

Value of Individual Rate Components: Page 4

Component Changed	Value
Acquisition Expense*	+2.5%
Premium Tax	-0.1%
Premium Discount	+1.3%
U/W Profit	-0.3%

*Changing from 3-year average is +1.8% of total

Interpreting the Effects:
Caveats

- Each change assumes all prior changes have already been made; order matters

- Some effects should be examined on a combined basis

- Trend period extended by six months relative to 7/1/96 filing

- Large effect of off-balance factors driven by experience mods/ARAP data, not methods