HOW TO CHOOSE A TREND FACTOR

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Abstract

The first half of this paper is meant to be a descriptive compendium of those considerations which for one particular line go into the selection of a trend number once the mechanics of the formulas have been mastered. One sees too often in rate indication analyses the correct formulas used without the requisite thought as to the issues affecting their correct application. The second half, concerning credibility, is more speculative, and describes my current thinking as to the application of credibility to trend indications. It too is instructive in that it presents the sorts of issues one has to deal with in making this significant decision. My concern is in deriving the most reasonable number given the available information; i.e. a number(or set of numbers) such that when used in a rate indication analysis, gives the most informative and accurate results to those who make decisions on its basis.

I would like to thank J. Pergrossi for producing the exhibits

June 25, 1993

1. INTRODUCTION

The selection of a trend factor[1] is often the most important component of rate indications and rate filings (and certainly always an important component). Indeed, it is often the first and primary number to be contested by, e.g., consumer advocates: presumably because of both its leveraged impact, and the fact that the data itself frequently leaves room for multiple interpretations with divergent conclusions. I wish here to delineate the various considerations which go into choosing a trend number. As shall be seen, and as one might expect, the selection process is a synthesis of theoretical and practical considerations.

While there are numerous different procedures for calculating and applying trend numbers for the various lines of business (one has only to look at ISO circulars for different lines to appreciate the diversity), I shall not be attempting to choose among or even survey, them. Rather I shall take one set of procedures as

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[1]I restrict myself here to trends in losses, about which disagreement most often revolves. It should be noted that at least for some lines of business (e.g. where billings is the exposure base), exposure trend may have an at least equally significant impact on the underlying pure premium (or loss ratio) trend, and hence rate indications.

applied to one line, Medical Malpractice, and describe the considerations which go into the selection of a trend number. Other lines of business will, of course, have similar, though not identical issues.

The first half of this paper is meant to be descriptive and instructive. It is meant as a compendium of those considerations which--again, for one particular line--go into the selection of a trend number once the mechanics of the formulas have been mastered. One sees too often in rate level analyses the correct formulas used without the requisite thought as to the issues affecting their correct application. While there is no substitute for practice, it is hoped the current delineation of issues can serve as a guide as to what to look for. This is <u>not</u> a listing of every possible factor which can influence a trend number; it is those which have in practice been encountered as having significant impact on the final result. Important factors, such as the level of future monetary inflation, have also been left out when there is not much that can be said about them.

Since the focus is on trend, other aspects of the rate analysis process are often referenced without detailed explanation or example. The reader is assumed to have a thorough knowledge of basics.

The second half, concerning credibility, is more speculative, and describes my current thinking as to the application of credibility to trend indications. It too is instructive in that it presents the sorts of issues one has to deal with in making this significant decision.

My concern here will be in deriving the most reasonable number given the available information; i.e. a number(or set of numbers) such that when used in a rate indication analysis, gives the most informative and accurate results to those who make decisions on its basis. I shall also assume, though the realities are otherwise, that this will go into a rate filing as well.[2] The procedure involved will be that of extrapolating internal loss data, to a future average loss date (which extrapolated losses are then to be compared to matching exposures or premiums at current levels). I will assume the "standard" procedure for the application of trend in the case of severity. That is a trend number is selected and applied to ultimate losses for each loss year (See e.g McClenahan [1], pg. 82 for a typical example). It will be seen that some of the problems that arise are due to this format itself.

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[2]Thus putting in something other than what a state insurance department is habituated to seeing is often a prescription for exponentially increasing headaches. Though, to be fair, constant revision of procedures might suggest, not unreasonably, that numbers are being cooked to produce specific results.

2. GENERAL CONSIDERATIONS

I. What should be fit: frequency & severity, or pure premiums?

If one has only pure premiums (or equivalently current level loss ratios) then the data has determined this decision for you. Where frequency and severity data is available as well, the tendency is usually to analyze the two separately so as to better understand the underlying dynamics: the reduction in frequency for various lines in the late 80's being a case in point. This is especially so in the case of Medical Malpractice, since frequency for this line has shown a distinct cyclical pattern (from the data I have been able to observe); while severity, over the long run is probably best thought of in terms of an exponential growth curve. There remains, nevertheless, a most definite virtue in looking at pure premiums as well. Thus, for example, there may have been a recent increase in nuisance claims, or the company may have gone to incident reporting, or made some other definitional change as to what constitutes a claim. Since it is often the case that one can pick ultimate claim counts in more recent years (on claims made after 6 or even 4 quarters of development), while ultimate dollars and severities are far more uncertain, one may reasonably use more years in the frequency indication than in the severity indication.[3] Doing so

[3]Even if the same number of years are used, an, e.g., decrease in severity might more likely than frequency be considered a) uncertain and b) just a random blip in the data

would, under our scenario, severely distort the indication, since the increase in frequency would be picked up, without the concomitant decrease in severity. Looking at pure premiums as well can be an antidote to this subtle distortion.

II. Should one use ultimate reported or ultimate paid counts?

Reported claims are considerably more responsive for frequency calculations(4 quarters is usually plenty to get an accurate estimate of ultimate counts on a claims-made book). Thus if one is fairly confident that there has be no change in the underlying relationship of reported to (ultimate) paid counts, one might be better served with reported counts. Paid counts (on an ultimate basis) are, however, more representative of that which we are trying to measure. Thus severities using reported counts are rather meaningless by themselves. So especially if one can not rule out the possibility that there has been some shift in the underlying relationship to reported counts (e.g. more closed without payments for whatever reason), one might be better served by ultimate paid counts. In any case one should be consistent between one's analysis of severity and frequency.[4]

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even if the estimate is accurate.

[4] I am speaking here only of which statistic to use, not how it should be derived. One could certainly use "incurred" counts--or even reported--to derive ultimate paid.

III. Type of curves

There is wide latitude to what sort of curve one could fit in any given circumstance; the choice is often dictated by external considerations rather than the data itself: as far as the data goes many curves could be reasonably used. Given the cyclical nature of Medmal frequency, an indexing procedure seems more reasonable than a curve fitting procedure. Countrywide frequencies are indexed to the latest reliable point as the best indicator of future frequency levels, see Exhibit 1. (This procedure will cause much less variance than trending procedures when the curve turns). Severity, as is conventionally done, was assumed to fit an exponential curve; though again, the data itself would certainly allow for other curves, e.g. a 2nd degree polynomial.

Given the above choices what adjustment should one make to pure premiums, if one is looking at it as well? Logically it should be a combination of the frequency and severity trends. While this can be done (e.g. in St. Paul Medmal filings), since in the present case these numbers are being used primarily as checks, I have simply fit an exponential to them (and even the raw pure premiums might do, if used only as checks).

IV. Calendar year vs loss year analysis

Standardly the independent variable in severity trend calculations is loss year (or policy year, etc.). Contrary to the standard view I believe that, where possible, calendar closed claim data should also be used. Loss year calculations involve calculating ultimates for each year. For long tail lines there is often considerable uncertainty in these ultimates especially for the most recent years which tend to be the ones of most interest in the trend calculations. Certainly there is a major benefit to this procedure in that it allows for the use of additional information in the form of the use of case reserves in projecting ultimates. However it also requires consistency of said reserves (or knowledge of and appropriate adjustment for changes). And unfortunately this is often not the case.[5] Exhibit 2 gives trend selections based on various loss year ultimate choices (as well as calendar year indemnity paid without the first two years of development). It is interesting to note the considerable variance of trend selections for the loss years given different methods of generating ultimates.[6] Finally the selection of ultimates assumes, implicitly or explicitly, a future severity trend. Thus for 1992 most claims are yet to close. If one had, for instance, reason to believe that in the state/line under consideration, a new court ruling will

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[5]This is true even with one's own data, but especially true when data is from an external source, and most especially when it is from many external sources (e.g. the data compiled by rating organizations.)

[6]This variance is considerably greater if one is looking at e.g. an individual state.

progressively increase in successive years judgement amount (i.e. increase trend) then 1992 ultimates (and 1991 to a lesser extent, etc.) should be adjusted accordingly. While the calculations may not show it, the true ultimates for a given recent loss year are a function of trend assumptions concerning future calendar years. (This implicit assumption might just be that trend, or the rate of change of trend, will remain constant: but an assumption it is, nevertheless.)

Calendar closed claim severity trend is, on the other hand, in "real time". One is comparing the average severity of closed claims in given actual real time years to each other. If so, why is this procedure not used more often? First, as mentioned above, the additional information provided by reserves--especially when one is confident of consistency--is not incorporated in a paid method. More importantly, in many, if not most instances, there are problems and distortions which make such analyses unusable. Thus, to mention a few, lines where there is a significant amount of partial payments, will throw the calculations into disarray (which is why we do not use this analysis on the allocated portion of Medmal). Simple growth or decline in exposures over time will by itself cause distortions in trend indications, as the percentage of faster closing (and hence smaller) claims shifts over time; and so on. Consequently it is quite often the case that a calendar year analysis just can not be done. But there are occasions when it <u>can</u> be done; and

then it should. Thus for Medmal as well as other lines there are typically no partial payments on the indemnity piece. Exposures may not be changing. Even if they are one can circumvent the distortions by eliminating the first two development years from each calendar year (this is described in a forthcoming article).

With the calendar year method two caveats are important. If one eliminates the first two development years, and thereby most small nuisance claims, it is important that there not have been a shift in the percentage of nuisance claims as a total of all paid claims, causing the severity trend to be on a different base than the frequency numbers. Exhibit 3 examines this for our data. If it is decided that there is such a shift of significance, then perhaps it is best to base frequency as well on non nuisance claims. Also if one does choose a trend based on calendar year numbers, then in one's rate indication the selected ultimates should ideally be consistent with that trend selection(e.g. in terms of average future pending severities implied by ultimates).

V.Long term vs Short Term trend

There is more than one issue here. The primary problem is that one gets a more reliable result when using a greater number of years(if available, which is not always the case), both because

of the greater number of points and because of the uncertainty surrounding the latest points, but a more responsive result restricting oneself to more recent years.

Traditionally for Medmal and other long-tailed lines longer term trend has been used (by e.g. ISO, or St. Paul, etc.). The rationale--I assume--is not so much in terms of which is a better predictor of the future, but that the short term indications are just not accurate and extremely unstable: looking at the indications for say, the last five years, can be very misleading: if it looks flat or particularly steep, there is a strong (sometimes almost overwhelming) inclination to think that this is mirroring the actual underlying process; but looking at Exhibit 4, which is not atypical, one can see that this would be highly inaccurate: as one takes a rolling five years (e.g first 78-82 then 79-83, etc.) one can see how dramatically the indications may change. And that ending with 92 is most uncertain since there is large "parameter uncertainty" around the points as well.

The typical rate indication uses a preset, let us say five, number of years in its experience period. The point of the adjustment to losses is to bring previous years' losscosts into the future. The trend adjustment should, therefore be conceptually divided into two components. First one should bring up the loss costs from these five years to the present actual level, the present being the latest year for which one

still has a somewhat reliable severity (say) indication. (Obviously a somewhat subjective decision). And then one should project out further all the years to the average loss date for the experience period being priced.

In the case of frequency, bringing up the five years to current is done via an indexing procedure, and hence is unproblematic: if one concurs that indexing is the best procedure. [7] In addition we are assuming that this latest point is the best predictor for the future, so there is no problem with long term trend either.[8]

In the case of severity one might, based on the previously presented randomness of short term trends, think that using long term trend indication for both components of the projection is optimal; and indeed this is often done. Given the standard procedures for trending losses in a rate indication (as given in [1]), this can cause significant distortions.[9] In spite of the fact that short term trend has followed erratic patterns, one still needs to bring the five years to the actual current level. Perhaps an example will explain.

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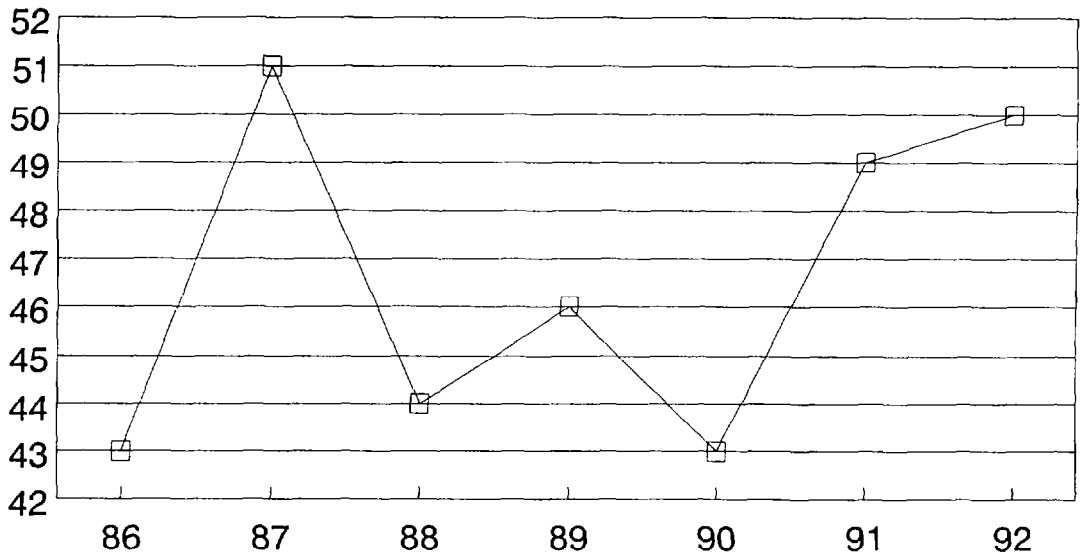
[7]This might certainly not be the case for other lines.

[8]Actually, "the latest point", might mean various things give the circumstances, e.g. it might be an average of the latest two empirical data points, etc..

[9]The St. Paul procedure does not suffer from this problem; this will be discussed briefly below.

FIGURE 1
STATE X – Hypothetical Example



Consider Figure 1 (made up) which represents, let us say, the severities for some particular state. One might reason that given the volatility of the data one should use an "expected" number for trend, to wit, long term state or countrywide trend(rather than the 1% trend indicated by the numbers.). Consider then what happens when we apply a 6.5%(long term) trend to these numbers. The impact of 87 thus trended helps produce overall results opposite of what we intended. The 6.5% trend applied is way too high, and since it is an old year this mistake is highly leveraged. The fact that we don't believe the 1% trend means that we think the high 87 number is a random "error" from the true number which would be closer to the long term fit line; and the true projected level of severity of 1987 is much closer to the 1% fitted number. Given the "standard" procedure for trending it would be more appropriate then to use the state's short term trend to bring the high indication down to the level we feel it should truly be projected to. (Of course this could be construed as an argument for modifying the standard procedure. Thus, it is perhaps best to fit a long term curve and get a fitted projected point; this would work for countrywide, but would need somehow to be modified for, e.g., individual state data--where the variability would still presumably exist; this is what St. Paul does.)

The reasoning which suggests that we here use an expected, i.e. long term trend number appears valid. Yet if we are going to

stick with the standard procedure then it appears we are constrained to use the short term trend. What gives? The issues here are complex, and need to be discussed in the context of the credibility weighting of state trend indications, which is given further below.

Exhibit 5 gives our various choices of the shorter term trend (in our case 85-92); given the data being analyzed, most weight was given to columns 2 and 5 in the fourth row. For projecting into the future--the second component of our trend indication the long term should be used. Looking again at Exhibit 4 one can see that over the course of many years (78-92) the selected 6.5% seems a reasonable expectation even though for any group of selected years it could be lower or higher. This is our best expectation for trend into the future.[10] Thus to trend out the severity component of the indemnity losses for loss year 1987 to mid 1984 one would use $1.08^5 * 1.065^2$.[11]

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[10]The actual increase for the next few years will almost certainly be different. That the long term trend is good predictor of future trends is matter of philosophical faith. Historically liability trends have been monetary inflation +social inflation. There is no principled reason why this could not change so that social inflation becomes negative (Perhaps if some of Clinton's proposals go through, it will indeed). But choosing the long term trend has intuitive appeal, and as long as we stick to regression analysis for trend I know of no better; certainly, as we have seen, short term would not do.

[11]If one did use all the years 78-92 in ones rate indication then one would just use the long term trend.

Another question, which is actually more concerned with rate indications in general, than strictly with the trend, is whether the rate indication is intended for the next policy year alone--as is most often presumed--or whether one is trying to price to a general level over the next few years with an eye, say, to trying to smooth out rate levels through the underwriting cycles, (e.g. in attempt to increase retention), as I believe might make more sense. I shall not attempt to address this question here other than to note that how one answers this question might have an impact on how one deals with trend (e.g., one might just take frequency to be flat.)

VI. Which years to put into regressions.

Whether one is trying to determine long or short term trends, there is always a question of which years to include. Thus the more recent years are most important, but unfortunately tend to be least accurate. In addition randomly low or high points at either end can have a distorting effect (the fewer the points the more the distortion). One adjustment that should be made is that the regressions should be weighted by number of claims (or some equivalent of this) where there has been any significant variation in overall level (especially if an endpoint has only a handful of claims).

Exhibit 6 and 7 show how great a variance one can get in trend indications depending on the year's used. One should look at the trend using various combinations of years, leaving off endpoints from either end. There is, however, no general procedure I know of other than common sense for choosing. If the first three years are flat followed by a very large increase, and then a gradual rise, one should not start the regression in year three without independent justification.

VII.Indemnity vs Allocated

The dynamics underlying the rise in indemnity costs is different, for Medical Malpractice and many other lines, than the dynamics of the underlying allocated expense, which is primarily driven by lawyer's fees. (Also allocated is unlimited, while the indemnity analyzed is usually limited.) Therefore to the extent that these can be analyzed separately and applied separately, they should.[12] Thus if one looks at exhibit 8 one can see that for allocated the long term trend is 15% and the short term trend chosen is 11%. Since 15% appears to be an unsustainable trend number in today's environment, it makes sense to use the 11% as a going forward trend rather than the 15% (unlike the indemnity case). For a combined allocated and indemnity going forward trend (rather than

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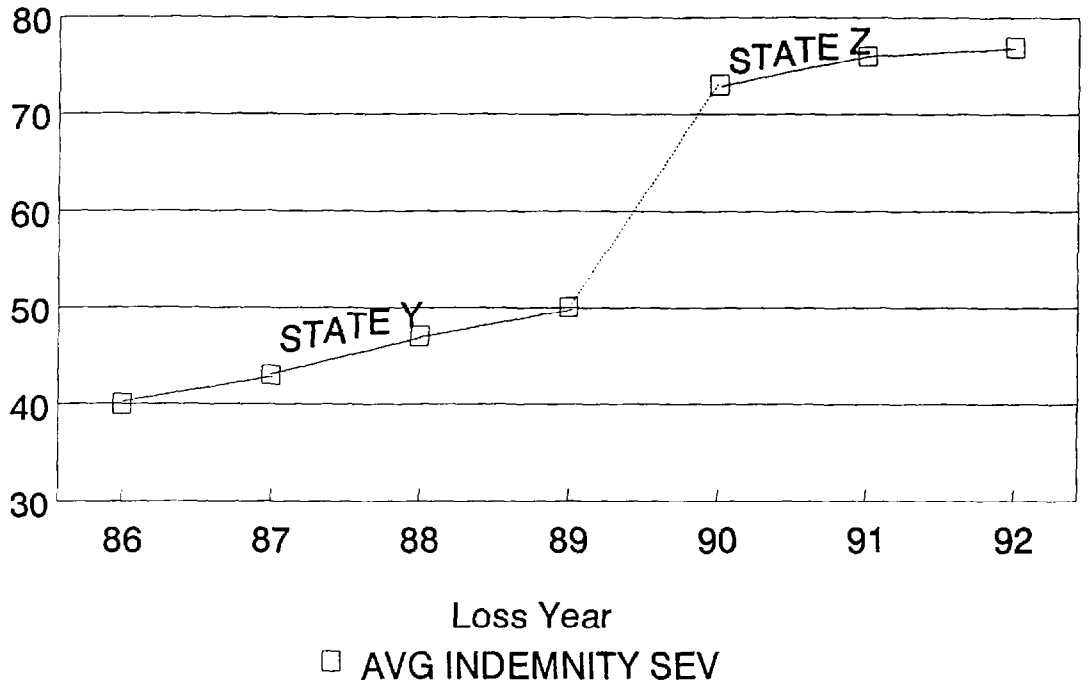
[12]This is not to say that the two are necessarily independent. A change in claim settlement philosophy might increase allocated costs, as claims are defended more vigorously, and decrease frequency--less claims settled--while increasing severity--the ones they do loose now are more likely to be whoppers(the pure premium could go either way).

FIGURE 2
STATE Y&Z–Hypothetical Example



a historical trend), one should weight the indemnity and allocated trends based on the current or future anticipated average severity of the two rather than just using the short term regression on the combined data (because of the shifting percentages over time of limited indemnity and allocated).

VIII.Distributional shifts:

One of the most insidious traps in analyzing trends is distributional shifts. To take a simple example in Figure 2 there are two states(our universe), and their respective trend lines. If--to take the extreme example--between 87 and 88 we went from writing everything in state A to everything in state B without realizing it, and then fit a trend line, the empirical data would follow the dotted line, making the trend look much more extreme than it is. The effect would be the same though obviously less extreme, if there were a lesser shift in the distribution of writings (i.e. percentages) between the two states.

For any given rating factor, if it truly mirrors exposure, one needs to be wary of such a shift. Class is a good example, which is why exposures are often given in class one equivalents: doing so takes out the impact of distortions. State is another example. On the model of class, it is probably best to take a base state (or make countrywide base) and then index each state to the base as a function of the states overall severity or

frequency (or pure premium if that is what we are doing).[13] The indices are probably best calculated by using exposures as weights for the frequency, and claim counts for the severity.

One needs to know (externally) when doing such an analysis what the potential distributional shifts might be (e.g. limits is another example).

IX. CM vs Occurrence:[14]

It is not unusual to have a book of business which contains both occurrence and claims made data.[15] If one uses the Marker & Mohl Method (see [2]) for organizing the data, this should not pose a major problem, since occurrence policies are easily incorporated (as diagonal elements). If, however, one uses the ISO methodology: CM exposures put on an occurrence equivalent basis as a function of lags between occurrence and report(see [3] and [4]), then the process is more involved. First we can not combine occurrence and CM severity since there is a timing

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[13] It is true that our indicated severities and frequencies by state are based on an analysis which itself is based on (credibility weighted) trends. So the process, if looked at iteratively, can be thought of not only as one of calculating credibility weighted trend, but one of updating the indices given new information.

[14] I shall assume for this discussion that the reader has a thorough familiarity with the articles referenced regarding the calculation of claims made rates; otherwise the discussion can not be followed.

[15] This is getting somewhat less usual as most Medmal carriers who switched to claims made, are by now all claims-made; but it still does occur.

difference(i.e. 1989 does not reflect the same time frame for an occurrence year and claims made year; hence combining them will distort trend indications.) One can look at the severity with all the data, claims made and occurrence, organized on either a claims made year or occurrence year basis if this data is available in these formats for all policies. I have used a claims made[16] year basis on exhibits 2, 4-9.

When dealing with frequency or pure premiums trend there should in theory be no problem in combining without adjustment claims made and occurrence year losses and exposures, since in the ISO methodology claims made exposures are already adjusted via the mechanism of backtrending (yes there is some circularity here) to take care of the timing differences. However in practice, because of the cyclical nature of frequency, it is typically only the severity trend which gets incorporated into the backtrending; consequently combining the occurrence and claims made data without adjustment will cause timing differences relative to the frequency component. One could do the analyses separately, and combine the results, though the results could be misleading (See Exhibit 1 and exhibit 10).

Nor can one straightforwardly combine the total losses of the two on a claims made year basis, as was done with severity, since one

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[16]I am using "claims made year" and "field notice year" equivalently in this context.

needs a way to get the matching exposures correctly. One possible way would be to spread out the occurrence exposures via lags. (See exhibit 11).

Note that there should be no reason (unless one has some knowledge of anti-selection or other such problems) why claims made and occurrence policies should have different "true" trends; the propensity to have a loss by an insured should be independent of the piece of paper the insured holds; all that is changed is the way these losses are organized and accounted for. Note also that when using the claims made exposures one needs to take out the impact from the step relativities of any fixed expenses or adjustments for differences in investment income etc.. If one has the original calculations of the step factors this should not be to difficult.

X.Ultimate choices: not using procedures which use trend.

There are a multitude of methods by which one could calculate ultimates on a loss year basis, Exhibit 9, gives ultimates based on 18 different methods. For purposes of the trend study these were winnowed down to six. First, paid methods were eliminated because their variability vitiated our confidence in them. Also eliminated were most methods which depended on trend(eg. trended future severities).[17] Fisher-Lange as well as Berquist-Sherman

[17]While the paid ultimates may or may not be appropriate in given circumstances, using methods which depend heavily on a trend assumption is always inappropriate.

were retained, however, even though there is dependency on trend factors. It was felt that the adjustments these methods made were sufficiently important, and that the sensitivity of selected ultimates to the precise trend factor was not so great, that these methods could be left in without too weighty a charge of circularity.

XI.Homogeneity: Clinics vs Docs, Phys vs Surgs, Large Deductibles

As with most aspects of data analysis, the extent to which one can subdivide the data into homogenous subsets, one can get more reliable indications. In the present case one might consider physicians versus surgeons or clinics (with vs. without large deductibles, or by size), vs individuals, etc.. While statistical tests might be run, it is most often the case that external knowledge guides one to which groupings are most likely to exhibit distinct loss generating characteristics. (See exhibit 5)

XII.250 vs unlimited

What layer should trend analysis be done on? While this is basically a severity question it can be asked about frequency as well. That is, it might make sense, especially--as was discussed--if there is a change in relationships, to treat all small "nuisance" claims as non-claims, and look at frequency trend for the "real" claims. If one does this then the definition of severity has to be adjusted accordingly.

When considering severity the simple answer is, "all layers". Nevertheless there should be one layer, the highest one with relatively stable results, which is the primary trend indication; in this case that was taken to be the $250,000 layer for indemnity. For allocated, for this line, one traditionally looks at the unlimited trend, since all policy limits have unlimited allocated.[18] It might be useful to look at allocated on a limited basis as well. When one has a 250,000 trend one can, if one has a theoretical distribution of indemnity claims, calculate the implied trend for higher limits, say 1 million and unlimited. These can be compared with the trends calculated independently for the higher layers (though one should be careful to realize that unlimited is not equivalent to total limits, i.e. the combination of all limits sold, which is usually the data available).

If the results of the implied and calculated trends for the higher layers do not match there are various possible explanations. First the severity distribution may be incorrect; thus since typically when constructing such a severity curve there are places in the analysis where trend assumptions are called for, these may not have been consistent with the present trend analysis; or it may be that the ultimates at the higher layers are so variable that the difference is due to random

[18]In other lines the sum of allocated and indemnity has one limit. This produces problems when one wishes to trend the component individually.

error, or some detail in the method by which ultimates were chosen for the higher layers may be culpable. It is impossible to give a formula as to how to adjudicate between these various possible explanations; especially so since in practice trend selection and curve selection are often interrelated processes. As a very general rule, to the extent that the indications at the higher layer are variable one should give more weight to the curve implied numbers; similarly to the extent one has or lacks confidence in the curve, one should give it more or less weight.

Care must be taken in that even if, e.g., 250 is the best layer at which to analyze trend it may not, in particular circumstances, be the right trend to apply. When one does a trend analysis at the 250,000 there is implicit in the analysis the dampening effect on trend as average severities get closer to the 250 limit. When applying such a fitted trend to indemnity numbers in a rate analysis it needs to be ascertained that there is a sufficient volume of data in each year, so that the average dampened trend is appropriate. Thus to take two extreme examples if an old year (87 say) has only 3 claims which randomly happen to all be (paid or incurred) at 250, then it would be incorrect to multiply by $1.065^5*1.08^2$; one would be increasing losses by over 50% too much. At the opposite end if the few losses are all small, then their increase will on average be more than 6.5% a year. In such cases it is best, if possible, to trend unlimited claims by unlimited (or total limits--though one will get the

same sort of issue with policy limits) trend. Where the volume is sufficiently large the limited trend will give more stable and accurate(if the trend selection is correct of course!) results.

3. CREDIBILITY

I. Introduction

Probably the most difficult aspect of trend selection is the decision of how one is to credibility weight a particular trend indication for a state, class, etc.. This assumes, of course that it makes sense at all to credibility weight. Thus even if it is clear that different states have different pure premiums, it might be thought that trends are driven exclusively by forces that work on, e.g., a countrywide level; and that separating trend indications by state makes no more sense than separating it by doctor height classes. For present purposes we shall assume (truly in this case, I believe) that it does in fact make sense to credibility weight.

Sometimes it may be clear that a state should be given full credibility; and sometimes it is clear that it should be given none: there is a minimum number of years (certainly two) and a minimum number of claims beneath which it would just not make sense to give any credibility to a trend indication; and certainly sometimes it is clear that there should be some

weighting. From my observation, most often when this is done it is done subjectively.

How would one proceed if one wanted some objective procedure for credibility weighting? (Which one should want, given the impact on the rate indication of this number.) There are various questions which need to be answered. First what is it that we should credibility weight? This question is interwoven with many of the issues which we considered previously. Is it long term trend or short term trend? Is the compliment one's own countrywide data or industry? or some combination? Is it frequency and severity or pure premium? (Note that even if the analysis was done separately for severity and frequency, we could still weight the pure premiums.) Is one more appropriate for long term and the other short? Is allocated included, or perhaps is the percentage of allocated to indemnity weighted (with one's own countrywide or with industry?)

Finally if the weight is not assumed to be 0% or 100 % what sort of credibility formula should be used? There are in the literature[19] three basic methods(see bibliography) as well as some procedures that ISO uses. In addition the method that St. Paul uses in its rate filings to derive a state pure premium is, I would assert, effectively a credibility method.

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[19]A fourth by Boor, " A Stochastic Approach to Trend and Credibility," has just come out and I have not had time to review it.

Here, succinctly, is my recommended procedure: the detailed rational shall follow. For a given state's rate indication, the frequency level for each year is brought up to, via indexing, a level which is calculated based on the state frequency's historical relationship to countrywide frequency.[20] Long term severity trend, used to project out to the future, is based on a credibility weighting between our own countrywide and industrywide (in this case St. Paul), while short term severity trend is weighted with the short term countrywide. The severity weighting used is a variant of that proposed by Brehm and Guenther [7] (henceforward B&G) of which more details will be given below.[21] (This method is clearly indicated for the long term weighting with industrywide, while there is more room to argue about the proper procedure for the short term state weighting with countrywide.)

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[20]In our case we are using St. Paul data, taken from filings, as proxy for industrywide. Since the frequency numbers are not on the same basis as St. Paul, the comparison could not be made with it, so our own countrywide data was used. If one had "industrywide" data on the same basis it would make sense to use it here.

[21]Actually it is unclear to me whether the complement of credibility for short term trend should be our countrywide short term trend, or the complement should be the weighting of our countrywide short term trend with industrywide (St. Paul in our case) short term trend. Jumping ahead, the referenced paper by B&G does not explicitly present a way of doing this two way weighting, but given the machinery they present, there is a natural extension which will do it: roughly, combine the countrywide and St. Paul data into one regression and use in the new weighting. (See the formulas starting on pg. 178)

As a check to all of the above the St. Paul method should be applied to pure premiums.

II. Details

Given that we index frequency to the current level the issue of long versus short term trend does not arise when adjusting numbers in a rate analysis. Likewise the standard credibility procedures, do not seem particularly relevant to the indexing procedure. We wish to bring frequency to its current state level, but run into the usual problem on a individual state basis that the latest point will be an unreliable indicator of the current state level, both for measurement reasons (i.e. ultimate count selections) and the inherent randomness of the process.

The solution I propose is to calculate the historical ratio of frequency in a state to countrywide frequency. Apply that historical ratio to the countrywide number, and allow that to be the level to which the other years are being indexed. Exhibit 1 gives the calculation of countrywide indices, and Exhibit 12 gives the calculation of the indices for a few states. Note that the calculation of the K factor (i.e. the adjustment factor on the exhibit, 1.241 for state A) is based on a weighted average(by claim count) of ratios by year. Note also that K was calculated from CM & Occurrence data to get the best estimate of the relationship, but applied to the CM frequency only (which is how

the rate analysis was done.) If one had combined without adjustment CM and Occurrence frequencies one could not legitimately, because of timing differences, calculate indices. As usual one's judgement can never be suspended, and in this particular case there might be some argument for selecting a K factor (the alternate option) other than that mechanically generated.[22]

Severity which has a more traditional trend number will also have a more traditional credibility procedure. On the one hand based on some--usually arbitrary--criterion one could just pick a full credibility number and proceed from there. This procedure is not as terrible as it sounds since in practice it tends, over a long period of time, to generate factors which work in practice. We would, however, like something a little more objective. There are three basic tacks available in the literature.[23]

First there is the Venter procedure [5]. Here a full credibility standard is set based on the confidence interval

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[22]A refinement on this procedure, in order, e.g., to capture turns in a state's frequency out of phase with the countrywide's, might be to give the more recent years greater weights in calculating the K factor; such a weight would have to be, partially at least, a function of the relative number of claims in a year, and the variability in the ultimate estimates.

[23]Again, this does not include the Boor article referenced in Fn. 19. B&G give a somewhat more detailed description of these, but somehow missed the Hachemeister [8] article.

around a projected point assuming P and K factors, and using the standard machinery of classical credibility. Partial credibilities are then generated--a la' limited fluctuation credibility--as the ratio of confidence intervals. As mentioned, this brings with it the problems of classical credibility, and in addition, deals with a projected point rather than the trend itself.

Hachemeister [8], constructs a formula based on the Buhlman-Straub method. He ends up with a standard n/(n+k) formula, with k being the ratio of the process variance to the variance of the hypothetical means (the means in this case are the various trend estimates).

Finally there is the B&G procedure, which takes off from work of Theil & Goldberger [9] and Van Slyke [6], based on the fact that the optimal weights for two independent unbiased estimates of the same parameter is proportional to the reciprocal of their variances: i.e. the weights are $1/\sigma_1^2$ and $1/\sigma_2^2$(normalized by dividing by their sum); where these are the error variances from the two regressions being credibility weighted. (In our case an individual state vs Countrywide or industrywide.) Actually based on the previous principle they should have used the standard error of the estimates; but in the typical cases these weights will work out the same.

B&G go through the derivation of the formulas based on the Theil & Goldberger work for generalized and ordinary least squares (which is what we will stick to; generalized involves dealing with an unknown variance-covariance matrix). It is interesting to note that their method, besides its intuitive appeal is a cross between the other two methods. Like the classical, it allows for external information to be the complement of credibility (and we indeed use it to credibility weight the St. Paul data for long term); and similarly to Venter it is built around the concept of the variance around a regression line, though it is the error variance rather than that of the predicted point.

On the other hand, its motivation is closer to Hachemeister: it can also be put into a n/n+k format, and there can never be full credibility. Here, however, k is the ratio of the two error(=process) variances of the two regressions(this is only roughly so, but for our point will do). Rather than the variance of the hypothetical means we have the variance of the alternative in the denominator of k.

It is this difference that is the basis of my decision of which procedure to use.

For long term trend, which we use to project out to the future, one needs to measure the extent to which our own data versus

one's choice of the most reliable alternate estimate (in our case industrywide data as derived from a St. Paul filing) is indicative of true trends. Here the B&G method is more appropriate than the Hachemeister; we have two independent estimates of the same parameter. Classical trend could be used as well, to the extent one can live with the classical assumptions.

Since we are using the "standard" approach to ratemaking, we have, as previously mentioned, need of a short term trend estimate for a particular state to bring up the severity for each year in the rate analysis, to its current level.(If we did not use the "standard" method, one might suggest using a state's long term trend weighted with the countrywide/industrywide trend to derive a weighted fitted severity for a future projected year.) We need a measure of the extent to which a state's short trend (the 1% from our short term/long term discussion above) should be used, in order that 87 and the other years in our example, be brought to an appropriate level. Weighting with the countrywide/industrywide short term (not long term!) trend functions as a compromise, as it were, on how we should look at 87: a random phenomenon, or indicative of a truly different trend.

When looking at the credibility weighting for short term trend it is unclear which credibility method is best. The question to ask

is as the variance between the different individual state trend indications gets progressively larger are we, ceterus paribus, inclined to give more credibility to a state's own indication (per Buhlman-Straub), or not. Another way perhaps of asking the same question is, should we think of what we are doing as having two independent estimates of the same process, i.e. the state's underlying trend; or rather should we think of it as there being a distribution of trends across the country from which this state is a random selection.[24]

My judgement is that(and it was a close call) if individual states vary a lot from each other, there is less credence to any one individual state indication. For it seems that there is some underlying severity trend which both (a given state and countrywide) regressions are estimating.

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[24]One might be inclined to think that it is better put in terms of the equivalent, "we are trying to minimize the error across the whole country, rather than just in one state". While this may in fact be often intended, I do not like this approach whether for trend or pure premium. Insurance product prices are usually determined by the market forces of individual states(or smaller units); one can not pretend one does not have competitors: competitors who, in many circumstances know the market much better than you--or your countrywide average--knows. One needs to work at the individual market level or get selected out of the market.

The Bayesean question of how one incorporates, e.g., knowledge of what the competitors are doing, both for determining true loss costs, and for determining marketing strategies, is a crucial one. It is not one which is addressed here, nor is it addressed in the literature or in practice (other than under the general term, "business decision")

Even so one can certainly easily imagine situations (perhaps even this one) where one does think of individual states having a distribution of different severity trends(just as they have different pure premiums), even some positive and some negatives; in which case the other procedure might be more appropriate.

Thus credibility theory itself can not tell one what the "correct" formulas are; this is entirely a function of how one thinks of the process. The process I chose is modelled by a modified (see below) B&G.

As a check on one's conclusions it would be useful to employ the methodology used in St. Paul filings. This is similar to the method I described for frequency, but applied to pure premiums. Countrywide pure premiums are fit to a curve--of whatever sort--and projected out to the state's average loss date; a K factor of the relativity of the state raw pure premiums to the Countrywide fitted pure premiums is chosen (St. Paul filings do not indicate how this is done); and that K factor is applied to the projected countrywide severity. This has the virtue of eliminating the trend problems associated with the random fluctuations of individual states. Though credibility problems do creep in the back door to a certain extent in choosing one's K factor.

Having said all this I now rescind it and assert that I believe that the above procedures are totally unjustified in theory!! The problem is that in fitting a line to countrywide or state average severities, we assert that are doing regressions with all the σ^2s and machinery that comes with it. Nonsense. A line is fit to (most typically the logs of) severities via some numerical calculations that give a least square estimate; that's it. Note that in practice there is usually only one point for each year (independent variable) and that typically there is absolutely no attempt to justify anything relating to the validity of regression assumptions and the entire machinery that comes with it (estimated variances, confidence intervals, etc.). Why is the calculated s^2 an estimate of the error variance? Consider if instead of average severities, we had for all years the entire distribution of claims, and we fit our curve to this loss data? Now in practice we can not do this since for the recent years most claims are still open and their values are "wrong", i.e. not at ultimate. (In some cases we could do so with calendar year closed claim data). But if, say, we just used old years, of what import would the residual(process) variance, i.e. the variance around the mean for the year, be to credibility weighting. If a curve fit exactly, or nearly exactly, to the yearly means, would we care if there were larger or smaller variances of the individual claims around those means, as far as the credibility of our trend indication. Not at all. Which would give us a more reliable trend line, one where the line went exactly through the

means, but there was very wide variance around those means, (and hence a poor fit in terms of r^2 or F value), or one where the means diverged significantly (perhaps systematically) from the fitted line, but where there was very little variance around those means (so the model "explained" a relatively large portion of the total variance). It seems clear that the poorer fit here, is the better trend line for our purposes. So though the machinery of regression could be brought to bear with individual claim data, it is not relevant here.

Hence, if we are going to think in terms of regression at all, we must think of the means themselves as being the random variables in our trend calculations. And that the particular mean value for the a particular year is just the actual instantiation out of a universe of possible worlds which could have occurred. Given such a mean there is further distribution of individual claim sizes around it, which we can indeed analyze, but which is not relevant to our concern here. So we are backed into saying that the variance of the individual (logs of) points (mean severities) from the trend line, is an estimate of the underlying variance of all the possible means that could have existed in a given year. And the set off all these possible values satisfy the regression assumptions. This is and OK metaphor (we might call it modal regression) and I proceed to use it. But one must realize that it can be pushed only so far.

III. Additional Considerations

In doing the regressions by state, it is important to weight the regressions by counts(or some equivalent which accomplishes the same thing). This is especially important for individual states, where if there are a few counts only in a given year, the trend line could be easily distorted. Making this correction is not too difficult using the SAS GLM procedure, where this adjustment is a few words of code. On a technical point, the "freq" rather than the "weight" options should be used: "weight" does not increase the degrees of freedom but just minimizes the weighted function. While this is useful in many contexts, here it would throw off the credibilities. One way to circumvent worrying about these issues--here and below--is to just pick up the standard error of the estimates.[25]

Another, more significant, adjustment made was that I wished to incorporate the relative variabilities (between the two estimates of trend) of the estimates of average severity by year. I.e. the greater the uncertainty about the true value of a point (as embodied, perhaps, in the uncertainty of the ultimate selection process), the less credibility. This variability would be

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[25]B&G note that the calculations of their test statistic in matrix language is not that difficult in Lotus. I should note that The SAS PROC IML language, as well as its regression routines, make this all very simple to program.

thought of as parameter uncertainty, if we are thinking of our fit as being applied to all claims. It corresponds more to the measurement component of process variance if we think of the means themselves as being the random variable, per our suggested metaphor.

We had use six methods of calculating ultimates to get our average severities(See exhibit 6). While my first thought was that for each regression--besides weighting by counts--I would have six observations for each year, one for each ultimate selection. This was not quite right since for the old years all the methods had collapsed to the same indication and for those years, there was really only one estimate. After trying various options, I decided on one observation for each distinct severity number produced within a year, with the claim count divided evenly among them. I.e., if for a given year the six methods produced: 56,78,84,78,78,84, there would be a total of 3 observations, each getting n/3 counts. To go back to my metaphor, there were still three possible worlds accessible for this particular year, so this variance needs to be incorporated; obviously for an individual state the greater variability of the estimates would find its way into the regression and thus, correctly reduce the credibility. Given in table 1 are the various calculated credibilities.

INDIVIDUAL STATE $250,000 LAYER SHORT TERM SEVERITY TRENDS
CREDIBILITY WEIGHTED WITH COUNTRYWIDE INDICATIONS

	CREDIBILITY	NOTICE YR METHOD	CREDIBILITY	CALENDAR YR METHOD	SELECTED
COUNTRYWIDE *		10.0%		6.6%	8.0%
STATE A	0.311	9.7%	0.376	7.7%	8.5%
STATE B	0.149	9.7%	0.643	12.1%	11.1%
STATE C	0.711	18.1%	0.263	8.8%	12.6%
STATE D	0.066	9.2%	0.014	6.8%	7.8%
STATE E	0.224	9.5%	0.214	7.1%	8.1%
STATE F	0.150	9.6%	0.144	6.3%	7.6%
STATE G	0.145	10.8%	0.147	6.8%	8.4%

* Countrywide excluding States B & C.

Now this procedure violates regression assumptions. In particular the three observations listed above are not independent.[26] My response to this is, "Big deal." The only basis for thinking of this as a "regression" is some such metaphor as given above, and if its my game I get to make up the rules; I treat these as independent even if they are not.

4.CONCLUSION

As should be seen, there are a multitude of considerations which need to be addressed, beyond the mechanical generation of numbers, when choosing a trend number. While the issues addressed here are representative every product and every situation has its own family of issues which need to be addressed.

And as can be seen most especially from the somewhat speculative discussion of credibility for trend, there is still a great deal of work to be done in determining the right way to think about rate indications and its various components. Especially when one does not have a very large body of data.

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[26]Sue Groshung has suggested that I do a regression on each method (which was actually done) and use the variance between the trend estimates as the additional variance; this would be an interesting avenue to pursue.

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[3] McManus, Michael F., review of [2], pg. 305

[4] Biondi, Richard S., "Claims Made Multipliers-Professional," ISO interoffice correspondence 08/22/78

[5] Venter, G. "Classical Partial Credibility with Application to Trend," PCAS LXXIII, p. 27.

[6] Van Slyke, O.E. "Credibility Weighted Trend Factors," PCAS LXVIII, p. 160.

[7] Brehm, P.J. and Guenther, D. G., "The Econometric Method of Mixed Estimation-An Application to the Credibility of Trend," CAS Pricing Discussion Paper, May 1990, p. 171

[8] Hachemeister, C. A. "Credibility for Regression Models with Applications to Trend," reprinted in CAS Forum, Spring 1992, p. 307

[9] Theil, H. and Goldberger, A. S. "On Pure and Mixed Statistical Estimation in Economics," International Economic Review, Vol, 2, 1961, pg. 65.

Exhibit 1

MEDICAL MALPRACTICE FREQUENCY TREND STUDY @12/92
INDIVIDUAL PHYSICIANS AND SURGEONS

COUNTRYWIDE FREQUENCY INDEX

Loss Year	(1) Claims Made & Occurrence Total Indemnity Frequency	(2) Claims Made Total Indemnity Frequency	Index *
1985	0.052	0.089	0.596
1986	0.046	0.092	0.576
1987	0.046	0.056	0.946
1988	0.049	0.053	1.000
1989	0.049	0.051	1.039
1990	0.048	0.048	1.104
1991	0.048	0.049	1.082
1992	0.053	0.053	1.000

* Yearly Index = 0.053 / (2)

1978 – 1992 $250,000 LAYER

	FNOT YR Method 1	FNOT YR Method 2	FNOT YR Method 3	FNOT YR Method 4	FNOT YR Method 5	FNOT YR Method 6	CAL YR Method
Countrywide	7.7%	7.8%	8.0%	8.2%	8.8%	7.6%	7.6%
Countrywide excluding State A	7.6%	7.6%	7.7%	8.2%	8.9%	7.1%	7.7%
Countrywide excluding State B	6.8%	6.8%	6.9%	7.1%	6.9%	6.7%	7.3%
Countrywide excluding State A & B	6.3%	6.4%	6.1%	7.0%	6.0%	5.7%	7.3%
Countrywide excluding high severity states	8.3%	8.4%	8.1%	8.6%	7.4%	8.0%	6.8%
Countrywide excluding high severity & state A	7.9%	8.1%	7.7%	8.5%	7.2%	7.4%	6.8%

1985 – 1992 $250,000 LAYER

	FNOT YR Method 1	FNOT YR Method 2	FNOT YR Method 3	FNOT YR Method 4	FNOT YR Method 5	FNOT YR Method 6	CAL YR Method
Countrywide	12.8%	13.0%	13.7%	13.9%	16.1%	13.1%	9.7%
Countrywide excluding State A	13.6%	14.0%	14.2%	15.2%	17.3%	12.8%	8.8%
Countrywide excluding State B	10.1%	10.4%	10.7%	11.1%	10.8%	11.2%	9.0%
Countrywide excluding State A & B	10.2%	10.7%	9.5%	12.0%	8.9%	8.8%	8.0%
Countrywide excluding high severity states	9.7%	10.1%	9.3%	10.6%	7.4%	10.1%	8.4%
Countrywide excluding high severity & state A	9.9%	10.3%	9.1%	11.2%	7.6%	8.9%	7.1%

Medical Malpractice Frequency Trend Study
Countrywide Medical Malpractice Programs

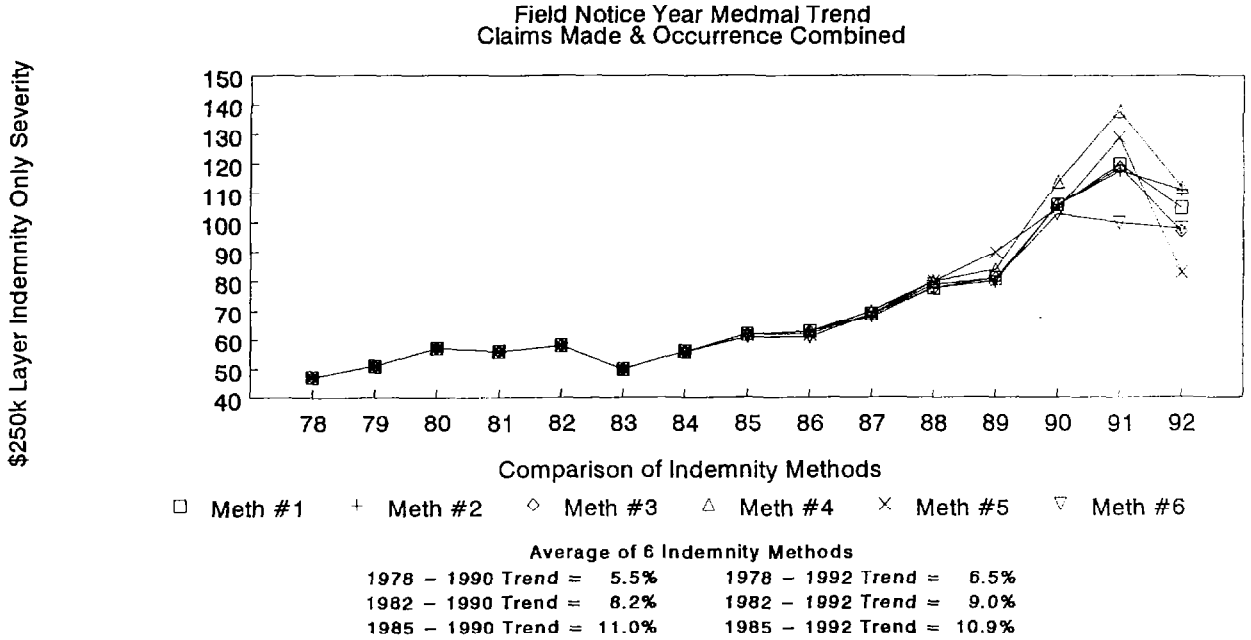
INDEMNITY COUNTS
Countrywide Frequencies : Claims <= $5,000

Loss Year	Occurrence Exposures	Claims Made Adjusted Exposures	Total Adjusted Exposures	Ultimate Indemnity Counts Occurrence	Indemnity Count Frequency Occurrence	Ultimate Indemnity Counts Claims Made	Indemnity Count Frequency Claims Made	Ultimate Indemnity Counts Total	Indemnity Count Frequency Total
1981	4302	15	4317	99	0.023	0	0.000	99	0.023
1982	6143	111	6254	106	0.017	4	0.036	110	0.018
1983	6649	188	6837	116	0.017	2	0.011	118	0.017
1984	6513	284	6797	112	0.017	7	0.025	119	0.018
1985	5255	415	5670	69	0.013	7	0.017	76	0.013
1986	4762	714	5476	39	0.008	13	0.018	52	0.009
1987	2632	1653	4285	23	0.009	19	0.011	42	0.010
1988	1175	4121	5296	12	0.010	38	0.009	50	0.009
1989	786	5042	5828	7	0.009	47	0.009	54	0.009
1990	567	5411	5978	5	0.009	32	0.006	37	0.006
1991	493	5521	6014	4	0.008	33	0.006	37	0.006
1992	459	5644	6103	7	0.015	31	0.005	38	0.006

INDEMNITY COUNTS
Countrywide Frequencies : Claims > $5,000

Loss Year	Occurrence Exposures	Claims Made Adjusted Exposures	Total Adjusted Exposures	Ultimate Indemnity Counts Occurrence	Indemnity Count Frequency Occurrence	Ultimate Indemnity Counts Claims Made	Indemnity Count Frequency Claims Made	Ultimate Indemnity Counts Total	Indemnity Count Frequency Total
1981	4302	15	4317	252	0.059	0	0.000	252	0.058
1982	6143	111	6254	339	0.055	8	0.072	347	0.055
1983	6649	188	6837	375	0.056	10	0.053	385	0.056
1984	6513	284	6797	338	0.052	11	0.039	349	0.051
1985	5255	415	5670	191	0.036	30	0.072	221	0.039
1986	4762	714	5476	146	0.031	53	0.074	199	0.036
1987	2632	1653	4285	79	0.030	74	0.045	153	0.036
1988	1175	4121	5296	28	0.024	179	0.043	207	0.039
1989	786	5042	5828	22	0.028	209	0.041	231	0.040
1990	567	5411	5978	21	0.037	229	0.042	250	0.042
1991	493	5521	6014	12	0.024	239	0.043	251	0.042

$250,000 Layer Indemnity Only Severity Trend
Countrywide excluding States A & B
Loss Data as of 12/31/92



Average of 6 Indemnity Methods

1978 – 1990 Trend = 5.5%	1978 – 1992 Trend = 6.5%
1982 – 1990 Trend = 6.2%	1982 – 1992 Trend = 9.0%
1985 – 1990 Trend = 11.0%	1985 – 1992 Trend = 10.9%

Exhibit 5

1993 MEDICAL MALPRACTICE TREND STUDY
CLAIMS MADE & OCCURRENCE COVERAGES COMBINED
1985 – 1992 $250,000 LAYER

	1	2	3	4	5	6
Countrywide	11.9%	13.8%	8.7%	9.7%	9.4%	11.0%
Countrywide excluding State A	12.1%	14.5%	8.6%	8.8%	8.1%	10.9%
Countrywide excluding State B	9.3%	10.7%	7.3%	9.0%	8.3%	11.0%
Countrywide excluding State A & B	9.2%	10.0%	7.3%	8.0%	6.6%	10.8%
Countrywide (Excluding High Severity States)	9.5%	NA	5.9%	8.4%	NA	9.4%
Countrywide (Excluding High Severity & State A)	9.5%	NA	5.9%	7.1%	NA	9.2%

1 = Individuals & Clinics – Field Notice Year Trend (Average of all 6 Methods)
2 = Individuals Only – Field Notice Year Trend (Average of all 6 Methods)
3 = Clinics Only – Field Notice Year Trend (Average of all 6 Methods)
4 = Individuals & Clinics – Closed Claim Trend Excluding 1st 2 yrs.
5 = Individuals Only – Closed Claim Trend Excluding 1st 2 yrs.
6 = Clinics Only – Closed Claim Trend Excluding 1st 2 yrs.

Medical Malpractice Coverage
Countrywide excluding states A & B : Claims Made & Occurrence Combined
$250,000 LAYER AS OF 12/31/92

ULTIMATE INDEMNITY ONLY

Field Notice Year	(1) Incurred Method	(2) Backwards Recursive Method	(3) Bornhuetter Ferguson Method	(4) Severity Method	(5) Berquist Sherman Method	(6) Fisher Lange Method	Paid Ind Only To Date	Current Reserves
1978	5,180	5,180	5,180	5,180	5,180	5,180	5,180	0
1979	5,458	5,458	5,458	5,458	5,458	5,458	5,458	0
1980	8,987	8,987	8,987	8,987	8,987	8,987	8,987	0
1981	11,896	11,896	11,896	11,896	11,896	11,896	11,896	0
1982	17,950	17,950	17,950	17,950	17,950	17,950	17,950	0
1983	16,575	16,575	16,575	16,575	16,575	16,632	16,575	257
1984	19,264	19,264	19,264	19,264	19,264	19,266	19,264	2
1985	19,576	19,576	19,576	19,576	19,334	19,742	18,826	918
1986	19,679	19,679	19,679	19,644	19,287	19,195	18,679	518
1987	16,786	16,585	16,942	17,089	16,935	16,749	16,401	131
1988	17,809	17,762	17,686	18,275	18,086	17,989	16,159	1,830
1989	18,978	18,959	18,984	19,823	21,205	19,861	16,356	2,626
1990	17,829	17,794	18,129	19,225	17,747	17,366	10,295	7,071
1991	21,444	21,077	23,810	24,636	23,029	17,762	6,983	10,779
1992	20,105	21,283	26,390	21,364	21,574	21,602	335	8,886
TOTALS	237,515	238,026	248,507	244,962	242,506	235,635	189,346	33,014

INDEMNITY ONLY SEVERITIES

Method 1 Severity	Method 2 Severity	Method 3 Severity	Method 4 Severity	Method 5 Severity	Method 6 Severity	Ratio of ALAE to Indemnity
47	47	47	47	47	47	28.6%
51	51	51	51	51	51	26.1%
57	57	57	57	57	57	26.5%
56	56	56	56	56	56	26.9%
58	58	58	58	58	58	31.9%
50	50	50	50	50	51	40.4%
56	56	56	56	56	56	52.3%
62	62	62	62	62	63	60.3%
63	63	63	63	62	62	68.3%
69	68	69	70	69	69	62.3%
78	78	78	81	80	79	68.5%
80	80	80	84	90	84	53.4%
105	105	107	114	105	103	65.5%
120	118	134	138	129	100	67.3%
105	111	149	112	113	113	61.8%

ULTIMATE COUNTS

Field Notice Year	Ultimate * Counts Method #1	Ultimate ** Counts Method #2	Backwards Recursive Ult Counts	Selected Ultimate Pd Counts	Pd To Date Closed Counts	Pending Counts	Future Paid Counts
1978	111	112	111	111	111	1	0
1979	107	107	107	107	107	0	0
1980	159	159	159	159	159	0	0
1981	214	214	214	214	214	0	0
1982	308	308	308	308	308	0	0
1983	331	337	331	331	331	7	0
1984	345	345	345	345	345	1	0
1985	313	317	314	314	311	8	3
1986	314	313	312	312	308	9	4
1987	251	240	244	244	240	8	4
1988	236	220	227	227	214	27	13
1989	252	224	236	236	207	55	29
1990	193	155	169	169	123	87	46
1991	245	154	178	178	93	189	85
1992	181	177	191	191	17	623	174
TOTALS	3,542	3,383	3,446	3,446	3,088	1,015	358

ULTIMATE ALLOCATED EXPENSES

Ultimate ** ALAE Method #1	Ultimate **** ALAE Method #2	Paid ALAE To Date	Incurred Ind & Alae To Date
1,482	1,482	1,482	6,662
1,417	1,434	1,417	6,875
2,359	2,412	2,359	11,346
3,398	3,474	3,398	15,294
5,668	5,792	5,645	23,595
6,888	8,743	6,611	23,443
9,970	10,170	9,751	29,017
11,748	11,841	11,333	31,075
13,203	13,478	12,194	31,389
10,381	10,598	9,077	25,609
12,168	12,398	9,861	27,850
10,365	10,575	7,361	26,345
11,874	11,924	8,018	23,384
14,590	14,950	3,209	20,871
13,736	13,953	340	9,561
128,865	131,226	90,056	312,416

ALAE ONLY SEVERITIES

ALAE Severity #1	ALAE Severity #2
13	13
13	13
15	15
16	16
18	19
20	20
29	29
37	38
42	43
43	43
54	55
44	45
69	71
82	84
72	73

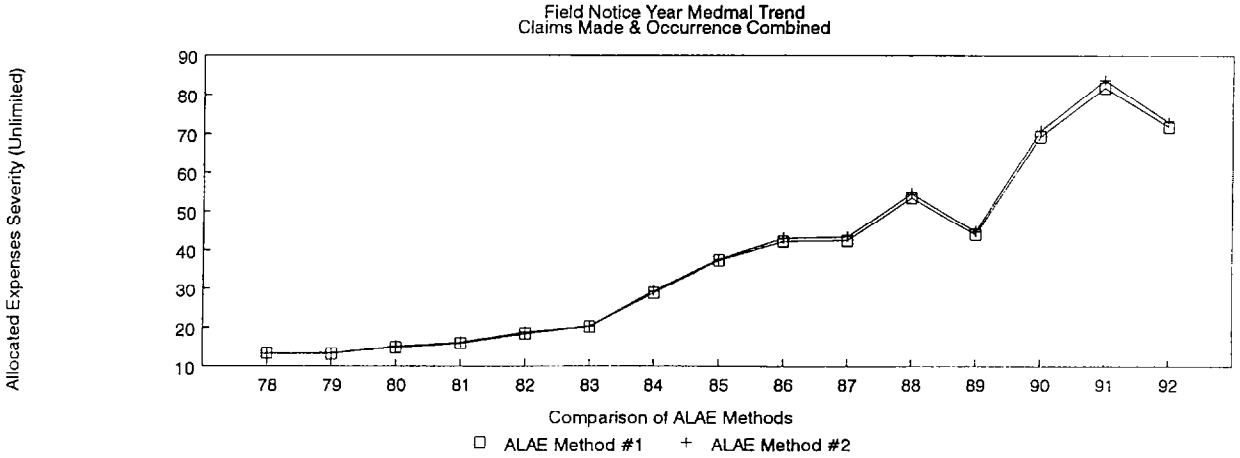
* Ultimate Counts Method #1 uses a Paid Counts triangle to develop Ultimate Indemnity Counts.
** Ultimate Counts Method #2 uses an Incurred Counts triangle to develop Ultimate Indemnity Counts.
*** Ultimate ALAE Method #1 is the traditional development method applied to paid allocated expenses.
**** Ultimate ALAE Method #2 develops the Ratios of Paid ALAE to Incurred Indemnity to get the Ultimate Ratio, then it multiplies this ratio by the projected Indemnity Only Ultimate (2).

Medical Malpractice Coverage
Countrywide excluding states A & B
$250,000 Layer as of 12/92

Indicated Trend *

Years Fitted	Method #1	Method #2	Method #3	Method #4	Method #5	Method #6
82 – 86	6.9%	6.9%	6.9%	6.7%	6.5%	5.9%
82 – 87	7.8%	7.8%	7.8%	7.7%	7.0%	6.6%
82 – 88	7.6%	7.6%	7.6%	7.9%	7.4%	7.3%
82 – 89	7.7%	7.8%	7.7%	8.2%	8.4%	7.8%
82 – 90	8.4%	8.5%	8.4%	9.1%	8.8%	8.2%
82 – 91	8.8%	8.9%	8.9%	9.7%	9.7%	8.3%
82 – 92	8.6%	8.7%	8.5%	9.3%	8.5%	8.6%
83 – 86	8.7%	8.7%	8.7%	8.5%	8.2%	7.5%
83 – 87	9.3%	9.3%	9.3%	9.2%	8.2%	7.8%
83 – 88	8.5%	8.5%	8.5%	8.9%	8.4%	8.4%
83 – 89	8.4%	8.5%	8.4%	9.0%	9.3%	8.7%
83 – 90	9.1%	9.2%	9.1%	10.0%	9.6%	9.0%
83 – 91	9.5%	9.5%	9.5%	10.5%	10.5%	9.0%
83 – 92	9.0%	9.2%	8.9%	9.8%	9.0%	9.2%
84 – 86	5.2%	5.1%	5.2%	4.8%	4.9%	4.1%
84 – 87	7.8%	7.7%	7.8%	7.7%	6.6%	6.3%
84 – 88	7.2%	7.3%	7.2%	7.8%	7.5%	7.6%
84 – 89	7.6%	7.7%	7.6%	8.4%	9.0%	8.3%
84 – 90	8.7%	8.8%	8.7%	9.8%	9.5%	8.8%
84 – 91	9.3%	9.3%	9.3%	10.5%	10.6%	8.8%
84 – 92	8.7%	9.0%	8.6%	9.7%	8.7%	9.1%
85 – 87	7.8%	7.8%	7.8%	7.8%	5.8%	5.9%
85 – 88	7.0%	7.2%	7.0%	8.0%	7.6%	8.1%
85 – 89	7.6%	7.8%	7.6%	8.7%	9.7%	8.9%
85 – 90	9.0%	9.2%	9.0%	10.4%	10.1%	9.4%
85 – 91	9.7%	9.7%	9.7%	11.2%	11.4%	9.2%
85 – 92	8.9%	9.2%	8.8%	10.0%	8.8%	9.5%
86 – 88	9.0%	9.4%	9.0%	11.0%	11.1%	12.2%
86 – 89	8.9%	9.1%	8.9%	10.5%	12.5%	11.3%
86 – 90	10.4%	10.6%	10.4%	12.3%	11.9%	11.0%
86 – 91	10.9%	10.8%	10.9%	12.7%	13.1%	10.3%
86 – 92	9.5%	9.9%	9.4%	10.7%	9.2%	10.3%
87 – 89	6.7%	6.9%	6.7%	8.4%	13.0%	10.3%
87 – 90	10.0%	10.1%	10.0%	12.1%	11.9%	10.4%
87 – 91	10.8%	10.7%	10.8%	12.8%	13.5%	9.6%
87 – 92	9.0%	9.5%	8.8%	10.0%	8.2%	9.9%
88 – 90	13.8%	13.7%	13.7%	15.6%	12.2%	10.1%
88 – 91	13.1%	12.7%	13.1%	14.9%	14.5%	9.1%
88 – 92	9.7%	10.2%	9.4%	10.2%	6.7%	9.8%
89 – 91	13.5%	13.0%	13.6%	15.9%	14.7%	8.6%
89 – 92	8.3%	9.2%	7.9%	8.3%	3.1%	9.8%

Allocated Expenses Only Severity Trend
Countrywide excluding states A & B
Loss Data as of 12/31/92



1978 – 1990 Trend = 15.3%	1978 – 1992 Trend = 15.0%
1982 – 1990 Trend = 16.1%	1982 – 1992 Trend = 15.2%
1985 – 1990 Trend = 10.2%	1985 – 1992 Trend = 11.4%

SELECTED LONG TERM TREND = 15%
SELECTED SHORT TERM TREND = 11%

Medical Malpractice Claims Made & Occurrence Coverage
Countrywide excluding states A & B
$250,000 Layer as of 12/31/92

ULTIMATE INDEMNITY & ALLOCATED EXPENSE PROJECTIONS

Field Notice Year	(1) Incurred Ind & Exp Method	(2) Incurred Ind only Method	(3) Paid Ind & Exp Method	(4) Paid Ind only Method	(5) Back-Rec Ind Only Method	(6) Back-Rec Ind & Exp Method	(7) Born/Ferg Incurred Ind & Exp	(8) Born/Ferg Paid Ind & Exp	(9) Born/Ferg Incurred Ind. Only	(10) Born/Ferg Paid Ind. Only	(11) Ind & Exp Paid Sev Method	(12) Ind Only Paid Sev Method	(13) Ind & Exp Inc. Sev Method	(14) Ind Only Inc. Sev Method
1978	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662	6,662
1979	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875	6,875
1980	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346	11,346
1981	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294	15,294
1982	23,618	23,618	23,618	23,618	23,618	23,595	23,618	23,618	23,618	23,618	23,618	23,618	23,618	23,618
1983	23,611	23,514	23,358	23,263	23,520	23,854	23,637	23,387	23,520	23,263	23,608	23,438	23,410	23,369
1984	29,375	29,291	29,312	29,234	29,238	29,030	29,372	29,310	29,293	29,234	29,384	29,279	29,409	29,310
1985	31,680	31,626	31,030	30,961	31,697	31,697	31,607	30,940	31,615	30,940	31,426	31,201	31,629	31,592
1986	32,911	32,916	32,704	32,675	32,941	32,806	32,795	32,575	32,914	32,691	32,760	32,709	32,995	32,971
1987	27,202	27,167	27,720	27,720	26,953	25,781	27,002	27,720	27,146	27,720	27,485	27,660	27,720	27,520
1988	29,906	29,976	30,806	30,773	29,884	28,335	29,524	29,806	29,998	30,418	29,544	30,027	30,768	30,517
1989	29,767	29,361	32,181	32,181	29,316	26,777	29,656	31,551	29,369	31,590	30,523	31,053	31,070	30,223
1990	29,381	29,503	30,594	30,594	29,434	24,978	29,808	30,594	29,574	30,594	27,899	29,369	30,594	30,594
1991	35,317	36,035	37,698	37,698	35,634	26,517	34,536	35,921	36,102	37,698	31,767	35,875	37,698	37,698
1992	33,058	33,842	15,767	20,139	34,982	25,889	34,861	34,746	35,530	36,095	18,381	21,203	35,325	35,201
TOTALS	366,003	367,026	354,963	359,032	367,395	339,437	366,593	370,343	368,857	374,037	346,570	355,608	374,412	372,790

Field Notice Year	(15) Hindsight Method	(16) Berquist Sherman Method	(17) Berquist Sherman Method	(18) Fisher Lange Method	Maximum	Minimum	Average Of all Ult Methods	Std Dev Of all Ult Methods	Lower Bound 95% C.I.	Upper Bound 95% C.I.	Paid Ind & ALAE To Date	Current Reserves	Inc. Ind & ALAE To Date	Average Pending Reserves
1978	6,662	6,662	6,662	6,662	6,662	6,662	6,662	0	6,662	6,662	6,662	0	6,662	0
1979	6,875	6,875	6,875	6,875	6,875	6,875	6,875	0	6,875	6,875	6,875	0	6,875	NA
1980	11,346	11,346	11,346	11,346	11,346	11,346	11,346	0	11,346	11,346	11,346	0	11,346	NA
1981	15,294	15,294	15,294	15,294	15,294	15,294	15,294	0	15,294	15,294	15,294	0	15,294	NA
1982	23,618	23,618	23,618	23,618	23,618	23,595	23,616	5	23,592	23,598	23,595	0	23,595	NA
1983	23,284	23,501	23,434	23,486	23,854	23,263	23,470	145	23,379	23,569	23,186	257	23,443	37
1984	29,309	29,369	29,422	29,265	29,422	29,030	29,302	87	29,295	29,409	29,015	2	29,017	2
1985	31,378	31,244	30,777	30,809	31,697	30,777	31,325	328	30,729	31,158	30,159	916	31,075	115
1986	32,416	32,562	32,280	32,139	32,995	32,139	32,709	234	32,174	32,480	30,873	516	31,389	57
1987	27,275	27,720	27,132	27,149	27,720	25,781	27,322	464	27,030	27,637	25,478	131	25,609	16
1988	29,650	29,788	29,631	29,625	30,806	28,335	29,943	574	29,306	30,056	26,020	1,830	27,850	68
1989	30,375	30,651	29,982	29,714	32,181	26,777	30,297	1,245	29,302	30,929	23,719	2,626	26,345	48
1990	27,868	27,728	27,438	26,724	30,594	24,978	29,070	1,577	26,266	28,327	16,313	7,071	23,384	81
1991	31,607	32,614	34,416	30,175	37,698	26,517	34,723	3,008	30,436	34,367	10,192	10,779	20,971	57
1992	31,101	33,752	18,156	29,828	36,095	15,767	29,325	7,050	22,639	31,851	675	8,886	9,561	14
TOTALS	358,057	362,723	346,461	352,710	376,856	327,136	361,279		344,326	363,558	279,402	33,014	312,416	

Medical Malpractice Coverage

Ultimate Indemnity Counts Frequencies
Occurrence & Claims Made Combined

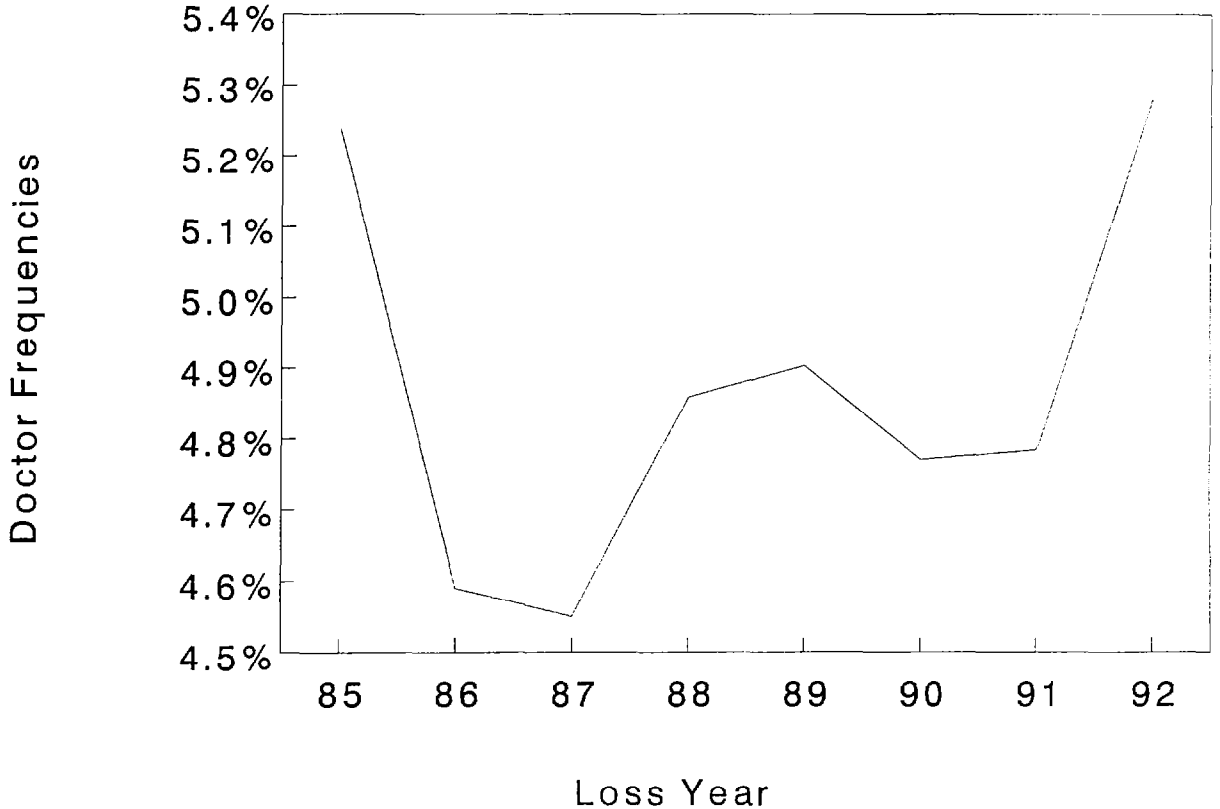


Exhibit 11

Medical Malpractice Claims Made & Occurrence Coverage
Countrywide excluding state A : Total Limits Layer @12/92

Field Notice Year	Occurrence Exposures	LAGS (0) 0.185	(1) 0.268	(2) 0.229	(3) 0.099	(4+) 0.219	Adjusted Occurrence Exposures	Claims Made Exposures	Combined Exposures	Ultimate Paid Counts	Frequency
1981	4302	796	1153	985	426	942	796	15	811	223	NA
1982	6143	1136	1646	1407	608	1345	2289	111	2400	353	NA
1983	6649	1230	1782	1523	658	1456	3862	188	4050	436	NA
1984	6513	1205	1745	1491	645	1426	4819	284	5103	511	NA
1985	5255	972	1408	1203	520	1151	5791	415	6206	442	7.1%
1986	4762	881	1276	1090	471	1043	5784	714	6498	408	6.3%
1987	2632	487	705	603	261	576	5067	1523	6590	295	4.5%
1988	1175	217	315	269	116	257	3960	2675	6635	294	4.4%
1989	786	145	211	180	78	172	2685	3661	6346	279	4.4%
1990	567	105	152	130	56	124	1888	4124	6012	214	3.6%
1991	493	91	132	113	49	108	1116	4278	5394	225	4.2%
1992	459	85	123	105	45	101	682	4404	5086	245	4.8%

Medical Malpractice Frequency Trend Study @12/92
Individual Physicians and Surgeons

Adjusted State Indices and Frequencies

State A Frequency Index

Calendar Year	(1) Total # Exposures	(2) Total # Frequency	(3) Relativity to Countrywide	(4) Adjusted Frequency	(5) Claims Made Frequency	(6) Adjusted Index 1	(7) Adjusted Index 2
1985	1182	0.058	0.188		0.091	0.723	0.538
1986	851	0.116	0.306		0.080	0.822	0.613
1987	742	0.036	0.083		0.053	1.241	0.925
1988	552	0.091	0.146		0.091	0.723	0.538
1989	769	0.048	0.107		0.048	1.370	1.021
1990	899	0.049	0.131		0.049	1.342	1.000
1991	975	0.049	0.142		0.049	1.342	1.000
1992	1046	0.049	0.138		0.049	1.342	1.000
Total	7016		1.241	0.066			
Alternate Option *				0.049			

(3) = { (2) / CW Total Indemnity Frequency } x { (1) / Total State A Exposures for all years }
(4) = Total of (3) x 1992 Countrywide Claims Made Frequency
(6) = 0.066 / (5)
(7) = 0.049 / (5)

Claims Made & Occurrence combined

* Due to the consistency in the total frequency from 1989 – 1992, 0.049 is and alternative adjusted frequency.

Individual State's Adjusted Index

	State A	State B	State C	State D	State E	State F
1985	0.472	0.000	0.713	0.000	0.240	0.000
1986	0.611	0.000	0.601	0.000	0.316	0.809
1987	0.674	1.291	1.022	1.865	1.093	1.248
1988	0.866	1.381	1.057	1.199	1.768	1.099
1989	1.487	1.291	1.022	1.007	1.156	0.945
1990	1.526	0.873	1.460	1.361	1.582	1.805
1991	1.526	0.958	1.136	1.171	1.503	0.945
1992	1.450	0.848	0.767	1.325	1.093	1.348
Projected Frequency	0.058	0.059	0.310	0.050	0.060	0.101