Comparison of Cost Valuation Methods for Workers Compensation Data[1]

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Background

The purpose of this study was to compare and contrast three workers compensation (WC) claim cost-valuation methods using data from the Ohio Bureau of Workers Compensation (OBWC). WC claims are composed of several cost components including payments for medical procedures, payments for indemnity (replacement wages), and claim reserves, which are anticipated future medical and indemnity costs. All paid and reserve costs combined for the claim are defined as the "total incurred" claim cost. WC claims can be open for extended periods of time, such that payments can be made over the course of months or years. As a claim ages, reserve cost totals diminish as the reserves are converted to paid totals. Once a claim is closed, the reserve cost is $0.

The "Most-Recent" method calculates costs as of a recent available date. This method is often used by insurers for both individual and aggregated claims to report losses back to insured clients. The purpose is to track current expected costs for the company and benchmark to insured peers for a given time period based on industry type and company size. Although the Most-Recent method is one of most commonly applied methods for benchmarking purposes, a possible basic drawback with the method for evaluating cost trends over time is that older claims are allowed more time to develop costs than newer claims. This means that a higher proportion of the total cost of older claims will be actual costs paid to date rather than reserves for future costs. This will bias the total cost estimate of older claims relative to more recent claims. At OBWC, reserve amounts for each claim are calculated using the proprietary "MIRA" system. These reserves represent estimates of the most likely future cost of the claim, which approximates the mode of the distribution of claims of that type, rather than the mean (or expected value). The Most-Recent method does not include inflation adjustments.

The "30-Month" method calculates costs after claims have been aged for a more consistent period of time. Costs of all claims are valued 30 months after January 1 of the calendar year in which the claim occurred (i.e. each claim is aged between 18-30 months). This method is used for both individual and aggregated claims to represent cost trends over time and to evaluate the effectiveness of interventions (e.g. compare losses before and after implementation). The 30-Month method is specifically designed to address the issue of differences in the valuation of claims associated with differences in the age of claims. The 30-Month method, like the Most-Recent method, includes reserve amounts that are estimates of the mode (most likely) future cost of claims of the same type, and does not include inflation adjustments.

One potential drawback of the 30-Month method is that the claim values are locked into past values that may be reflective of insurer system characteristics that were operating at that time. For example, OBWC changed reserving systems (e.g. MIRA I to MIRA II) such that, for the 30-Month method, reserves for claims prior to 2007 were calculated using

[1] The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of the Ohio Bureau of Workers' Compensation or the National Institute for Occupational Safety and Health.

MIRA I and reserves for claims 2007 and after were calculated using MIRA II. In contrast, the Most-Recent method (if applied 2007 and after) uses MIRA II for all claims, even for claims prior to 2007. OBWC has determined that MIRA II generally calculates smaller reserves for the same type of claim compared to MIRA I. Therefore, if trends over time using 30-Month reserve costs span the 2007 period, trend estimates will be biased downward, reflecting reserve system changes as well as changes of interest (e.g. industry exposure changes or intervention effects etc.).

A drawback of both the 30-Month and Most-Recent methods is that they do not represent the best estimate of the absolute values of claims. The Factor-Adjusted method addresses this limitation. It calculates costs by applying actuarial loss development factors that attempt to estimate the ultimate payout amounts for the claims. Reserves therefore represent the mean future cost of claims of the same type. This method is used by insurance underwriters for the purpose of analyzing aggregated claims for loss trends. A potential drawback with the Factor-Adjusted method is that it is intended to be applied to groups of claims, and its values are usually higher than actual individual claim values (since the mean is always higher than the mode and median in claim cost distributions). Another limitation of the Factor-Adjusted method is that the factors being used are based on all OBWC claims, so applying the factors to one industry may distort results. Unlike the other methods, the Factor-Adjusted method includes inflation adjustments for medical payments and projections of future costs are stated not in current year dollars, but dollars of future years.

Methods

Cost data from over 61,000 claims valued using the three methods were downloaded for all single location, OBWC-insured wholesale/retail trade (NAICS 42, 44, 45) companies for calendar years 2004-2009. Cost data included values for paid medical treatments, paid indemnity (compensation payments for lost wages), and reserved costs for the claim. The valuation date for the Most-Recent method was 12/31/2011, and slightly earlier, as of 9/30/2011, for the Factor-Adjusted method. OBWC sponsors two main programs that impact the cost of claims reported in their database. The first program allows insured companies to pay first dollar medical costs up to a specified limit for medical-only claims. Only medical paid costs in excess of this limit are reported to OBWC. A second program allows insured companies to pay first dollar indemnity costs, which are not reported to OBWC. Claims that were affected by either of these two programs were excluded from the cost comparison analyses. Many of the claims affected by these programs had a reported cost of zero, but there were also claims not affected by these programs that also had zero cost. These were also excluded from the analysis. To be defined as a $0 claim, the claim had to have a value of $0 for all three valuation methods. The three methods were first compared by calculating and comparing total incurred claim costs (medical paid + indemnity paid + reserves) as estimated by each method in each year 2004-2009, and for the 2004-2009 period as a whole. To test the statistical significance of the cost differences between methods, the non-parametric Wilcoxon Signed Rank test was used to compare the differences on a claim-level basis.

Next, 2004-2009 cost trends based on cost estimates of the three methods were compared. Two types of cost trends were calculated: trends in total cost per claim and trends in total cost per employee. The unit of analysis for cost per claim trends was the individual claim. The unit of analysis for cost per employee trends was the WRT industry subsector (3-digit NAICS code). Year-over-year rate ratios were calculated, with 95% confidence intervals. A single rate ratio for each method was calculated, but the average cost per claim or employee was allowed to vary by 3-digit NAICS code, since subsectors differ widely in costs.

Cost per claim was modeled using a log transformation, since the distribution of

individual claim costs was highly skewed, with a large proportion of low cost claims. The log transformation reduces the impact of very high cost, outlier claims which, without the log transformation, were observed to have large effects upon trend estimates and create an amount of year-to-year variation that makes trends more difficult to detect. Results of the trend analysis of logged claim cost are most accurately expressed in terms of the geometric mean, which usually varies in a way similar to the median in distributions with a strong rightward skew. Cost per employee was modeled as a rate, using negative binomial regression, which is robust to the distributional form of the cost. The results are presented in terms of mean cost per employee. All analyses were conducted using SAS version 9.2 (SAS Institute, Inc., Cary, NC).

Results

Costs per claim: The methods produced significantly different ($p < 0.0001$) total incurred values compared to each other on a claims level basis. Table 1 provides a summary of mean and median claim values with each method.

Geometric mean cost per claim trends: The three valuation methods yielded trends in total incurred cost that were substantially different, although the only differences that were statistically significant were those between the Factor-Adjusted cost trend and the trends using the other methods (Figure 1). Geometric mean costs increased by 24.9%, 15.8%, and 29.3% for the 30-Month, Most-Recent, and the Factor-Adjusted methods, respectively, from 2004-2009.

Mean cost per employee trends: While trends in total incurred costs were somewhat different, none of these differences were statistically significant (Figure 2). The mean cost per employee decreased by 46.2%, 56.3%, and 34.2% for the 30-Month, Most-Recent, and Factor-Adjusted methods respectively from 2004-2009.

Discussion

This study indicated that the three valuation methods tested produced different total incurred claim costs, total incurred cost per claim trends, and total incurred cost per employee trends. The importance of these findings depends upon the intended use of the data.

For benchmarking (e.g. comparing a company's losses to the industry mean in a given year), an interpretation of these results is that costs developed using one method should not be compared to costs using other methods. Since most insured companies are not able to use either the Factor-Adjusted or 30-Month methods to calculate costs, a suggested practice is to publish WC costs intended for benchmarking purposes using the Most-Recent method even if costs based on the other methods are also published.

For evaluating trends over time, although trends differed, it is unclear which method is most accurate. An overall issue with evaluating aggregate WC cost trends over time is that WC costs for a given claim continue to increase as the claim matures. This is exhibited in Table 1, where the Most-Recent total incurred values are higher than the 30-Month total incurred values. The 30-Month and Factor-Adjusted methods are both designed in part to address this problem, and in theory should produce a more accurate trend over time. The 30-Month method may be preferred, if only because it is easier to calculate and communicate with insured companies. To accurately determine trends in real costs over time, inflation adjustments should be made, since costs of claims in each accident year are stated in the dollars of different years. Additional research is required to guide the application of inflation factors, given the fact that paid and reserve amounts sum together costs that are paid and expressed in dollars of different years, and the Factor-Adjusted method reserve amounts, unlike reserves as estimated under the other methods, are stated in dollars of future years.

For estimating the absolute magnitude of costs of large groups of claims, it appears necessary to consider Factor-Adjusted costs, because reserves are based on the mean (expected

value) of the cost of claims of the same type. We saw that Factor-Adjusted costs are much higher than costs as estimated by the other methods (Table 1), and that trends using Factor-Adjusted cost are also often different from trends based on other methods.

For evaluating intervention effectiveness, the 30-Month and Factor-Adjusted methods may be preferred. Although these two methods produce different trends, the choice between them may be less important in the context of evaluating interventions, since the study design should measure the impact of intervention relative to the 'background' trend. Adjustment for cost trends would necessarily include adjustment for the impact of inflation, as well as any other trends in costs that are independent of intervention.

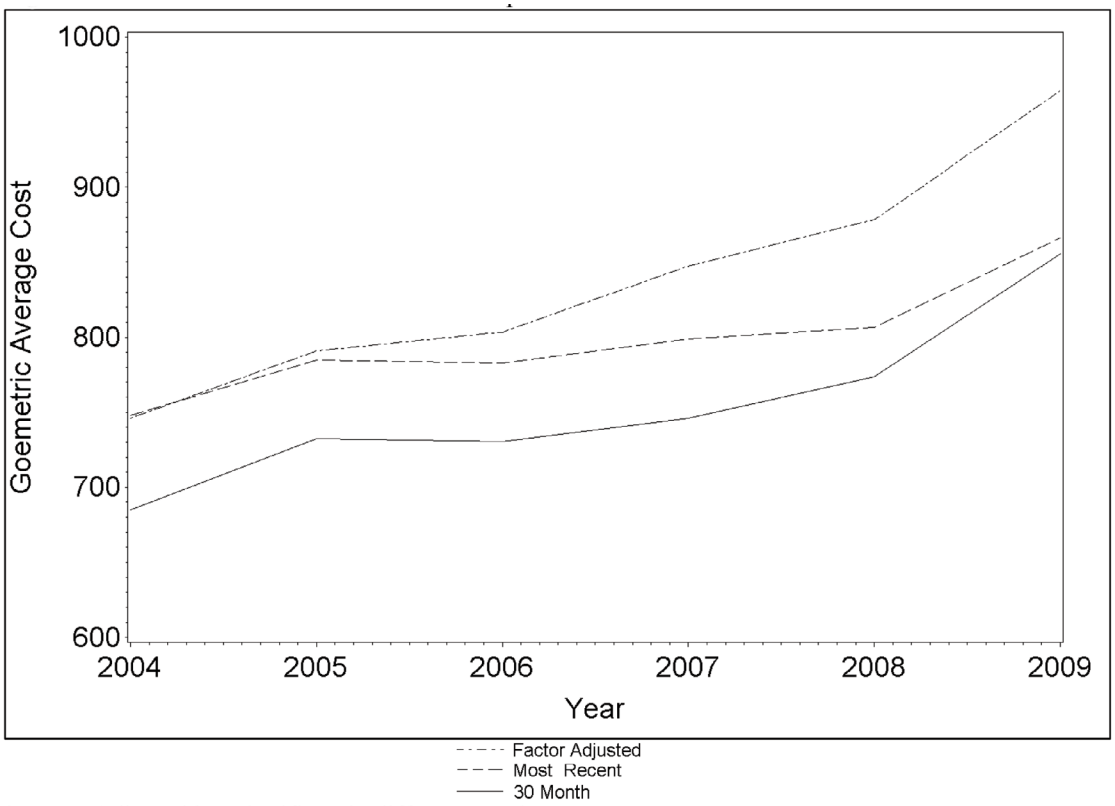
Conclusions

The differences between valuation methods for WC claims must be understood and communicated to users and audiences before applying for intended uses.

Table 1. Mean and Median Total Incurred Costs per Claim

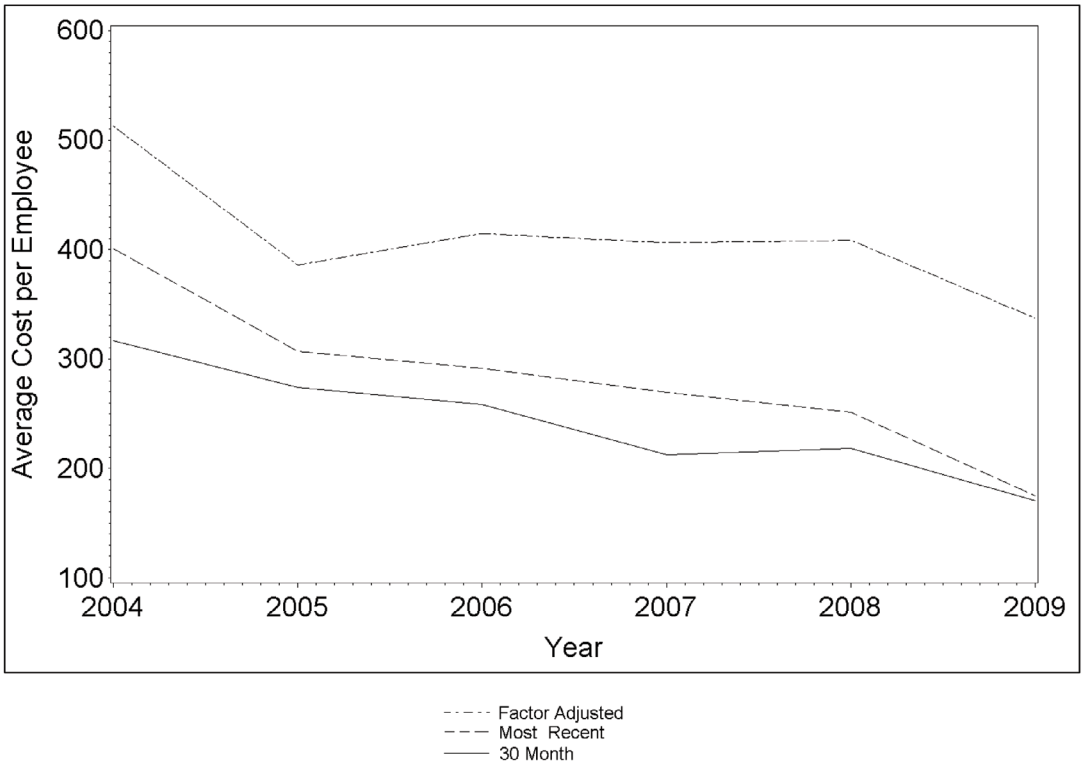
Year	Number of Included Claims	Number of Excluded Claims	30-Month		Most-Recent		Factor-Adjusted	
			Mean	Median	Mean	Median	Mean	Median
2004	13439	1684 (11.1%)	$6,518	$476	$8,083	$506	$10,287	$496
2005	12304	1652 (11.8%)	$5,763	$516	$6,429	$549	$7,996	$542
2006	10845	1518 (12.3%)	$6,411	$517	$7,445	$560	$10,655	$554
2007	9705	1690 (14.8%)	$5,240	$557	$6,569	$581	$9,455	$582
2008	8358	1606 (16.1%)	$5,964	$553	$6,786	$561	$10,848	$565
2009	6732	929 (12.1%)	$5,654	$624	$5,921	$627	$11,290	$638
TOTAL	61,383	9079 (12.9%)	$5,975	$530	$6,986	$556	$9,948	$552

Figure 1. Total Incurred Geometric Mean Cost per Claim*



*Factor-Adjusted is a significantly different trend

Figure 2. Total Incurred Mean Cost per Employee*



*Trends not significantly different

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