



Does Experience Rating Help Keep Workers Safe?

Julia Zhang, PhD, Esther Li,
Lucy Chen and YiChen Yu, MS

March 2023

WCIRB
California™
Objective. Trusted. Integral.

Table of Contents

Acknowledgements	3
Notice and Copyright	3
Executive Summary	4
Background	5
Research Questions	6
Research Methods	7
<i>Research Framework</i>	7
Figure 1. Years Used in Experience Rating	7
Figure 2. Trend of Total Claim Frequency for Experience-Rated Employers (2008-2019)	8
Figure 3. Comparison of Treatment and Control Employer Groups to Evaluate Efficacy of Experience Rating	9
Treatment and Control Employer Groups	10
Impacts of the First X-Mod	10
Table 1. Definition of Treatment and Control Employer Groups	10
Impacts of a Credit-to-Debit X-Mod Increase	11
Data Source	11
Regression Modeling Approach	12
Research Findings	13
<i>Research Question 1: How does the initial qualification for experience rating affect employers' future frequency of workers' compensation claims?</i>	13
Figure 4. Impact of First X-Mod on Claim Frequency	13
<i>Research Question 2: How does an increase in experience modification from credit to debit affect employers' future frequency of workers' compensation claims?</i>	14
Figure 5. Impact of a Credit-to-Debit X-Mod Increase on Change of Likelihood of Having Any Claims	14
Figure 6. Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency Change	15
Figure 7. Claim Frequency Change in Leading Industries Due to a Credit-to-Debit X-Mod Increase	16
Figure 8. Change in the Likelihood of Being Claim Free for Construction Employers Who Had an X-Mod Increase from Below 125 to Above 125 Percent	17
Figure 9. Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency by Employer Size	18
Conclusions	19
Conditions and Limitations	20
Appendix	21

Acknowledgements

The authors want to thank several colleagues at the WCIRB for their valuable and constructive suggestions for this study, including Dave Bellusci, Sean Cooper, Tony Milano and Laura Carstensen. This study also benefited from helpful comments and feedback from members of the WCIRB Actuarial Committee.

Notice and Copyright

The *Does Experience Rating Help Keep Workers Safe* (Report) was developed by the Workers' Compensation Insurance Rating Bureau of California (WCIRB) for the convenience of its users. The WCIRB has made reasonable efforts to ensure the accuracy of this Report. You must make an independent assessment regarding the use of this Report based upon your particular facts and circumstances. The WCIRB shall not be liable for any damages of any kind, whether direct, indirect, incidental, punitive or consequential, arising from the use, inability to use, or reliance upon information provided in this Study.

© 2023 Workers' Compensation Insurance Rating Bureau of California. All rights reserved.

No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including, without limitation, photocopying and recording, or by any information storage or retrieval system without the prior written permission of the Workers' Compensation Insurance Rating Bureau of California (WCIRB), unless such copying is expressly permitted in this copyright notice or by federal copyright law. No copyright is claimed in the text of statutes and regulations quoted within this work.

Each WCIRB member company, including any registered third party entities, (Company) is authorized to reproduce any part of this work solely for the following purposes in connection with the transaction of workers' compensation insurance: (1) as necessary in connection with Company's required filings with the California Department of Insurance; (2) to incorporate portions of this work, as necessary, into Company manuals distributed at no charge only to Company employees; and (3) to the extent reasonably necessary for the training of Company personnel. Each Company and all agents and brokers licensed to transact workers' compensation insurance in the state of California are authorized to physically reproduce any part of this work for issuance to a prospective or current policyholder upon request at no charge solely for the purpose of transacting workers' compensation insurance and for no other purpose. This reproduction right does not include the right to make any part of this work available on any website or any form of social media.

Workers' Compensation Insurance Rating Bureau of California, WCIRB, WCIRB California, WCIRB Connect, WCIRB Inquiry, WCIRB CompEssentials, X-Mod Direct, eSCAD, Comprehensive Risk Summary, Annual Business Comparative, X-Mods and More and the WCIRB California logo (WCIRB Marks) are registered trademarks or service marks of the WCIRB. WCIRB Marks may not be displayed or used in any manner without the WCIRB's prior written permission. Any permitted copying of this work must maintain any and all trademarks and/or service marks on all copies.

To seek permission to use any of the WCIRB Marks or any copyrighted material, please contact the WCIRB at customerservice@wcirb.com.

Executive Summary

In the California workers' compensation system, experience rating is a merit rating system with the primary statutory goal of providing a direct financial incentive for employers to promote a safe workplace. An experience modification, also called an X-Mod, compares the claims history of one employer to the average expected of other employers of similar size in the same industry. All things equal, an X-Mod greater than 100 percent increases the cost of an employer's workers' compensation insurance, while an X-Mod less than 100 percent decreases an employer's premiums. The key assumption underlying experience rating is that some employers will respond to significant experience rating events. Specifically, becoming experience-rated or experiencing changes in X-Mods, especially increases that cross the 100 percent threshold, is assumed to incentivize employers to address emerging work-related hazards to lower premiums and promote a safer workplace.

However, there is limited research validating the efficacy of experience rating in promoting safety and reducing work-related injuries. Prior research tends to support the safety incentive of experience rating mostly based on aggregate injury data or using a proxy measure for the experience rating status of employers, but results were somewhat limited in scope and not always conclusive. To further analyze the effectiveness of experience rating in reducing work-related injuries, the WCIRB conducted a study based on over a decade of employers' loss and payroll experience and published X-Mods to evaluate the independent impacts of experience rating on work-related injuries. The study used regression modeling to better understand whether employers respond to significant experience rating events and take action to reduce work-related injuries. Specifically, this study focused on two types of "shock" experience rating events that would potentially provide safety incentives to employers: an employer becoming initially qualified for experience rating and an increase in an employer's X-Mod from below 100 percent to above 100 percent. This study also analyzed whether impacts of experience rating events vary by employer size and industry.

The key findings of the study include:

- Qualification for experience rating led to a larger decline (-17%) in claim frequency for newly rated employers relative to non-rated employers of similar size and industry in the first year of experience rating. The impact on claim frequency persisted for the study period, three years after the first X-Mod was issued ([Figure 4](#)).
- For experience-rated employers, an increase in X-Mods from credit (less than 100%) to debit (greater than 100%) is associated with a larger decline in the likelihood (-2%) of having any claims. The difference adjusts for employer size and industry sector and is statistically significant ([Figure 5](#)).
- A credit-to-debit increase in X-Mods is also associated with larger declines in future claim frequency for experience-rated employers for three years after the X-Mod increase. The difference in claim frequency change is statistically significant and the difference grew to 8% by the third year after the X-Mod increase ([Figure 6](#)).
- The construction, manufacturing and hospitality industries have a relatively high share of X-Mod eligible employers. In these three industries, employers that had an increase in their X-Mods from credit to debit had a larger decrease in future claim frequency than other experience-rated employers whose X-Mods did not increase from credit to debit. In particular, construction employers with an X-Mod increase had a larger decline (-15%) in claim frequency by the third year of the X-Mod change than other experience-rated construction employers of similar size ([Figure 7](#)).
- The impact of a credit-to-debit X-Mod increase on future claim frequency varies by employer size. While an X-Mod increase is associated with a larger decline in claim frequency for employers of all sizes, medium-sized employers¹ appear to have the largest relative decline (-8%) in claim frequency ([Figure 9](#)).

¹ The average annual payroll range for medium-sized employers is between \$360K and \$880K. The range represents employers whose payroll is between the 33rd percentile and 67th percentile of the annual payroll distribution for all employers.

Background

In the California workers' compensation system, experience rating is a merit rating system with the primary goal of providing a direct financial incentive for employers to promote a safe workplace. Specifically, Section 11736 of the California Insurance Code provides that an experience rating plan shall contain reasonable eligibility standards, provide adequate incentives for loss prevention, and provide for sufficient premium differentials to encourage safety. In addition, Section 11734 of the California Insurance Code requires that each insurer adheres to the uniform experience rating plan approved by the insurance commissioner. Pursuant to the approved uniform California Experience Rating Plan, an experience modification, also called an X-Mod, is computed for each eligible employer that compares the claims history of that employer to the average expected of other employers of similar size in the same industry. Generally, a lower-than-100 percent X-Mod, referred to as a "credit" X-Mod, reflects better-than-average experience, while a higher-than-100 percent X-Mod, referred to as a "debit" X-Mod, reflects worse-than-average experience. A debit X-Mod usually increases the cost of an employer's workers' compensation insurance, while a credit X-Mod usually decreases an employer's premiums. The key assumption underlying experience rating is that employers will respond to significant experience rating events and their financial implications. Specifically, becoming experience-rated or experiencing a credit-to-debit X-Mod increase is assumed to incentivize employers to address emerging work-related hazards to lower premiums and promote a safer workplace.

However, there is limited research validating the efficacy of experience rating in promoting safety and reducing work-related injuries. Prior research tends to support the safety incentive of experience rating,² but results were somewhat limited in scope and not always conclusive, primarily due to two factors. First, most prior studies reviewed used only aggregate injury data at the industry or state level to draw inferences as to behavior change among employers, although some prior studies used a proxy, such as firm size, to measure the experience rating status of employers. Second, most prior studies reviewed did not adjust for the long-term downward trend of workers' compensation claim frequency largely driven by automation and improvements in workplace safety practices; instead, the observed declines in claim frequency in these studies could also be a result of many other factors in addition to X-Mod changes.

To further analyze the effectiveness of experience rating in reducing workplace injuries, the WCIRB conducted a study based on over a decade of employers' loss and payroll experience and published X-Mods to evaluate the independent impacts of experience rating on work-related injuries. The study used regression modeling to better understand whether employers respond to significant experience rating events and take action to reduce work-related injuries. Specifically, this study focused on two types of "shock" experience rating events that would potentially provide incentives to employers to promote a safer workplace:

- an employer becoming qualified for experience rating, and
- a large increase in an employer's X-Mod from below 100% to above 100%.

The "shock" of the first X-Mod may cause newly rated employers to pay close attention to how this first X-Mod affects their workers' compensation insurance premiums. Employers with a first X-Mod over 100 percent would likely see an increase in their premiums due to their worse-than-average claims history for their industry. Therefore, this study hypothesizes that these employers might pay greater attention to safety or implement some safety programs to reduce future workplace injuries and lower their X-Mods. A first X-Mod below 100 percent will likely reduce premiums, which may also motivate employers to continue their safety measures and keep claim frequency low, especially relative to employers that do not qualify for experience rating and do not benefit from the safety incentive of an X-Mod.

² Barth, Michael & Klein, Robert & Krohm, Gregory. (2008). *Workers' Compensation Insurance Experience Rating and Subsequent Employer Claims: The Wisconsin Experience*. Journal of Insurance Issues. 31. 16-42; Neuhauser, Frank W., Seth A. Seabury, and John Mendeloff, *The Impact of Experience Rating on Small Employers: Would Lowering the Threshold for Experience Rating Improve Safety?* RAND Corporation, WR-955-CHSWC, 2013. In addition, several studies on experience rating efficacy were conducted in Canada: Emile Tompa, Kim Cullen & Chris McLeod (2012) *Update on a systematic literature review on the effectiveness of experience rating*, Policy and Practice in Health and Safety, 10:2, 47-65.

The “shock” of a credit-to-debit increase in X-Mods may cause experience-rated employers to become more sensitive to workplace safety as not only has their premium increased due to the number and cost of work-related injuries, but it could also affect the perception of their business as a safe place to work. Therefore, this study hypothesizes that employers with a credit-to-debit X-Mod increase would be more incentivized than other experience-rated employers to take action to reduce work-related injuries subsequent to the X-Mod increase.

The study did not, however, test any experience rating events that could lead to no change or an increase in claim frequency, such as a decrease in X-Mod.

Research Questions

The key research questions of the study include:

- 1. How does the initial qualification for experience rating affect employers’ future frequency of workers’ compensation claims?**
- 2. How does an increase in experience modification from credit to debit affect employers’ future frequency of workers’ compensation claims?**



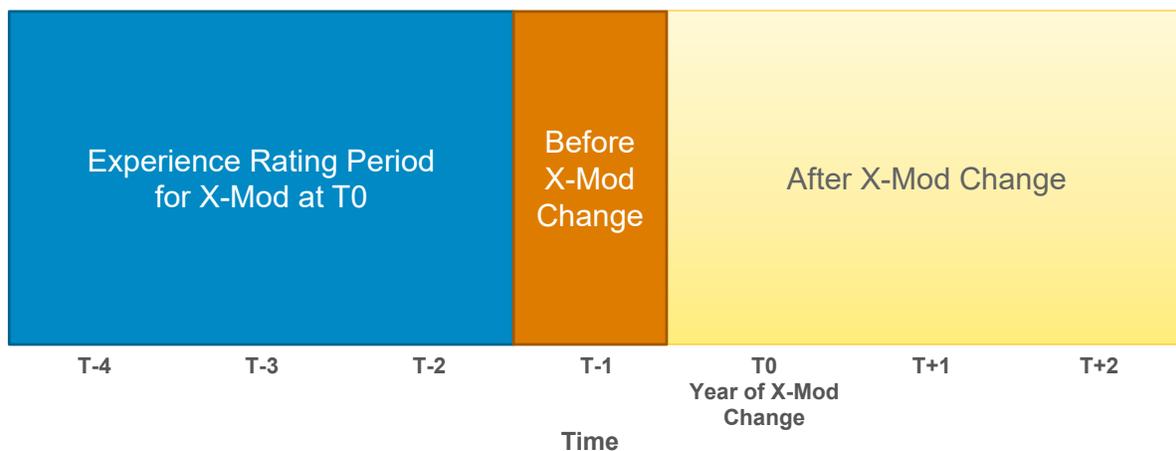
Research Methods

Research Framework

This study is designed to evaluate how significant experience rating events incentivize workplace safety practices to affect future claim frequency. As a result, it is important to ensure the significant experience rating event happens before the potential effects of changes in an employer’s efforts to promote workplace safety are realized.

An employer’s X-Mod is determined by the employer’s actual claim costs or losses³ in the experience rating period relative to the average expected losses of all employers in the same industry of similar size.⁴ The experience rating period is a three-year period that typically ends one policy year before the effective date of an issued X-Mod. As shown in **Figure 1**, an X-Mod for policy year T0 is determined by the loss experience for policy years T-4, T-3 and T-2, the experience rating period, and is not affected by the loss experience for policy year T-1. The study hypothesizes that an employer’s loss experience in year T0 and later might be more affected than the experience in policy year T-1 by the X-Mod changes in year T0 because it may take time for employers to react to any significant experience rating event and implement additional safety measures. Safety measures may also have a delayed effect on the employer’s loss experience after the X-Mod change, as it may take time to implement revised safety practices or to fully realize the impact of the revised safety practices. Therefore, this study measures how changes in X-Mod for policy year T0 affect employers’ loss experience in years T0, T+1 and T+2. Claim frequency (i.e., number of claims relative to reported payroll) is a key determining factor for employers’ loss experience and is used as the outcome measure for workplace safety in this study.

Figure 1. Years Used in Experience Rating

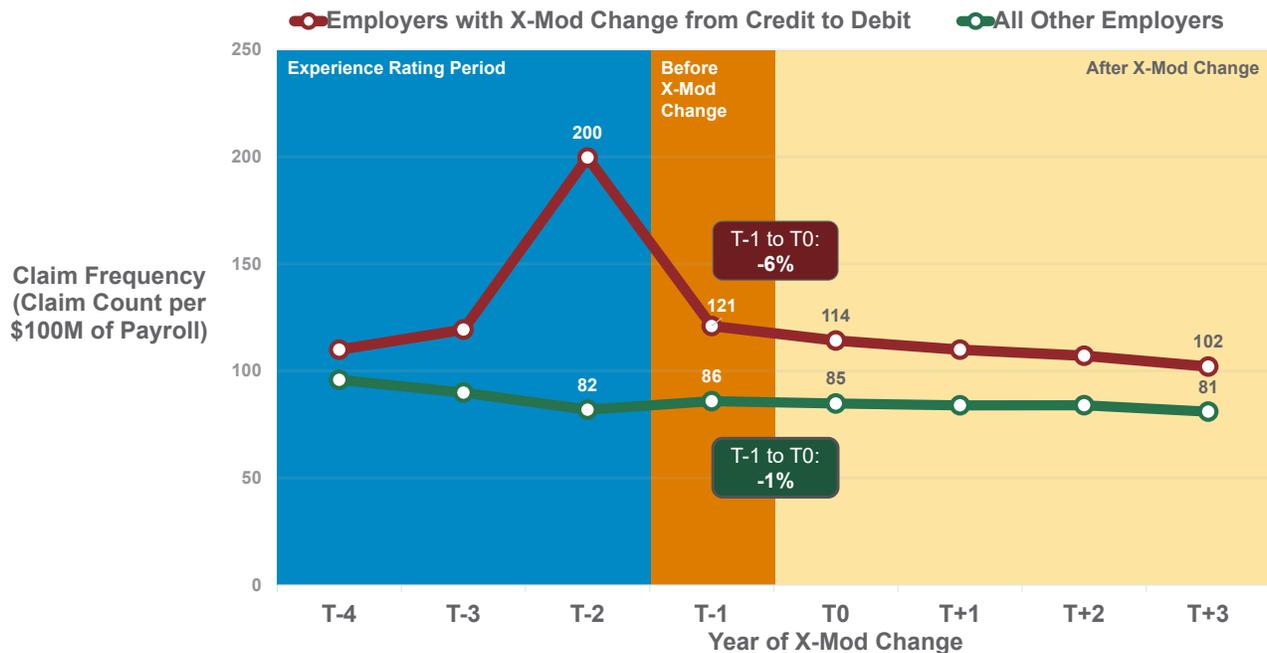


3 Actual losses include indemnity (i.e., wage replacement) and medical costs incurred on workers’ compensation claims.

4 California Workers’ Compensation Experience Rating Plan – 1995. [Experience Rating Plan \(wcirb.com\)](http://www.wcirb.com)

Comparing the experience in the gap year (T-1) and the year of the significant experience rating event (T0) helps ensure that changes in the employer’s loss experience in year T0 and later relative to that in year T-1 are not driven by outlier experience in year T-2 and a subsequent natural regression back to a more typical level (the “regression to the mean” effect), but potentially by the employers’ reactions to the significant change in the X-Mod in year T0.⁵ As shown in **Figure 2**, employers with a credit-to-debit X-Mod increase in year T0 generally have a spike in claim frequency in year T-2 (which in effect causes the X-Mod increase in year T0) and a dramatic frequency decline in year T-1, potentially reflecting “regression to the mean.” However, the continued frequency decline in year T0 and later may be partly attributed to employers’ reactions to the X-Mod increase in year T0. The “difference-in-differences” methodology and regression modeling approach described below are key to isolating the independent effects of an X-Mod change on future claim frequency.

Figure 2. Trend of Total Claim Frequency⁶ for Experience-Rated Employers (2008-2019)

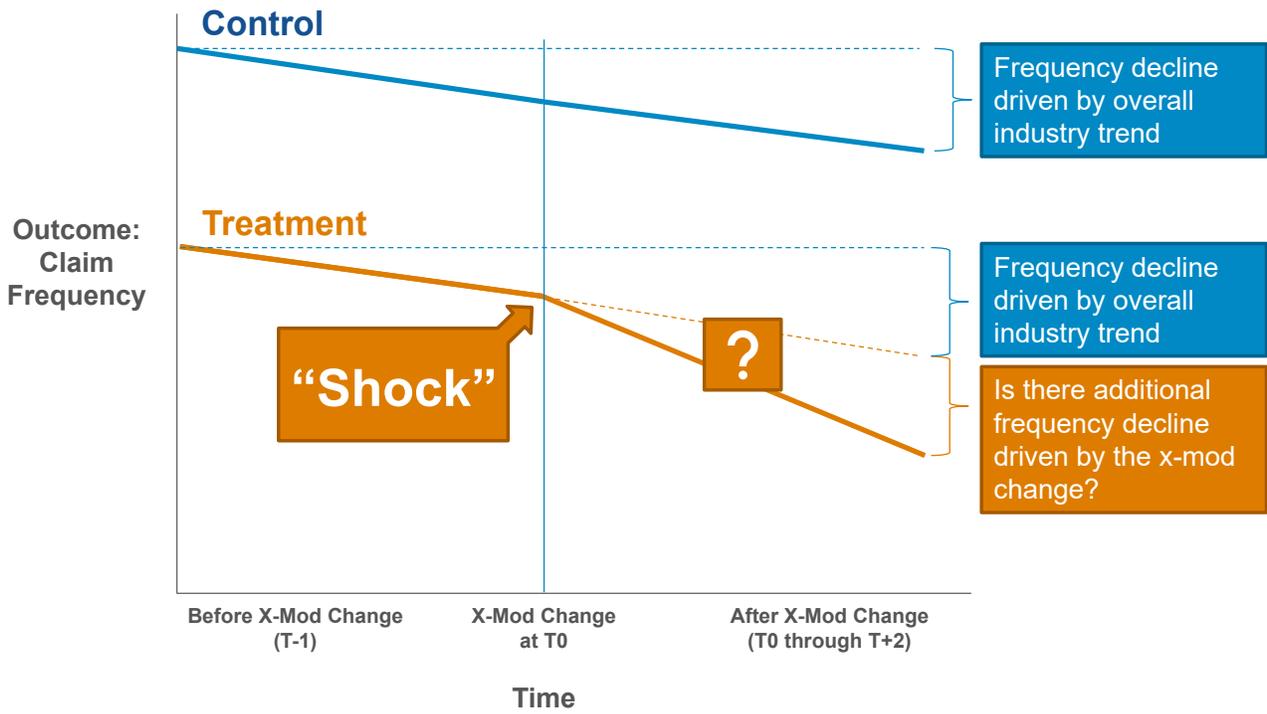


A key limitation in most prior studies is the limited differentiation in the claim frequency decline due to long-term trends (resulting from, for example, automation, higher safety standards, legislative reforms) from the decline that is due to safety efforts from employers following significant X-Mod changes. This study addressed the limitation by using a classic econometric method of “difference-in-differences”, which compares the outcome change for a treatment group to the outcome change for a control group so that any long-term trends that would presumably affect both groups similarly can be canceled out when comparing the two outcome changes. For the purpose of this study, we created a treatment group for employers with significant experience rating events and a control group for employers with limited or no change in their X-Mods (**Figure 3**). The frequency decline for the employers in the control group would mostly be driven by the overall long-term trends and not by a sharp change in X-Mods, while those in the treatment group would presumably see further declines in frequency directly related to the X-Mod “shocks”. Analyzing the “difference-in-differences” enables us to measure the extent to which X-Mod changes independently lower future claim frequency.

5 By our research design, a significant change in X-Mods in year T0 (determined by experience in years T-4 through T-2) from year T-1 (determined by experience in years T-5 through T-3) is typically driven by a claim frequency change in year T-2.

6 Claim frequency shown in the chart is not adjusted for employer size or industry mix, but average claim frequency for all employers in the treatment and control groups, respectively.

Figure 3. Comparison of Treatment and Control Employer Groups to Evaluate Efficacy of Experience Rating



Treatment and Control Employer Groups Impacts of the First X-Mod

To evaluate the impact of an employer's first X-Mod, we created a treatment group for newly rated employers who were not experience-rated for two years (T-2 and T-1) prior to year T0, when the employer's first X-Mod was issued, and remained experience-rated for the subsequent two years (T+1 and T+2) (see **Table 1**).⁷ The control group includes employers of relatively similar size that are not experience-rated from years T-2 through T+2. To help ensure the similarity of the treatment and control employer groups, as newly rated employers may be much larger than non-rated employers with experience too limited to be credibly predictive of future losses, the study focused on non-rated employers who are just below the X-Mod eligibility threshold for the control group and limited the newly rated employers to those who are just above the eligibility threshold for the treatment group. In effect, this assumes employers of size close to the eligibility threshold are similar regardless of their experience rating status.⁸ The assumption is reasonable as a 2020 WCIRB analysis showed that the predictiveness of prior loss experience was similar for employers both just below and above the eligibility threshold.⁹

Table 1. Definition of Treatment and Control Employer Groups

Impact of First X-Mod

Comparison Groups	Years in the Experience Rating Period				
	T-2	T-1	T0	T+1	T+2
Treatment Employer Group	Not experience-rated		First X-Mod	Continue to be experience-rated	
Control Employer Group	Not experience-rated				

Impact of a Credit-to-Debit X-Mod Increase

Comparison Groups	Years in the Experience Rating Period				
	T-2	T-1	T0	T+1	T+2
Treatment Employer Group	Have a workers' compensation policy	X-Mod <100	X-Mod >100	Continue to have a workers' compensation policy	
Control Employer Group		No change or any change in X-Mod other than from credit to debit ¹⁰			

⁷ Newly rated employers defined for the purpose of this study may have an X-Mod before year T-2. However, it is generally rare for employers to move from above the X-Mod eligibility threshold to below the threshold.

⁸ Newly rated employers in the treatment group were further adjusted to be those that had a calculated indicated eligibility to X-Mod eligibility threshold ratio greater than 0.7 in year T-1 and smaller than 1.5 in year T0, while non-rated employers in the control group were those with a threshold ratio greater than 0.8 in both year T-1 and T0. X-Mod eligibility for each employer was calculated as the total of multiplying payroll and expected loss rate for each classification for the appropriate year. The calculation accounts for the 2017 change in the California Experience Rating Plan X-Mod calculation formula.

⁹ [The WCIRB Actuarial Committee Meeting Presentation](#) (Item AC20-12-04) at the December 11, 2020 meeting.

¹⁰ X-Mod change from credit to credit, debit to debit, debit to credit or to or from 100 percent.

Impacts of a Credit-to-Debit X-Mod Increase

Also shown in **Table 1** are the comparison groups for evaluating the impact of a credit-to-debit X-Mod increase. Employers in the treatment group are those with an X-Mod below 100 percent in year T-1 and an X-Mod above 100 percent in year T0, while employers in the control group are those with either no change or any change in X-Mod other than a credit-to-debit increase.

For both research questions, this study focused on employers in certain industries based on two criteria. First, given that only a fraction of employers are experience-rated, we focused on industry sectors with a high share of X-Mod eligible employers to ensure a sufficient analysis sample. In addition, it would be challenging to observe any significant declines in claim frequency for low-risk industries, such as computer programming and other professional services industries, as a result of X-Mod changes, so we also limited the analysis to industries with relatively high claim frequency in the past decade. Therefore, employers in ten industry sectors were included in the analysis: Construction, Manufacturing, Hospitality, Wholesale Trade, Agriculture, Healthcare, Retail Trade, Administrative Services, Transportation/Warehousing and Real Estate.¹¹

Data Source

This study analyzed the WCIRB Unit Statistical Report data of employers' loss and payroll experience for policy years 2008 through 2019 and compared claim frequency before and after the "shock" experience rating event for both the treatment and control employer groups. Published X-Mods for policy years 2011 through 2019 were used to create treatment and control employer groups for the evaluation of the first X-Mod, and those for policy years 2011 through 2017 were used for assessing the impact of a credit-to-debit X-Mod increase.¹² Claim frequency was calculated as the number of claims per \$100 million of reported payroll for each employer. The impacts of X-Mod changes on future indemnity claim frequency were also analyzed. The differential in the average claim frequency change for the treatment employer group relative to that for the control group was considered a direct result of the first X-Mod or the credit-to-debit X-Mod increase. Statistical tests on the differentials were performed in multivariate regression models as described in detail in the Regression Modeling section.

The impacts of credit-to-debit X-Mod increases were further analyzed by employer size, defined by average annual payroll over policy years 2012 through 2017.¹³ Employers were grouped into three sizes: small (average annual payroll less than \$360K), medium (average annual payroll between \$360K and \$880K) and large (average annual payroll greater than \$880K). Payroll ranges for the three employer sizes were determined by the 33rd percentile and 67th percentile of the average payroll distribution of all employers included in the analysis so that all three groupings contained the same number of employers. In addition, the impacts of X-Mod changes by industry sector were analyzed based on the employer's dominant classification on their policy mapped to the North American Industry Classification System (NAICS) Sector.¹⁴

11 An employer's industry sector is based on the employer's dominant classification on their policy mapped to the North American Industry Classification System (NAICS) Sector.

12 As shown in Table 1, the treatment and control employer groups for the evaluation of the first X-Mod (first research question) are defined as those that maintain the same experience rating status for two years after year T-0, while there is no X-Mod requirement for either treatment or control employer group after year T-0 for the evaluation of a credit-to-debit X-Mod increase (second research question). Therefore, the number of years of X-Mod information needed to define treatment and control groups differs between the two research questions.

13 For the purpose of this study, adjustments were made to make the three employer size groups in different industries comparable, including limiting employers with average annual payroll between 33rd percentile and 67th percentile at the time of X-Mod change for each industry.

14 The dominant classification for each policyholder was determined based the classification that had the most reported payroll. Employers were selected for this component of the analysis only if they had the same dominant industry sector in years T-1 through T+2.

Regression Modeling Approach

We constructed multivariate regression models to estimate the independent effects of the first X-Mod and a credit-to-debit X-Mod increase on future claim frequency comparing the treatment employer group to the control group.¹⁵ In each model, we controlled for several key confounding factors that may influence claim frequency, including industry sector, employer size and different policy years when the X-Mod change occurred. The selection of these controlled variables was informed by exploratory data analysis and model fit.

Since the key outcome measure is claim frequency (i.e., claim count per \$100 million of payroll), a rate variable, we selected a Poisson regression model with an offset term as the primary modeling approach. In addition, a large share of employers, especially the newly rated and non-rated employers, remained claim free during the analysis period from years T-1 through T+2; hence, the distribution of claim frequency is skewed with a high concentration of zeros. Because of the skewed frequency distribution, we selected a zero-inflated regression for this analysis, which can model count and rate data that has an excess of zero counts. The zero-inflated regression model allows modeling impacts of X-Mod changes on the likelihood of being claim free concurrently with the impacts on claim frequency. To facilitate the interpretation of the results from the logistic regression component, we estimated the average marginal effects of a credit-to-debit X-Mod increase on changes in employers' probability of having any claims based on the sample data.¹⁶

We conducted model diagnostics for the final model specifications, including testing the overdispersion of the outcome variable for the Poisson regression component in the zero-inflated model and evaluating the overall model fit for the logistic regression component. Statistical significance at 95% confidence level of the model results was based on robust standard errors adjusted for correlation by employer over time.

Using a similar modeling approach, we analyzed the impacts of credit-to-debit X-Mod increases by industry sector and by employer size in separate zero-inflated Poisson models for each selected industry and for each employer size group.

¹⁵ An interaction term for treatment/control group indicator and different years in the analysis period was included in all regression models to estimate the average claim frequency change for employers in the treatment group relative to that for employers in the control group.

¹⁶ Without any transformation, logistic regression produces the effects of any intervention on the odds of success for one group relative to another, commonly known as "odds ratio". Odds of success is defined as the probability of success relative to the probability of failure. Due to challenges in interpreting X-Mod impacts in the form of odds ratios, we transformed odds ratios to probability changes.

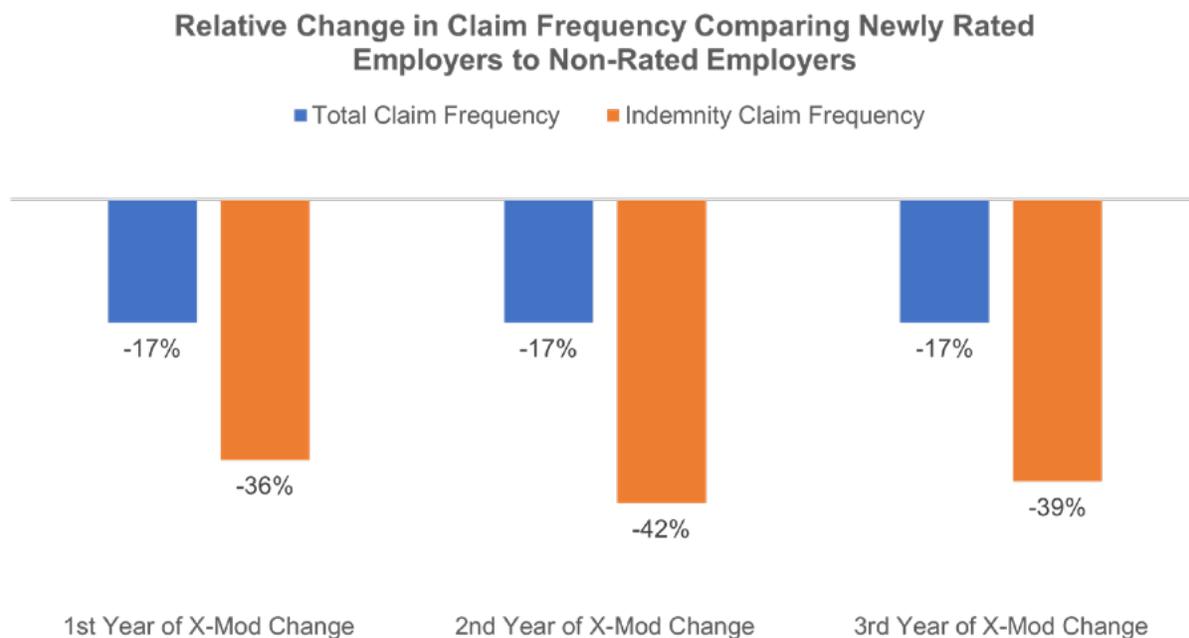


Research Findings

Research Question 1: How does the initial qualification for experience rating affect employers' future frequency of workers' compensation claims?

Overall, a sample of 5,309 newly rated employers and 2,644 non-rated employers were included in the treatment and control groups, respectively. The initial qualification for experience rating appears to incentivize newly rated employers to respond, which leads to a larger decrease in future claim frequency. As shown in **Figure 4**, during the first year of the initial X-Mod, employers who were experience-rated for the first time had on average a larger decline in claim frequency (-17%) than employers of similar size and industry who did not become experience-rated. The difference in the claim frequency change between the newly rated and non-rated employers persisted in the second and third year after the first X-Mod.

Figure 4. Impact of First X-Mod on Claim Frequency



We also analyzed the impact of the first X-Mod on future lost-time or indemnity claim frequency. Indemnity claims include claims with lost time from work, which typically incur significantly higher average costs than claims involving only medical benefits. Similar to the impact on all claims, indemnity claim frequency for newly rated employers declined more significantly (-36%) than for non-rated employers of similar size and industry in the first year of the initial X-Mod. The larger decline in indemnity frequency for the newly rated employers continued in the second and third year.

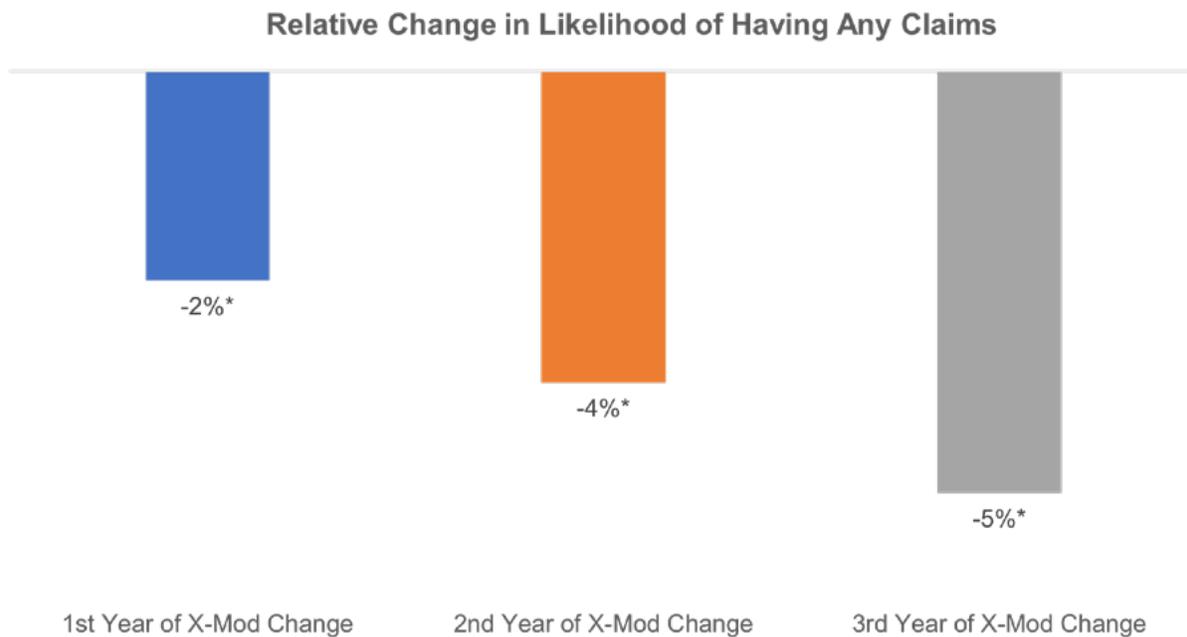
However, the estimated X-Mod effects on total claim frequency and indemnity claim frequency are not statistically significant at the 95% confidence level, mostly due to a small sample size of employers with at least one claim during the analysis period of four years. On average, about 56% of newly rated employers remain claim free throughout the analysis period compared to 72% of non-rated employers. The high share of claim free employers in both the treatment and control groups is because most employers near the experience rating eligibility threshold have no claims during the three-year experience rating period, and those without any claims during the experience rating period are less likely to have claims in future years.¹⁷ Despite the limited sample size, the analysis results are directionally consistent with the study hypothesis and suggest that the initial qualification for X-Mod may have provided financial incentives for employers to improve workplace safety and thereby reduce workers' compensation claims.

¹⁷ [The WCIRB Actuarial Committee Meeting Presentation](#) (Item AC20-12-04) at the December 11, 2020 meeting.

Research Question 2: How does an increase in experience modification from credit to debit affect employers' future frequency of workers' compensation claims?

Overall, a sample of 14,757 employers that had a credit-to-debit X-Mod increase and 226,177 employers with no X-Mod change or any X-Mod change other than from credit to debit were in the treatment group and control group, respectively. The average X-Mod change for employers in the treatment group is a 34-percentage-point increase, while that for employers in the control group is a 3-percentage-point decline. During the first year of the X-Mod change, employers with a credit-to-debit X-Mod increase (treatment group) had a 2% larger reduction in the likelihood of having at least one claim than rated employers of similar size and industry who have no change or other types of change in their X-Mods (control group) (**Figure 5**). While the magnitude of the difference within the first year is small, it is statistically significant at the 95% confidence level. The difference between the treatment and control employer groups is greater by the second (-4%) and third year (-5%), both of which are also statistically significant at the 95% confidence level. This increase in differential between the treatment group and control group over time is consistent with the hypothesis that safety efforts may take time to implement and affect the number of workplace injuries and suggests significant impacts of experience rating on reducing work-related injuries.

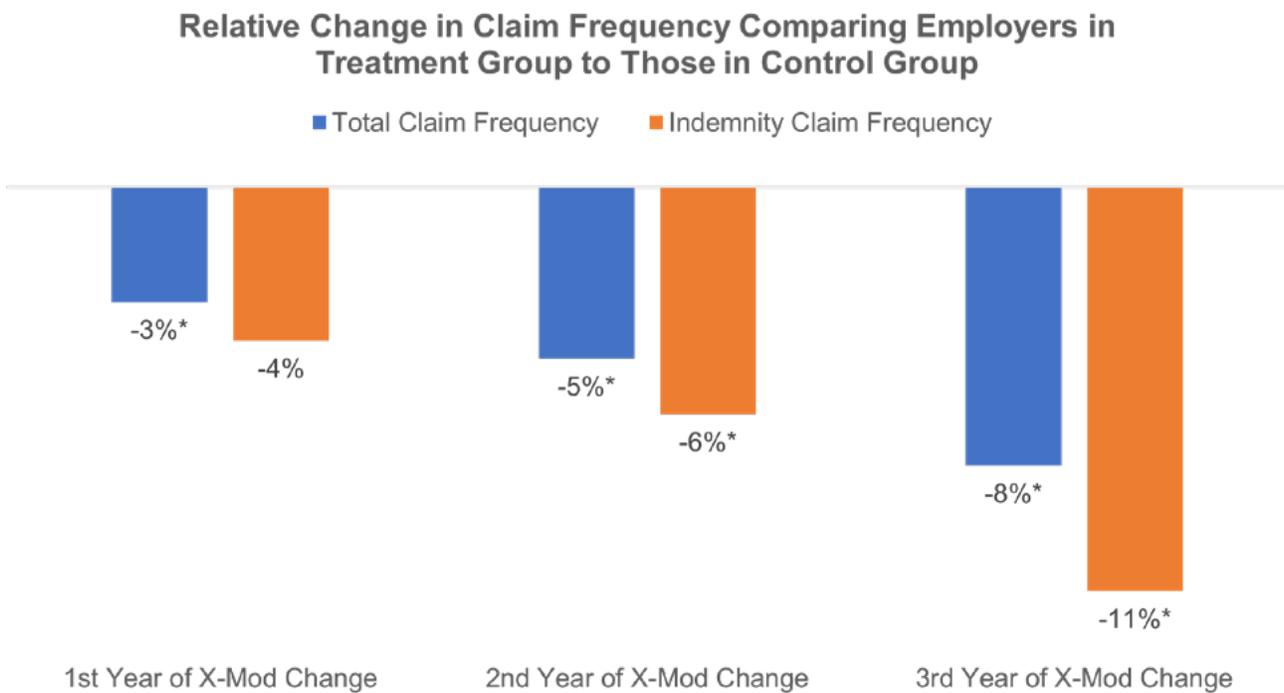
Figure 5. Impact of a Credit-to-Debit X-Mod Increase on Change of Likelihood of Having Any Claims¹⁸



¹⁸ The asterisk (*) in the chart indicates that the point estimate is statistically significant at the 95% confidence level.

Regarding claim frequency, a credit-to-debit X-Mod increase is also associated with greater declines in total claim frequency for employers in the treatment group over the next three years after the X-Mod increase than for employers of similar size and industry in the control group. **Figure 6** shows that the difference in frequency declines increased from 3% in the first year to 8% by the third year, and all three years are statistically significant at the 95% confidence level. As detailed in the research framework, the estimated differences in the frequency declines account for the “regression to the mean” effects by measuring the frequency change excluding the year with a dramatic frequency spike. The frequency decline for indemnity claims in the treatment employer group is even greater, reaching a difference of 11% by the third year, relative to the control group. The larger decline in indemnity claim frequency for the treatment group suggests that employers experiencing a credit-to-debit increase in X-Mods were not only able to reduce work-related injuries overall, but were also effective in reducing more serious injuries that require workers to take time off work to recover.

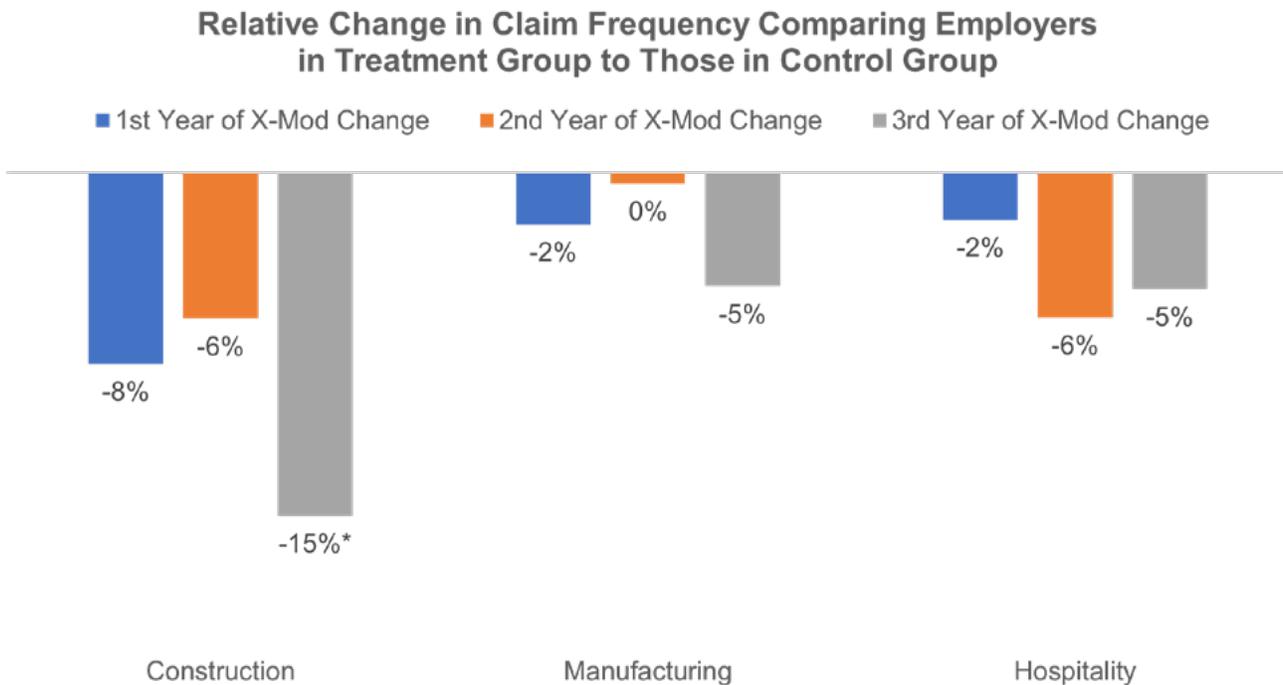
Figure 6. Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency Change¹⁹



¹⁹ The asterisk (*) in the chart indicates that the point estimate is statistically significant at the 95% confidence level.

To examine how employers in different industry sectors respond to the increase in X-Mod from credit to debit, we modeled claim frequency changes for employers in each selected industry and found employers in construction, manufacturing and hospitality appear to be particularly sensitive to increases in X-Mods. These three industry sectors have a relatively high share of X-Mod eligible employers²⁰ and a high level of workers' compensation risk exposure as reflected in advisory pure premium rates.²¹ As shown in **Figure 7**, employers in all three industries had a larger decline in claim frequency after an increase in X-Mod than all other employers of similar size in the control group. The difference in frequency decline continued in the third year after the X-Mod change.

Figure 7. Claim Frequency Change in Leading Industries Due to a Credit-to-Debit X-Mod Increase²²



The claim frequency decline for construction employers in the treatment group was the largest among the three industries. Construction employers may be more sensitive to changes to a debit X-Mod potentially because, although not a direct proxy for safety, experience rating is often linked to the bidding process of construction projects as certain projects may require construction employers to have an X-Mod below a specific threshold to be eligible to bid. As shown in **Figure 7**, there were initial effects of the X-Mod increase on the employers in the treatment group in the first and second year after the X-Mod change, and the effects reached a 15% larger decline than the construction employers in the control group by the third year. The excess frequency decline by the third year after the X-Mod change for construction employers is statistically significant at the 95% confidence level.

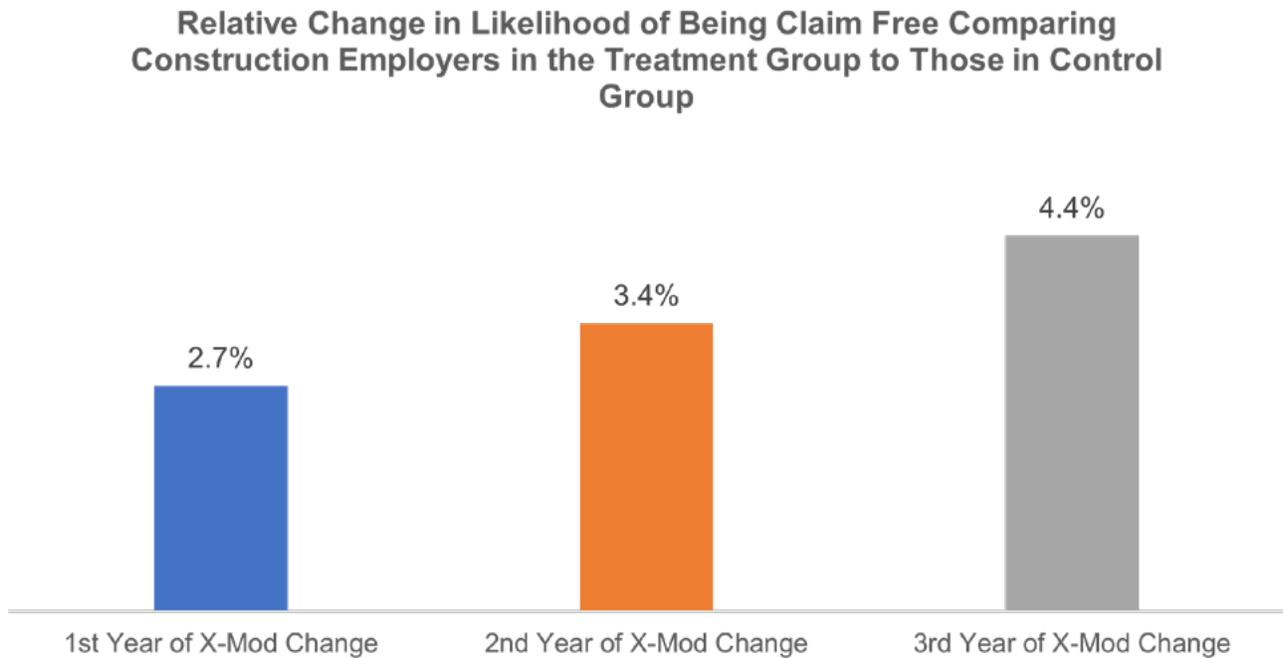
20 The three industry sectors account for approximately 42% of X-Mod eligible employers of all industry sectors.

21 Effective September 1, 2022, the average pure premium rates are \$4.60 for the construction industry, \$4.26 for the manufacturing industry and \$3.18 for the hospitality industry, all of which are significantly higher than the statewide average of \$1.56.

22 The asterisk (*) in the chart indicates that the point estimate is statistically significant at the 95% confidence level.

We further analyzed the effects of an X-Mod increase beyond a specific threshold (125 percent) on construction employers' likelihood of being claim free. For the purpose of the study, we selected the threshold of 125 percent because an X-Mod of 125 percent or higher may trigger a Cal/OSHA inspection and may compromise a contractor's ability to bid on certain projects.²³ As shown in **Figure 8**, among construction employers of similar size, there was a larger increase in the likelihood of being claim free for construction employers with an X-Mod increasing from below 125 percent to above 125 percent in the first year than construction employers who did not have an X-Mod increase to above 125 percent. The differential in the likelihood of being claim free continued to grow in the second and third years following the X-Mod change.

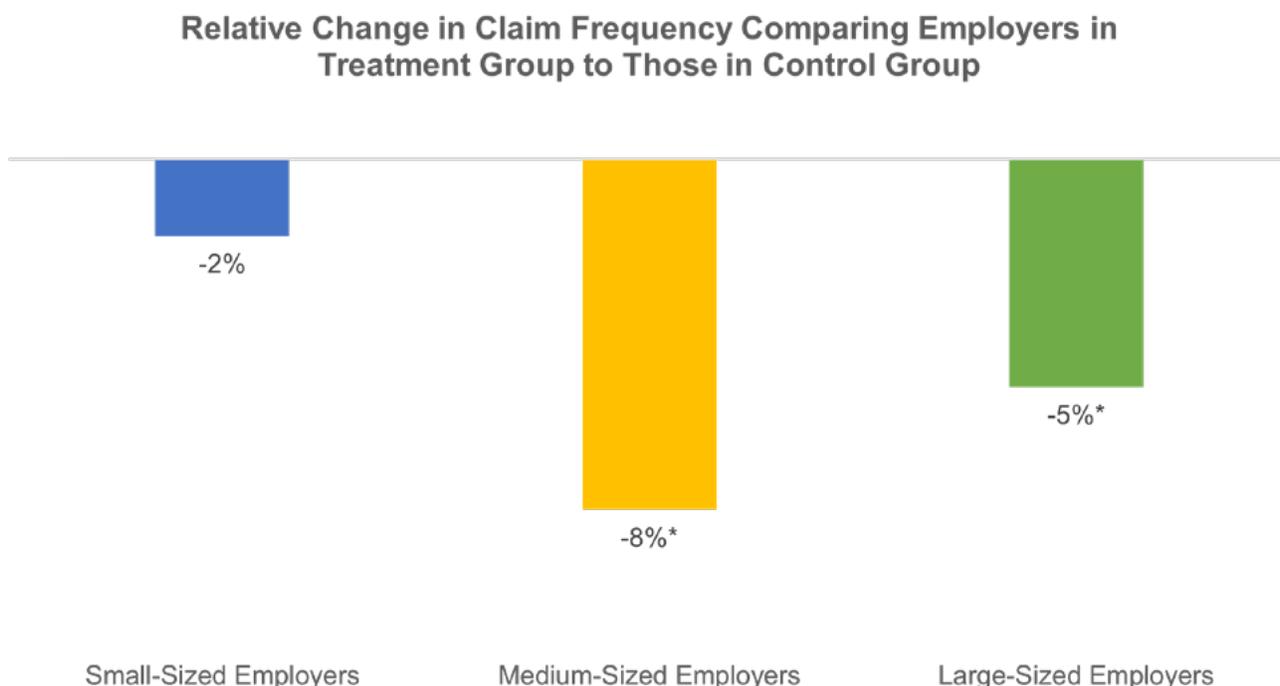
Figure 8. Change in the Likelihood of Being Claim Free for Construction Employers Who Had an X-Mod Increase from Below 125 to Above 125 Percent



²³ Cal/OSHA: Programmed inspection targeting: High hazard industries. <https://www.dir.ca.gov/doshpol/P&PC-19.pdf>.

This study also explored whether the impact of a credit-to-debit X-Mod increase varies by employer size based on annual average payroll, as employers with different resources may not have the same capability to invest in safety measures in response to an X-Mod increase. **Figure 9** shows the impact of the X-Mod increase on the claim frequency change²⁴ for small, medium and large employers.²⁵ Overall, we found an increase in X-Mod has an impact on further reducing injuries for employers of all sizes in the treatment group compared to other employers of the same size who are in the control group. Interestingly, mid-sized employers have the largest relative decline in claim frequency (-8%) after an X-Mod increase, followed by large employers (-5%), while small employers showed only a minimal impact (-2%). The analysis results are not surprising in that small employers may have limited resources to implement safety measures effectively after having a significant increase in their X-Mods and large employers may be less responsive to X-Mod changes since they may already be using loss sensitive rating plans, such as large deductible policy plans.

Figure 9. Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency by Employer Size²⁶



24 The claim frequency change for each employer size group represents the average impacts of a credit-to-debit X-Mod increase over a three-year period after the X-Mod increase.

25 As detailed in the Research Methods section, small employers are defined as those with average annual payroll lower than \$360K (33rd percentile), medium-sized employers were those with average annual payroll between \$360K and \$880K and large employers were those with more than \$880K (67th percentile) in annual average payroll.

26 The asterisk (*) in the chart indicates that the point estimate is statistically significant at the 95% confidence level.

Conclusions

This study is intended to assess the efficacy of experience rating in promoting workplace safety based on over a decade of California employers' loss and payroll experience. Overall, the study found that both first X-Mods and an increase in X-Mods from credit to debit appear to serve as an effective incentive for employers to promote a safer workplace.

Specifically, the analysis showed:

- Newly rated employers tend to have a larger decline in claim frequency over three years after their first X-Mods than employers of similar size in the same industry that do not become experience-rated. The results indicate an impact of the initial qualification for experience rating that is directionally consistent with the intended incentive of experience rating to improve workplace safety.
- For experience-rated employers, we found that a credit-to-debit increase in X-Mods is associated with a statistically significant larger decline in the likelihood of having any claims and in overall future claim frequency. The observed impacts of the X-Mod increase on reducing work-related injuries persisted for several years.
- The study further evaluated the efficacy of a credit-to-debit X-Mod increase for employers in three relatively high-risk industries: construction, manufacturing and hospitality. In all three industries, employers with an X-Mod increase from debit to credit had a larger decrease in claim frequency than other rated employers. In particular, construction employers were found to be more sensitive to an X-Mod increase than employers in other industries, potentially driven by the close relationship between X-Mods and eligibility for bidding on certain construction projects.
- In addition, the study found medium-sized employers appeared to have the largest relative decline in claim frequency following a credit-to-debit increase in X-Mods, suggesting a relatively high level of sensitivity to experience rating events compared to small employers with limited resources and large employers who may already be on other types of loss sensitive rating plans.

While this study uses claim frequency as a proxy for workplace safety, the WCIRB may further explore other measures in future research of experience rating efficacy, such as claim severity and the frequency of certain injuries that could more easily be prevented or reduced by implementing safety measures.

Conditions and Limitations

- The analysis of the California workers' compensation claims is based solely on the experience of insured employers and does not reflect the experience of self-insured employers. For the purpose of this study, employers in the treatment group and control group are those meeting the inclusion criteria of the research design and a sample of employers deemed credible for the purpose used.
- Workplace safety measured by claim frequency is based on the reported claims of insured employers. The study did not extensively explore the potential for employers to discourage the filing of claims, or so called "claim suppression", which may contribute to claim frequency decline for employers with significant experience rating events; however, the impact of X-Mod changes on claim frequency was found among all claims as well as among more severe indemnity claims, which tend to be more challenging to suppress. Our insights into claim suppression are consistent with RAND's prior research on the impact of experience rating.²⁷
- The information presented reflects a compilation of individual insurer submissions of information to the WCIRB. While the individual insurer data submissions are regularly checked for consistency and comparability with other data submitted by the insurer as well as with data submitted by other insurers, the WCIRB can make no guarantee with respect to the information provided by third parties.
- WCIRB estimates were based on information available at the time of this study. If subsequent information becomes available that changes the basis of our assumptions, these estimates may be affected.

²⁷ Neuhauser, Frank W., Seth A. Seabury, and John Mendeloff, *The Impact of Experience Rating on Small Employers: Would Lowering the Threshold for Experience Rating Improve Safety?* RAND Corporation, WR-955-CHSWC, 2013.

Table A. Coefficients of the Count Model in Zero-Inflated Poisson Regression on the Impact of First X-Mod on Claim Frequency Change (Figure 4)

	Adjusted Coefficient for All Claim Frequency	Robust Std. Error	Adjusted Coefficient for Indemnity Claim Frequency	Robust Std. Error
Year T0	0.181	0.145	0.396	0.290
Year T+1	0.014	0.153	0.214	0.330
Year T+2	-0.038	0.157	0.092	0.448
Treatment	0.035	0.140	-0.018	0.290
Year T0 * Treatment	-0.185	0.175	-0.451	0.318
Year T+1 * Treatment	-0.189	0.187	-0.549	0.368
Year T+2 * Treatment	-0.192	0.189	-0.501	0.478
Sample Size	7,953		7,953	

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment variable is the indicator for X-Mod qualification (1 for newly rated employers and 0 for non-rated employers). Controlled variables in the regression model include industry sector, employer size and different years of initial qualification for X-Mod (i.e., different T0 for initial X-Mods), and the coefficients are not shown. Robust standard errors were estimated to adjust for clustering by employer over time.

Table B.1. Marginal Effects of a Credit-to-Debit X-Mod Increase on the Likelihood of Having At Least One Claim (Figure 5)

	Estimated Changes in Likelihood of Having Any Claims	Robust Std. Error
Treatment group in Year T0 vs. in Year T-1	-1.5% ***	0.4%
Control group in Year T0 vs. in Year T-1	0.8% ***	0.1%
Treatment group in Year T+1 vs. in Year T-1	-1.5% ***	0.4%
Control group in Year T+1 vs. in Year T-1	2.0% ***	0.1%
Treatment group in Year T+2 vs. in Year T-1	-2.8% ***	0.5%
Control group in Year T+2 vs. in Year T-1	1.9% ***	0.1%

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment group represents rated employers with a credit-to-debit X-Mod increase, while control group represents other rated employers. Controlled variables in the regression model include different policy years for the X-Mod change (T0), industry sector and employer size, and the marginal effects are not shown. Robust standard errors were estimated to adjust for clustering by employer over time. The sample size is 240,934.

Table B.2. Coefficients of the Count Model in Zero-Inflated Poisson Regression on the Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency Change (Figure 6)

	Adjusted Coefficient for All Claim Frequency	Robust Std. Error	Adjusted Coefficient for Indemnity Claim Frequency	Robust Std. Error
Year T0	-0.011	0.008	0.004	0.010
Year T+1	-0.038 ***	0.009	0.008	0.011
Year T+2	-0.071 ***	0.011	-0.027 *	0.011
Treatment	0.251 ***	0.024	0.301 ***	0.031
Year T0 * Treatment	-0.033 *	0.017	-0.044	0.025
Year T+1 * Treatment	-0.049 **	0.019	-0.066 *	0.027
Year T+2 * Treatment	-0.081 **	0.025	-0.120 ***	0.033
Sample Size	240,934		240,934	

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment variable is the indicator for X-Mod change (1 for rated employers whose X-Mods increased from credit to debit and 0 for other rated employers). Controlled variables in the regression model include different policy years for the X-Mod change (T0), industry sector and employer size, and the coefficients are not shown. Robust standard errors were estimated to adjust for clustering by employer over time.

Table C.1. Coefficients of the Count Model in Zero-Inflated Poisson Regression for the Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency Change in Leading Industries (Figure 7)

	Adjusted Coefficient for All Claim Frequency for Construction	Robust Std. Error	Adjusted Coefficient for All Claim Frequency for Manufacturing	Robust Std. Error	Adjusted Coefficient for All Claim Frequency for Hospitality	Robust Std. Error
Year T0	0.001	0.014	-0.023	0.014	-0.024	0.015
Year T+1	-0.051 ***	0.015	-0.060 **	0.021	-0.044 **	0.015
Year T+2	-0.087 ***	0.016	-0.094 ***	0.026	-0.087 ***	0.017
Treatment	0.242 ***	0.041	0.417 ***	0.073	0.122 **	0.047
Year T0 * Treatment	-0.085	0.044	-0.022	0.034	-0.020	0.053
Year T+1 * Treatment	-0.065	0.044	-0.005	0.037	-0.064	0.064
Year T+2 * Treatment	-0.159 **	0.052	-0.050	0.061	-0.051	0.068
Sample Size	49,282		43,506		28,146	

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment variable is the indicator for X-Mod change (1 for rated employers whose X-Mods increased from credit to debit and 0 for other rated employers). Controlled variables in the regression model include different policy years for the X-Mod change (T0) and employer size, and the coefficients are not shown. Robust standard errors were estimated to adjust for clustering by employer over time.

Table C.2. Marginal Effects of an X-Mod Increase from Below 125 Percent to Above 125 Percent on the Likelihood of Being Claim Free for Construction Employers (Figure 8)

	Estimated Changes in Likelihood of Having Zero Claims	Robust Std. Error
Treatment group in Year T0 vs. in Year T-1	1.7%	1.1%
Control group in Year T0 vs. in Year T-1	-1.0% ***	0.2%
Treatment group in Year T+1 vs. in Year T-1	1.0%	1.1%
Control group in Year T+1 vs. in Year T-1	-2.4% ***	0.2%
Treatment group in Year T+2 vs. in Year T-1	2.1%	1.2%
Control group in Year T+2 vs. in Year T-1	-2.4% ***	0.3%

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment group represents rated employers with a credit-to-debit X-Mod increase, while control group represents other rated employers. Controlled variables in the regression model include different policy years for the X-Mod change (T0) and employer size, and the marginal effects are not shown. Robust standard errors were estimated to adjust for clustering by employer over time. The sample size is 49,282.

Table D. Coefficients of the Count Model in Zero-Inflated Poisson Regression on the Impact of a Credit-to-Debit X-Mod Increase on Claim Frequency Change by Employer Size (Figure 9)

	Adjusted Coefficient for All Claim Frequency for Small-Sized Employers	Robust Std. Error	Adjusted Coefficient for All Claim Frequency for Medium-Sized Employers	Robust Std. Error	Adjusted Coefficient for All Claim Frequency for Large-Sized Employers	Robust Std. Error
Year T0	0.041	0.025	0.017	0.013	-0.015	0.009
Year T+1	0.010	0.024	0.000	0.013	-0.040 ***	0.010
Year T+2	-0.041	0.025	-0.036 *	0.014	-0.072 ***	0.012
Treatment	0.188 **	0.059	0.227 ***	0.031	0.256 ***	0.026
Year T0 * Treatment	0.056	0.086	-0.034	0.040	-0.033	0.018
Year T+1 * Treatment	-0.026	0.083	-0.095 *	0.042	-0.046 *	0.020
Year T+2 * Treatment	-0.088	0.091	-0.122 *	0.048	-0.080 **	0.028
Sample Size	80,311		80,308		80,315	

* P-value <0.05, ** P-value < 0.01, *** P-value <0.001

Note: Treatment variable is the indicator for X-Mod change (1 for rated employers whose X-Mods increased from credit to debit and 0 for other rated employers). Controlled variables in the regression model include different policy years for the X-Mod change (T0) and industry sector, and the coefficients are not shown. Robust standard errors were estimated to adjust for clustering by employer over time.



1901 Harrison Street, 17th Floor
Oakland, CA 94612
888.CA.WCIRB

wcirb.com