

Why did the claim rate fall in the 1990s?

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The rate at which indemnity claims were filed in Minnesota fell by more than one-third during the 1990s.¹ After rising through the mid-1980s, the number of filed indemnity claims peaked at almost 48,000 a year in 1989 and 1990. The number of claims declined through most of the 1990s, and reached 38,000 claims a year in 1998. Considering the growth of the labor force, the claim rate per full-time-equivalent (FTE)² worker declined at an average annual rate of 4 percent. This article examines factors that may have caused this decline.

Minnesota's experience was not unique. Significant declines in claim rates occurred in most U.S. states and in Canada. Figure 1 shows trends in the Minnesota claim rate and U.S. injury rate.³ In Minnesota, the claim rate fell by 34 percent from 1990 to 2000. In the United States, the incidence rate for injuries resulting in days away from work fell by 47 percent. While the injury rates shown in Figure 1 are defined slightly differently, they both show similar, strong downward trends.⁴

The claim rate may decline for two main reasons. First, the claim rate may fall because the injury rate falls. Second, it may fall because of a decline in claiming propensity.⁵ Claiming propensity is the likelihood that a worker, once injured, will file a claim.

Three reasons the injury rate may have fallen are examined in this article. They are (i) a long-term trend toward safer work environments, (ii) an increase in the age of the work force and (iii) a change in the mix of industries. A somewhat surprising finding is that in Minnesota the change in the mix of industries does not explain even a small part of the drop in the injury rate. The mix of industries actually became slightly more dangerous during the 1990s. It is difficult to quantify the extent to which other factors have affected the injury rate. Safer work environments probably made an important contribution to the fall in the injury rate. There was a significant increase in the average age of the workforce, but it is difficult to assess the impact of this change on the injury rate.

Three reasons claiming propensity might fall were also examined. They are (i) a decline in the expected wage-replacement rate, (ii) a change in the attitudes of workers toward filing claims and (iii) a decrease in the unionization rate. Declines in the expected wage-replacement rate were found and might explain between 20 and 40 percent of the drop in the claim rate. Interestingly, most of the change in the wage-replacement rate does not seem to be due to changes in statutes, but are due to changes in the denial rate and in workers' wages. Changes in workers' attitudes might also explain a significant share of the drop in the claim rate. One finding is that two sharp drops in the claim rate that can't be explained by other factors might be explained by negative publicity about the workers' compensation system. The drops

¹Filed indemnity claims are claims made for indemnity benefits, whether benefits are paid or not. Indemnity benefits compensate workers for loss of wages, permanent functional impairment or death.

²One full-time-equivalent worker is defined as 2,000 hours of work a year.

³All of the figures in this report show claims by year of injury.

⁴The data also comes from different sources – the U.S. data is from the Bureau of Labor Statistics and the Minnesota data is from the DLI claims database. Also, indemnity claims do not correspond exactly to “days away from work cases.” A case involving days away from work is one in which a worker was injured and missed at least one day of work after the day of injury. Most indemnity claims in Minnesota are triggered when a worker loses more than three days of work.

⁵It could also decline if changes to the workers' compensation system affected what is considered a compensable injury. However, it seems unlikely any such changes to the system in the 1990s would have significantly affected claim rates.

coincide with large numbers of negative newspaper stories about workers' compensation. Changes in unionization seem unlikely to have had much affect on the claim rate.

In this article the factors discussed above are analyzed individually, and using a statistical model that allows some interactions between the factors to be examined. The results of the statistical model are described in more detail in the appendix.

Factors affecting injury rates

Three main factors could affect the injury rate. First, workplaces may become safer because of factors under the control of employers. These include safer equipment, better safety rules and better training. Second, injury rates may fall because of a change in the types of things firms do, i.e., because of shifts in employment between industries or occupations. Third, injury rates may drop because of changes in the workforce. There could be changes in the age of the workforce, for example.⁶

Some researchers believe the drop in workers' compensation claims in the 1990s occurred mainly because of a decline in injury rates.⁷ While injury rates likely have declined significantly, following a long-term trend that goes back at least a few decades, a significant share of the drop in claims is probably also explained by other factors. There are two main reasons for this belief. First is the variability in the drop in claim rates. The average annual decline in the claim rate was 4 percent in the 1990s, but the rate fell much faster during 1992 and 1995. In some years in the 1980s, the rate actually rose. It seems unlikely that dramatic improvements in safety would occur in some years and declines in safety in others.⁸ Figure 2 shows the change in claim rate from 12 months prior (i.e., it shows the percent change from the monthly rate one year before).⁹ It shows large declines in claim rates from October 1991 to September 1992 and from October 1994 to September 1995, as well significant fluctuations in the 1980s. The second reason not to automatically expect drops in claims mean drops in injuries is that researchers have found claim rates are affected by factors such as the workers' compensation benefit levels.¹⁰ Studies have generally found, for example, an increase in benefits of 10 percent leads to an increase in claims of between 4 and 10 percent.

Trends toward safer work environments

The trend toward safer work environments has probably been the main factor that explains long-term reductions in claim rates. How much of the drop in the claim rate during the 1990s does it explain?

⁶Improvements in medical care can be thought of as pushing down the injury rate by reducing the number of compensable injuries. They could also be thought of as reducing claiming propensity, because the actual number of injuries stays the same, but the likelihood that claims will be filed declines. The ratio of indemnity to medical-only claims did decline in the 1990s.

⁷See, for example, Welch in *On Workers' Compensation*, "A real reduction in injuries," March 2002, pages 5-6 and the study he cites.

⁸It is possible that injury rates could drop rapidly in some years if employers suddenly place a much higher emphasis on safety. Such an awareness of the importance of safety could have come about because of the widespread concerns about rising workers' compensation costs in the early 1990s. Still, it seems unlikely this could entirely explain changes of the magnitude seen in the 1992 and 1995.

⁹Figure 2 can be difficult to interpret because it shows changes and not actual levels. When the graph is negative, the claim rate is declining. Figures 2, 3 and 4 show moving averages. A five-month moving average is the average for the period from two months previous to two months ahead. A seven-month moving average is the average from three months previous to three months ahead.

¹⁰Some of these studies are discussed by Butler in *The Journal of Risk and Insurance*, "Economic determinants of workers' compensation trends," pages 383-401, 1994. Some work finds that benefit levels also affect injuries (higher benefit levels reduce injuries but increase the claim rate), but this effect is generally thought to be much smaller than the effect on the claim rate.

The most comprehensive source of data about work-related injury rates is the Bureau of Labor Statistics (BLS) annual survey of occupational injuries. Unfortunately, the data collected in the survey is probably significantly influenced by workers' compensation claims. This is because people answering the survey are much more likely to recall an injury if a workers' compensation claim was actually filed. Because of this, it is not clear how the BLS survey data can be used to estimate the difference between the changes in injury rates and changes in claim rates.

One potential way to try to determine the overall trend in injury rates is to examine types of claims or injuries that seem unlikely to be underreported. Nationally, the rate of occupational fatalities dropped by approximately 2 percent a year during the 1990s. However, there are a number of reasons the rate of fatalities may not change the same way other injury rates do. Fatalities may receive extra attention from regulators. Traffic accidents and homicides account for a significant share of all work-related fatalities. While an employer can do things to reduce the likelihood a worker is involved in a fatal traffic accident or a homicide, overall trends for work-related traffic accidents and homicides may be most affected by outside factors.¹¹

The statistical model of claim filing suggests that perhaps as much as one-half of the drop in the claim rate can be explained by the trend in safety. The model works by examining a number of factors that have the potential to explain the drop in the claim rate. After accounting for these other factors, 49 percent of the drop in the claim rate during the decade of the 1990s appears to be due to the time trend. This 49 percent should be thought of as an upper bound on the decline brought about by the long-term safety trend. This is because other factors, about which data is not available, may explain some portion of the change.

Age and job tenure

Both age and experience probably have important effects on injury rates. Examining workforce data and the Minnesota DLI claims database shows claim rates are significantly higher for middle-aged workers than for young or old workers. Although data about the job tenure of the workforce is limited, the claims database also seems to show workers who are new to their job are more likely to be injured.¹² Between 1990 and 2000 there was a large increase in the average age of workers in Minnesota, from 35.5 to 38.4. This suggests changes in age and, perhaps, experience may have had a significant effect on the overall claim rate during the 1990s.

Unfortunately, it is difficult to determine the effects of age on the claim rate. Three factors cause problems. First, the overall relationship between age and claim rate is not monotonic – claim rates are lower for young and old workers than they are for middle-aged workers. Second, disentangling the effects of age and experience is difficult. As workers age, they generally become more experienced at their jobs, but people also switch jobs, so average experience does not increase as fast as average age. Third, there is only limited data about the amount of job experience of Minnesota workers.

The data that is available about age suggests the likely effect of the aging of the workforce is to push up the claim rate. This is because, overall, the claim rate peaks when workers are in their mid-40s to early 50s. Because the average age of workers is less than 40, an increase in the average age tends to push up the claim rate. However, given the complications of analyzing the relationship between age and the claim rate, it seems premature to conclude changes in age or job tenure have had a large effect on the claim rate.

¹¹Highway safety levels and the rate of violent crime, for example.

¹²In 2000, the median tenure of claimants in Minnesota was 2.1 years and the median tenure of all workers in the United States was 3.5 years.

One recent study of the effect of age on workers' compensation claims predicts only small effects on claim rates from the aging of the workforce.¹³

Industry mix

A long-term trend in the U.S. economy has been a shift of employment from manufacturing to services. Because workers in service industries generally have lower injury rates than workers in manufacturing industries, the change in the mix of industries should reduce the overall injury rate.¹⁴

Somewhat surprisingly, the opposite seems to have occurred. An analysis of 46 industries in Minnesota shows changes in industry mix during the 1990s actually tended to increase the overall injury rate to a small degree.¹⁵ The analysis worked by assuming claim rates for each industry did not change and stayed at each industry's average levels. If claim rates had not changed, the effect of the change in the industry mix would have been to increase the claim rate by 1.4 percent from 1993 to 2000.

Figure 3 shows the results of a similar type of analysis done for 10 major industry groups.¹⁶ The claim rates were seasonally adjusted to account for shifts in industry mix throughout the year. To reduce random variation, a five-month moving average was calculated.

Note that the scale of Figure 3 magnifies the size of the increase in the claim rate that seems to be due to changes in industry mix. The overall increase in the claim rate is quite small – about 2.5 percent for the entire period of the 1990s. The figure seems to capture effects of economic trends. The rate declines slightly from 1990 to 1992, probably because the economic slowdown hurt the manufacturing sector. The rate increases slowly from 1993 to 1997, probably because of the strength of the manufacturing sector. From 1997 to 2000, the rate increases even faster, coinciding with a boom in the construction industry. In 2000, the rate starts to decline, again probably because of layoffs in the manufacturing sector.

The result that changes in industry mix tended to lead to higher injury rates during the 1990s, while somewhat surprising, agrees with other research.¹⁷ It also agrees with the results of the statistical analysis discussed in the appendix. The change in the composition of industries seems to have tended to work against the overall downward trend in claims, pushing up the claim rate by 2 or 3 percent.

Factors affecting claiming propensity

Almost all workers' compensation claims result from injuries – fraudulent claims appear to be very rare – but many work-related injuries may not result in claims. One study suggests that approximately 50 percent of work-related *illnesses* do not result in claims.¹⁸ Injuries, as opposed to illnesses, are probably

¹³Tattarie, Gotz, and Liu, *Workers' compensation and the changing age of the workforce*, Workers Compensation Research Institute, 2000.

¹⁴However, some types of service workers have higher than average injury rates. Health care workers are one example.

¹⁵The analyses discussed here ignore shifts in occupational groups within industries. Such shifts could have important effects on safety. For example, the number of workers in relatively high-risk manufacturing industries might have increased, but the added workers may be operating computers instead of more dangerous types of equipment.

¹⁶The figure was constructed by assuming the average claim rate for each industry group was constant throughout the 1990s. Then the number of monthly claims for each industry was calculated based on the number of full-time-equivalent (FTE) workers for that industry.

¹⁷See, for example, Conway and Svenson in the *Monthly Labor Review*, "Occupational injury and illness rates, 1992 – 1996: Why they fell," Bureau of Labor Statistics, pages 36-58, November 1998.

¹⁸See Biddle, Roberts, Rosenman, and Welch, *Journal of Occupational and Environmental Medicine*, "What percentage of workers with work-related illnesses receive workers' compensation benefits?" pages 325-331, April 1998.

reported more often, but many still probably do not result in claims. A large number of unreported injuries means changes in claiming propensity – the probability of filing a claim, given an injury has occurred – may have large effects on claim rates. A variety of factors have been found to influence claiming propensity. Three are discussed here: the wage-replacement rate, workers’ attitudes and unionization rates.

Changes in the wage-replacement rate

The wage-replacement rate is the ratio of the benefits a worker would receive from workers’ compensation if a claim were filed to the wages that would be received if no claim were filed and the person continued working. The *expected* wage-replacement rate is the wage-replacement rate considering that future wages and benefits are uncertain. Most studies about the subject have found an increase in the wage-replacement rate of 10 percent leads to an increase in claims of between 4 and 10 percent.¹⁹

Using data from the Current Population Survey for 1994 to 1999, it appears the wage-replacement ratio of benefits to wages fell by from 61 percent to 57 percent, or by 5.9 percent, for the average worker in Minnesota.²⁰

A better measure of the wage-replacement rate would account for expectations of future employment and benefits. Define the expected wage-replacement rate to be the rate of expected earnings to expected benefits, given uncertainty about factors such as future job layoffs and the potential that benefits will be denied.

Other things equal, higher employment raises expected earnings. Accounting for the upward trend in the employment rate, and assuming expected wages equal actual wages times the employment rate, the expected wage-replacement rate fell by 7.3 percent from 1994 to 1999.

To adjust for the probability that a claim will be denied, it was assumed that expected benefits equal actual benefits times the claim acceptance rate.²¹ Because information about the claim acceptance rate is transmitted only slowly to workers, it was assumed the acceptance rate changed throughout the 1990s at a steady rate, based on the difference between the average rate in the 1980s and the average rate in the 1990s.²² Accounting for the change in denials, the expected wage-replacement rate fell by 10.2 percent from 1994 to 1999.

During the whole period of the 1990s, the expected wage-replacement rate fell by somewhat more than 16 percent.²³ Assuming an increase in the wage-replacement rate of 10 percent leads to an increase in

¹⁹ Some of these studies are discussed by Butler in *The Journal of Risk and Insurance*, “Economic Determinants of Workers’ Compensation Trends,” pages 383 – 401, 1994.

²⁰ These numbers were calculated by applying the benefit formula to the data on individual workers. The numbers account for changes in wage levels and statutory changes in benefit levels. They do not account for cost-of living adjustments that affect claims that receive payments for more than one year. Also, these numbers do not account for taxes. Not accounting for taxes mean that these wage replacement rates significantly underestimate actual wage replacement. Relative wage replacement rates will also be different to the extent that tax laws changed and changing incomes push people into different tax brackets.

²¹ Another way to adjust benefit levels would be to multiply the benefit level times the percentage of claims that are ever paid. (Some claims are initially denied, but then eventually paid.) Adjusting benefit levels this way is sensible, but it would ignore the costs to workers (monetary and non-monetary) of disputes.

²² Only data from 1983 to 1999 was available. The average denial rate for all indemnity or lost time claims for the years 1983 to 1989 was 9.5 percent. For the years 1990 to 1999 it was 14.7 percent.

²³ The unadjusted wage replacement level fell at a faster rate from 1990 to 1994 than it did from 1994 to 1999. The unemployment rate fell at approximately the same average annual rate from 1990 to 1994 as it did from 1994 to 1999.

claiming propensity of between 4 and 10 percent, the change in replacement rate during the 1990s may have led to a decline in claiming propensity of between 6 and 16 percent. A mid-range estimate would be 10 or 11 percent. Because the overall indemnity claim rate fell by 36 percent, changes in the wage-replacement rate may account for between one-fifth and two-fifths of the drop in the claim rate. Figure 4 shows the trends in expected wage-replacement rate, accounting for the rate of unemployment and denials.

The statistical analysis of the effect of the wage-replacement rate (not the expected wage-replacement rate considering denials and unemployment) suggests its decline caused 17 percent of the drop in the claim rate. Two-thirds of this decline was due to the October 1992 law change that lowered the wage-replacement rate for workers earning less than half of the statewide average weekly wage (SAWW).²⁴ Figure 5 shows the estimated effect of the change in the wage-replacement rate holding other factors constant.

Changes in workers' attitudes

One puzzling fact about changes in the claim rates is that they are not particularly gradual. There was a very large decline in the claim rate in 1995 – almost 11 percent – and declines of almost 8 percent in 1992 and 1993. Together, these three years accounted for more than half of the overall decline in the claim rate during the 1990s. The annual changes in the filed indemnity claim rate are shown in Figure 6. (Monthly changes are shown in Figure 2.)

One potential explanation for the relatively sharp drop in claims in 1992 and 1995 is the fairly large changes that occurred in workers' compensation laws. At first this explanation seems flawed, because the laws did not take effect until October of these years and the largest declines in claims occurred in the first parts of these years. However, changes in the law may have been less important than changes in workers' attitudes. The legal changes had fairly modest impacts on wage-replacement rates anyway.²⁵ The debate about the law, and the attention to perceived problems with the workers' compensation system that prompted the legislation, may have made workers more reluctant to file claims. If, perhaps, one half of workers who are injured on the job do not file claims, it would not be surprising if even fewer workers would file claims when a great deal of public attention is being given to perceived problems with workers' compensation.

²⁴This change was especially significant for workers earning less than 20 percent of the SAWW. Before the law change, these workers received benefits equal to 20 percent of the SAWW. After the change, they received benefits equal to their pre-injury wage.

²⁵The analysis of the wage-replacement level found that, without adjusting for unemployment or denial rates, the wage-replacement level may have fallen by 9.6 percent during the 1990s. However, this entire decline is not due to statutory changes; a significant share of this drop is due to changes in the distribution of wages. However, the change in the law in 1992 did have a significant effect on the replacement rate for workers at low wage levels.

Figure 6 Change in the claim rate from the previous year	
Year	Change in rate
1990	-2.2%
1991	-4.0%
1992	-7.7%
1993	-7.7%
1994	-3.5%
1995	-10.8%
1996	-3.2%
1997	-4.2%
1998	-5.2%
1999	-0.9%

Workers' attitudes may also change because the cost of having a claim denied may change (or at least may be perceived to change). The potential effect of denials on expected benefits was quantified above, but workers may also feel that having a claim denied is costly. A denied claim might cause tension between the worker and the employer and, perhaps, affect future promotions and wages. This means higher denial rates might have a larger effect on claiming propensity than previously estimated. This effect may have been most pronounced in the early 1990s, because most of the increase in the denial rate occurred in the 1980s and, especially, the late 1980s. The denial rate went from about 8 percent in the early 1980s, to 10 percent in the late 1980s and then rose rapidly to approximately 15 percent, where it stayed for most of the mid-1990s. Unfortunately, there is not much data available with which to quantify the effects on claiming propensity of either the perceived costs of denials or public debates about workers' compensation.

An analysis of the relationship between the claim rate and an index of newspaper stories about workers' compensation appears to show a strong relationship between the two. This relationship is shown in Figure 7. The claim rate appears to drop when the index of stories is high.²⁶ The index of newspaper stories may be a good indicator of the amount of public attention workers' compensation receives in Minnesota. While the index doesn't account for stories in other media – television stories, for example – the relative rates of coverage in different types of media may be roughly the same. The index probably serves an indicator of perceived problems with workers' compensation. The index gives extra weight to stories about fraud and rates of news coverage seem likely to be higher when there are perceived problems than when the system seems to be functioning smoothly.

One thing to note in Figure 7 is that high rates of news coverage precede drops in the claim rate from mid-1991 to mid-1992 and from mid-1994 to mid-1995. These drops in the claim rate have been perplexing because they occurred *before* the law changes took effect (in October 1992 and October 1995).

²⁶The index was constructed by weighting equally the relative monthly number of four types of stories – stories in the Minneapolis *Star Tribune* containing “workers’ compensation” in the headline or first paragraph, stories in the *Star Tribune* containing “workers’ compensation” and “fraud” anywhere in the story, stories in the St. Paul *Pioneer Press* containing “workers’ compensation” anywhere in the story and stories in the *Pioneer Press* containing “workers’ compensation” and “fraud” anywhere in the story.

However, there were high rates of negative coverage of the workers' compensation system associated with the periods before the laws changed and this could have made workers reluctant to file claims.²⁷

The statistical model of the claim rate also provides some evidence that declines in the claim rate are associated with higher rates of news coverage. The index of news stories is associated in a statistically significant way with the claim rate, and the estimated effect of the index is large enough to explain an important part of the decline in the claim rate from 1990 to 1996.

Changes in unionization

A study by Hirsch, Macpherson and DuMond found that after controlling for other factors, union members were 60 percent more likely than nonunion members to receive workers' compensation benefits.²⁸ According to Bureau of Labor Statistics data, the unionization rate fell in Minnesota by slightly less than 8 percent during the 1990s. In addition, there has been a nationwide trend during the past three or four decades in which an increasing share of union membership has been shifting to the public sector. This means declines in union membership have probably occurred disproportionately in relatively high-risk industries such as construction and manufacturing. Workers in the public sector generally have low injury rates.²⁹

Using data from the Current Population Survey about unionization in nine major industry groups in Minnesota, it appears the net affect of changes in unionization on claims rates is small. If these industry groups had the same unionization rates in 2000 as they did in 1993, the year 2000 claim rate might be 0.7 percent higher. Therefore, it seems unlikely that changes in unionization could account for more than 1 or 2 percent of the overall decline in claim rate during the 1990s.

Conclusions

There seems no reliable way to estimate how much safer workplaces are, as opposed to how claiming propensity has changed. Using national figures about fatalities, general improvements in safety may be pushing down injury rates by 2 percent a year. If that is right, the trend in safety may explain approximately one-half of the change in the claim rate. The effects of changes in the age and job tenure of workers are not clear. There was a significant increase in the average age of workers, and this would tend to push the claim rate up, other things equal, but it is not yet possible to quantify this effect with confidence. Changes in the mix of industries in Minnesota seem to have actually pushed the claim rate up a bit.

Somewhere between 20 and 40 percent of the drop in the claim rate might be explained by changes in the expected wage-replacement rate. The expected wage-replacement rate fell during the 1990s because of statutory changes in benefit rates, changes in the wage distribution, a decline in the unemployment rate and an increase in the denial rate. Unionization may contribute slightly to the decline in the claim rate, but probably only explains – at most – a few percent of the drop in the claim rate.

The large drop in the claim rate that occurred during two years when major changes to the workers' compensation system were being debated, but before the changes took effect, suggests changes in

²⁷However, this need not be the only explanation. News coverage could induce firms to find ways to reduce workers' compensation costs. Also, it could be that high rates for workers' compensation insurance led to the news coverage, but that these rates also led to responses from firms, such as increasing safety efforts. In this situation, newspaper stories would not cause a decline in the claim rate, the responses to high rates would.

²⁸Hirsch, Macpherson, and DuMond, "Workers' compensation reciprocity in union and nonunion workplaces," *Industrial and Labor Relations Review*, pages 213-236, January 1997.

²⁹In the 1990s, average claim rates for private-sector construction and manufacturing employees were about 25 percent higher than they were for public employees.

claiming propensity occurred during those years. The change in claiming propensity may have been driven by negative news coverage of the workers' compensation system. Two large drops in the claim rate seem to correspond to periods when a large number negative newspaper stories appeared. Negative news coverage may make workers reluctant to file claims.

One story that fits the data fairly well is that changes in the wage-replacement rate and a general trend toward safer workplaces account for 70 or 80 percent of the drop in the claim rate and changes in workers' attitudes account for the remaining 20 or 30 percent of the drop. Attitudes may have been especially influenced by public debates about how to change the workers' compensation system, perhaps explaining the large share of the decline in the claim rate that occurred in the first half of the 1990s.

This explanation does not seem to fit the last two or three years of the 1990s. During this period, the claim rate stabilized. The years 1998 to 2000 were a boom period in which labor markets were extremely tight. Tight labor markets may raise claiming propensity, because workers know demand for their services will stay high.³⁰

The statistical analysis of the claim rate generally reinforces this account. The trend toward safer workplaces may explain up to 50 percent of the drop in the claim rate. Changes in the wage-replacement rate seem to explain at least 15 or 20 percent of the decline in the claim rate. An index of the number of mostly negative newspaper stories about workers' compensation seems to explain a significant part of the drop in the claim rate in the first half of the 1990s. The statistical analysis also suggests, along with some earlier work, that changes in the age of the workforce may have helped to push the claim rate up. However, this finding should be regarded as tentative until there is a better understanding of how these changes interact with other variables and, especially, with job tenure. Finally, it seems increases in real wages may have helped push the claim rate down, controlling for replacement rate effects, especially in the last half of the 1990s. This finding is also tentative and could be due to unobserved factors affecting the claim rate.

³⁰A tight labor market also puts upward pressure on wages, which tends to push down the claim rate. There is some evidence that overall rapid economic growth is to push up the claim rate. See Gardner, Telles, and Moss, *The 1991 reforms in Massachusetts: An assessment of impact*, Workers Compensation Research Institute, May 1996.

Appendix: A statistical model of claim filing behavior

A model of claim filing behavior was developed using data from the Minnesota workers' compensation claim database and the Bureau of Labor Statistics' Current Population Survey. The model covers the period from 1989 to 2001. This made it possible to estimate a worker's probability of filing a claim in each month, given the person's characteristics.

The characteristics that were examined are shown in Figure 8. The individual characteristics are age, gender, major industry group, real wage and wage-replacement rate. The real wage is in 2001 dollars. The wage-replacement rate is the ratio of workers' compensation benefits to weekly wage. In addition, monthly variables to account for the time trend were included, as well as a monthly variable to account for news coverage of workers' compensation. The data only includes workers with ages from 20 to 60. In addition, about 15 percent of claims data was eliminated because of missing variables. Whether variables get recorded as missing may vary over time, so the remaining data was weighted on a monthly basis to account for claim data that was dropped. Claims data was also scaled to account for the development of future claims. In addition, wage data about claimants was adjusted to correspond to the CPS wage data. This was done by "top-coding" weekly wages at \$1,923 for 1989 to 1997 and at \$2,885 for 1998 to 2001.³¹

A logistic regression was run to predict the probability a person will file a claim given the individual's characteristics and the monthly variables. The results of the regression are shown in Figure 9. All of the estimated coefficients were significant at a confidence level of more than 99 percent.

Two of the variables were categorical – the SIC group and gender. The SIC group coefficients are relative to the coefficient for public administration. The odds ratio for construction workers is 1.55, so construction workers are about 55 percent more likely to file claims than people who work in public administration. Likewise, males are about 87 percent more likely to file claims than females.

Neither categorical variable was found to have an important affect on claim-filing behavior over time. As discussed in the main section of the report, changes in the mix of industries may have led to a 2- or 3-percent increase in the claim rate during the decade of the 1990s. There were only small changes in the relative labor force participation of men and women, and these changes appear to have almost no affect on the claim rate in the 1990s.

The coefficients of the noncategorical variables are somewhat difficult to interpret in relation to time trends. The effect of the time trend and changes in the wage-replacement rate were discussed in the main part of this article. The index of news stories was constructed so it had the same level at the start of the decade as at the end, so its construction did not allow it to affect the claim rate during the whole decade. The level of media coverage appears to have had a significant affect on the claim rate from 1991 to 1996.

Two variables that were not discussed earlier also may have important affects on the claim rate over time. The age of workers was estimated to have a large affect on the claim rate. Figure 10 shows the estimated effect of age on the claim rate. The estimated claim rate peaks at 2.74 claims per 100 full-time-equivalent (FTE) workers at age 47. Because the work force has aged – the average age of workers from 20 to 60 has increased from 35.8 years in 1990 to 38.4 years in 2000 – age may have been a significant factor in pushing the claim rate *up*. If this is correct, then the decline in the claim rate in the 1990s was even more dramatic than it first appears. However, as discussed earlier, a lack of understanding of how other factors

³¹This affected slightly more than 0.1 percent of claimants. Wages are topcoded in the CPS by approximately 0.9 percent of the population.

have changed with age means conclusions about the effects of age on the claim rate should be taken as tentative.

The statistical estimates imply changes in the real wage rate have had a significant effect on the claim rate. The estimates suggest these changes may have been responsible to about one-third of the drop in the claim rate, most of which came during the last half of the decade. However, this conclusion should be regarded as tentative. One possibility is that real wage is serving as a proxy for another factor that is affecting the claim rate. Real wage could be a proxy for occupation, for example. Until such possibilities are explored more thoroughly, it seems premature to assign much of the drop in the claim rate to changes in the real wage.