Industry shifts in hours and nonfatal work injuries and illnesses, 2003–2008

Three separate approaches show that shifts in shares of hours worked across industries explain just a small portion of declines in injury and illness rates from 2003 to 2008

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Data from the 2003–2008 Surveys of Occupational Injuries and Illnesses[1] (SOII) indicate that the total recordable injury and illness rate in the private sector fell from 5.0 to 3.9 cases per 100 full-time workers. The exact reasons for this decline are unknown, but one contributing factor may be that safer industries are accounting for an increased share of hours worked. This report uses data from the Bureau of Labor Statistics (BLS) SOII to examine the extent to which shifts in the share of hours worked across industries contributed to the decline. The analysis presented estimates the impact of these shifts on private sector injury and illness rates between 2003 and 2008.[2]

Methods

The impact of changes in industries' shares of hours on private sector injury and illness rates is estimated by a mathematical relationship between those two variables. This relationship is used to compare the private sector injury and illness rate in a base year with what it would have been in another year if only the share of hours worked in each industry were allowed to vary. The difference between the two rates represents the impact of shifts in industry hour shares on the rate between the years compared.

The BLS injury and illness rate in a given industry is related to the number of hours worked in that industry by the equation

$$\text{rate}_i = \frac{200{,}000 \times \text{cases}_i}{\text{hours}_i}, \quad (1)$$

where

cases_i = the number of recordable injury and illness cases in industry i in a given year,

hours_i = the number of hours worked in industry i in a given year, and

200,000 = the number of hours worked by 100 full-time workers in a year.

Because the number of cases and the number of hours in the private sector is the sum of the number of cases and the number of hours in each industry of the economy, the private sector rate is related to industry hours worked by the formula

$$\text{private sector rate} = \frac{200{,}000 \times \sum \text{cases}_i}{\sum \text{hours}_i}. \quad (2)$$

Equation (2) is sufficient for isolating the effects of shifts in industry hours on injury and illness rates, but it treats cases and hours as independent of each other, an approach that is unrealistic. Instead, this study assumes that cases are dependent on both hours and the injury and illness rate via equation (1). Solving that equation for cases_i and substituting the result into equation (2) yields

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$$\text{private sector rate} = \frac{\sum(\text{rate}_i \times \text{hours}_i)}{\sum \text{hours}_i}, \quad (3)$$

which can be rewritten more concisely as

$$\text{private sector rate} = \sum_i (\alpha_i \times \text{rate}_i), \quad (4)$$

where α_i is the share of hours worked in industry *i*.

One interpretation of equation (4) is that each quantity ($\alpha_i \times \text{rate}_i$) is the portion of the overall private sector injury and illness rate attributable to industry *i*. Under this interpretation, the impact of a shift in the share of hours in industry *i* on the overall private sector rate is the difference between what that industry's contribution to the overall rate would have been when its share of hours was $\alpha_{i,b}$ and what it would have been when its share of hours was $\alpha_{i,c}$, with the industry rate fixed at some level.

Summing these effects across all industries gives the total impact of shifts in hours:

$$\text{impact of shifts in hours} = \sum_i (\alpha_{i,c} - \alpha_{i,b}) \times \text{rate}_i, \quad (5)$$

Here,

$\alpha_{i,b}$ = the hours share in industry *i* in base year *b*, and
$\alpha_{i,c}$ = the hours share in industry *i* in comparison year *c*.

One ambiguity in equation (5) is that it is not clear which industry rates should be used to perform the calculation in question, because the rates from both the base year and the comparison year seem to be equally viable candidates. This study avoids the question and uses both years in reporting calculations.

To illustrate the calculation, suppose an imaginary economy consists solely of two industries, goods and services, with the following information:

Year and industry	*Share of hours*	*Injury and illness rate*[3]
2004:		
Goods	0.40	15
Services	.60	3
2005:		
Goods	.35	12
Services	.65	3
Overall injury and illness rate:		
2004		7.80
2005		6.15

From equation (4), the portion of the private sector rate attributable to the goods industry in 2004 is 0.40 × 15 = 6. If, however, the industry rate were held fixed at 2004 levels, the goods industry would have accounted for only 0.35 × 15 = 5.25 of the overall industry injury and illness rate in 2005, a decline of 0.75, due solely to the shift in the share of hours.

Similar calculations for the services industry show that it accounted for only 1.8 of the overall industry injury and illness rate in 2004, but would have accounted for 1.95 of the overall rate in 2005, an increase of 0.15, if the industry rate had been held constant at 2004 levels.

The overall impact of shifts in shares of hours on the private sector rate is the sum of all the separate impacts in each industry: –0.75 + 0.15 = –0.60. In other words, with industry rates held fixed at their levels in 2004, these calculations estimate that shifts in industry shares of hours caused 0.60, or about 36 percent, of the 1.65 decline in the private sector rate between 2004 and 2005. If, instead, the calculations had held industry rates fixed at their levels in 2005, the estimated impact of the shift in industry shares of hours would have been –0.45.

One problem with applying the impact calculation to SOII data is that SOII industry case and hours estimates are not available for every private sector industry. For survey years 2003 through 2008, the SOII classified industries according to the 2002 NAICS, which classifies industries at varying levels of detail. An establishment involved in oil and gas extraction, for example, is classified as belonging to both the oil and gas subsector (NAICS 212) and the more aggregated mining sector (NAICS 21). Ideally, the impact calculation would use data at the most detailed level of industry classification, so that it could capture all shifts in industry hour shares. However, the SOII does not currently provide publishable estimates for all of the most detailed NAICS classifications, and the coverage that is provided varies by year, with some sectors, such as manufacturing and construction, covered in more detail. This inchoate situation raises questions about which industry estimates to include in the impact calculations.

To address these issues, the analysis that follows uses three different approaches to calculate impacts. The first approach aims to capture as much of the impact on the private sector as possible, using the most detailed industry estimates available that are common to the 2 years examined in the calculation. A disadvantage of this approach is that the availability of industry data varies from one set of years to the next, so the impact of shifts in hours between, for example, 2003 and 2004 is not necessarily comparable to that between 2004 and 2005. The second approach avoids this problem by using the most detailed industry estimates available that are common to all years

Table 1. Three approaches to calculating impacts of shifts in hours on injury and illness rates, 2003–2008

Year 1	Year 2	Total private sector rate change	Rate change due to industry shifts in hours						Average
			Industries shared in years compared (first approach)		Industries shared in 2003–2008 estimates (second approach)		Sector shifts only (third approach)		
			Impact[1]	Impact[2]	Impact[1]	Impact[2]	Impact[1]	Impact[2]	
2003	2008	–1.092	–0.057	–0.036	–0.053	–0.036	–0.040	–0.029	–0.042
2003	2004	–.198	.013	.013	.012	.012	.005	.003	.010
2004	2005	–.145	–.004	–.004	–.005	–.004	–.006	–.006	–.005
2005	2006	–.220	–.017	–.019	–.015	–.017	–.012	–.012	–.015
2006	2007	–.192	–.020	–.017	–.018	–.016	–.010	–.008	–.015
2007	2008	–.336	–.012	–.008	–.012	–.008	–.009	–.007	–.009

[1] Calculated with industry rates fixed at value in year 1. [2] Calculated with industry rates fixed at value in year 2.

between 2003 and 2008, but it comes at a cost of less industry detail.

A weakness of either approach is that certain sectors of the economy tend to be covered in greater detail than others. As a result, using the most detailed industry estimates available causes the calculations to be more reflective of shifts in some sectors of the economy than others. The third approach addresses this imbalance by measuring only the shifts between the 19 NAICS sectors of the privately owned economy. The results of all three approaches appear in table 1.

Depending on the approach, estimates of the 2003–2008 impact of shifts in industry shares of hours on injury and illness rates range from –0.029 to –0.057, or roughly between 3 percent and 5 percent of the observed rate decline from 5.0 cases per 100 full-time employees in 2003 to 3.9 cases in 2008. The calculations also show that shifts in shares of hours contributed to the overall rate decline in each pair of consecutive years between 2003 and 2008, except between 2003 and 2004, when the estimated impact of such shifts was positive. For example, the impact of shifts in shares of hours between 2003 and 2004 was 0.005 when only shifts between industry sectors were measured (the third approach) and industry rates were held fixed at 2003 levels.

Conclusion

Although this study is limited by the absence of fully detailed industry data and the inability to provide confidence levels for its calculations, its results support the conclusion that shifts in industry shares of hours explain only a small portion of the decline in injury and illness rates in the private sector between 2003 and 2008. □

NOTES

[1] The Survey of Occupational Injuries and Illnesses is an annual survey of approximately 250,000 establishments that collects information about work-related injuries and illnesses recorded by employers following guidelines from the Occupational Safety and Health Administration (OSHA). For more information about the survey, see *BLS Handbook of Methods*, Chapter 9, "Occupational Safety and Health Statistics, Part II, Survey of Occupational Injuries and Illnesses," **http://www.bls.gov/opub/hom/homch9.htm#background_part2**.

[2] Data from 2003–2008 were used because that timespan is the most recent multiyear period during which the SOII employed a single industry classification system: the 2002 North American Industry Classification System (NAICS). (See *North American Industry Classification System: United States, 2002* (Executive Office of the President, Office of Management and Budget, 2002).)

[3] Number of injuries and illnesses per 100 full-time employees.